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POSSIBLE IMPACT OF PLANNING INTERVENTION ON CITY RIVER CORRIDORS

(A CASE STUDY OF DHOBI KHOLA CORRIDOR, KATHMANDU)

SUBMITTED BY

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Institute of Engineering
Department of Architecture
M. Sc. in Urban Planning

CERTIFICATION

This is to certify that this thesis entitled "POSSIBLE IMPACT OF PLANNING INTERVENTION ON CITY RIVER CORRIDORS (A CASE STUDY OF DHOBI KHOLA RIVER, KATHMANDU)", submitted by KICHAH CHITRAKAR has been examined and it has been declared successful for the fulfillment of the academic requirement towards the completion of the Master of Science Course in Urban Planning.

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DECLARATION

I declare that this dissertation has not been previously accepted in substance for any degree and is not being concurrently submitted in candidature for any degree. I state that this dissertation is the result of my own independent work / investigation, except where otherwise stated. I hereby give consent for my dissertation, if accepted, to be available for photocopying and understand that any reference to or quotation from my thesis will receive an acknowledgement.

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Date: Jan 7th, 2003

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ABSTRACT

City river corridors of the Kathmandu valley have a significant role to play on urban planning and urban development. Unlike others, these rivers flow through the middle of the city; therefore, it's high time to study and plan these river corridors before they are encroached and turndown into messy slum riversides by the haphazard urban growth.

Dhobi-Khola, though the discharge is low and small, is a perennial river and flows through the heart of the city. The built up area which was 4% in 1954 within the 200 meter band of Dhobi-Khola River has now been increased to 31%. Net river area has been decreased to 9% now from 18% in 1964. Against this backdrop, this study has been carried out with the aim to investigate the existing situation and changes; to review proposed projects namely DKCIP and GAIAUPP; to find out possible impacts focusing on the transportation networks, socio cultural aspect, people's response, environmental aspects like sewage and solid waste; and land development etc.

A descriptive and interpretive approach has been adopted including data analysis of primary survey namely 'river use survey' and "Household questionnaire survey". Chronological studies of river corridor with the help of aerial photographs, Satellite Images and field visits have been made.

Urban land availability, environmental degradation, easy to layout roads and sewers as corridors, less cultural and religious linkage to the river, financial viability for development as road corridor too has encouraged authorities to intervene this river corridor.

Unlike Bagmati and Bishnumati, less archaeologically important sites and monuments have been found in this river. Less cultural and religious linkage to the river of the surrounding people is also due to the changes on river alignment naturally and artificially in the past. Lacks of facilities to perform their cremation works and other religious function have kept them far from this river.

Nearly 5.5 m^3 solid wastes per day has been found to be deposited at the entire river corridor from Bagmati confluence to Chabahil (Section 1 to section 7) which should be added to the 350 – 400 m3 per day being managed for KMC today if planning intervention is to made at the corridor.

Through the urban planning perspective, the 'Dhobi Khola Link Road' (DKLR) is justifiable. Less cultural impacts, significant improvement over river environment,

immediate functioning of the innermost ring road and Dhobi Khola ring road along with existing ring road among four concentric ring roads of the valley envisioned with the huge relief of traffic from city core, decongestion at Thapathali junction, Gaushala and Chabahil Chowks, establishment of connector road between the rapidly growing urban fringe Kapan area and Patan core area and large vacant plots going to be developed at Chabahil, Ghattekulo etc. are the justifications of the construction of DKLR. Comparative chart made in this study for various origin and destinations have also proved this road to be significant.

The corridor may be converted into a large institutional and commercial center of the city combining the characteristics of both the river corridor and the major transport corridor.

If not intervened, the proposed land development pockets at Ghattekulo and Chabahil areas, which are the river banks of last 100 years, is most likely to develop as the present area of GAIAUPP, which was also a river bank in the past. The large spaces remained at the corridor as the household courtyards and vacant plots have positively indicated the land readjustment schemes necessity. Still, around 60% area of the corridor has found to be vacant including roads. The prospect of appreciation of land value, with reference to the lands of Bishnumati corridor, where the price hike was almost 10 times after construction of Bishnumati link Road, has been found to be sufficient to finance the proposed planning intervention at the corridor if minimum of 25 meter land is acquired and developed. The proposed ratio of contribution for separate land development schemes and the peoples will for contribution have found significantly different. The necessity of partnership programs with people have been recommended

Finally, since the different rivers of Kathmandu Valley have their own characteristics and require different approach for intervention, the study will definitely help the future researchers specifically for them who want to study in rivers like Manohara, Nakhu etc.

Hence, the strategy to develop river corridors should be synchronizing its potentiality with the potentialities of the surrounding areas of the river.

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ABBREVIATIONS / ACRONYMS

ADB	Asian Development Bank
BC	Before Christ
BLR	Bagmati Link Road
CBS	Central Bureau of Statistics
CBD	Central Business District
CEO	Chief Executive Officer
DC	District Council
DDC	District Development Committee
DHBPP	Department of Housing, Building and Physical Planning
DUDBC	Department of Urban Development and Building Construction
DWSS	Department of Water Supply and Sewerage
DLR	Department of Land Revenue.
DK	Dhobi Khola
DKCIP	Dhobi Khola Corridor Improvement Project
DKLR	Dhobi Khola Link road
DSC	District Steering Committee
DOI	Department of Irrigation
DHM	Department of Hydrology and Metrology
DMG	Department of Mines and Geology
DOR	Department of Road
DOA	Department of Archeology
DMG	Department of Mines and Geology
DBMS	Database Management System
DHUD	Department of Housing and Urban Development
DOS	Department of Survey
DWSS	Department of Water Supply and Sanitation
ESRI	Environmental Systems Research Sanitation
FINNMAP	Finnish Map
GIS	Geographic Information Systems
GPS	Global Positioning System
GCP	Ground Control Points
GAIAUPP	Ghattekhulo / Anamnagar Integrated Area Upgrading Pilot Project

GKDMPS	Greater Kathmandu Drainage Master Plan Study.
HMG/N	His Majesty's Government of Nepal
HRD	Human Resources Department
ICIMOD	International Centre for Integrated Mountain Development
KMC	Kathmandu Metropolitan City
KUDP	Kathmandu Urban Development Project
KVMP	Kathmandu Valley Mapping Programme
KVUDC	Kathmandu Valley Urban Development Council
KMC	Kathmandu Metropolitan Corporation
KVTDC	Kathmandu valley Town Development Committee
KVDA	Kathmandu Valley Development Authority
KTDIC	Kathmandu Town Development Implementation Committee
KUDP	Kathmandu Urban Development Project
LGSA	Local Self Government Act
LSGR	Local Self Government Rules
MENRIS	Mountain Environment and Natural Resources Information Service
MOPE	Ministry of Population and Environment
MUAN	Municipal association of Nepal
MHPP	Ministry of Hosing and Physical Planning
MLD	Ministry of Land Development
MOPE	Ministry of Population and Environment
MSMD	Management Support for Municipal Development
MIR	Ministry of Land corporation
MOA	Ministry of Agriculture
MLD	Ministry of Local Development
MECSW	Ministry of Education, Culture and social welfare
MWR	Ministry of Water Resources
MOL	Ministry of Labor
MC	Municipal Council
MFSC	Ministry of Forest and Soil Conservation
NWSC	Nepal water Supply Corporation
NEPAP	Nepal Environmental Policy and Action Plan
NPC	National Planning Commission
NTC	Nepal Telecommunication Corporation

RDBMS	Relational Database Management Systems
SWMRC	Solid Waste Management Resources and Mobilization Center
TIPC	Town Planning Implementation Committee
TA	Technical Assistance
UDD	Urban Development Department
UDLE	Urban Development through Local Effort
VDC	Village Development Committee

GLOSSARY

Anna	Unit of Land Measurement, 1/16 of a Ropani, 4 Paisa, 16 Dam, 342.25 Sq. ft.
Crore	10,000,000 (Ten Million)
Jatra	A religious or ritual festival celebrated by group outdoor with procession.
Khola	Small River
Kitta	A number given to a plot for its unique identification, tax purpose.
Lakh	100,000 (One Hundred Thousand)
Puja	A worshipping program offered to god and goddesses
Ropani	Unit of Land Measurement, 5476 sq. ft. (1 / 13 of a Bigha)
Tirtha	A religious/ritual or holy place of Hindus and Buddhists.
Utsav	Joyful celebration / ceremony

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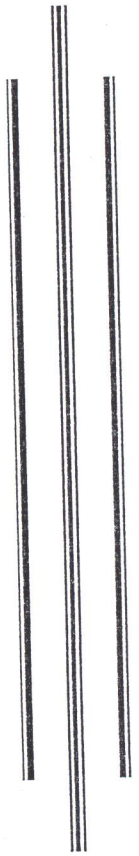
CHAPTER- I

INTRODUCTION



CHAPTER I

1.0 Introduction

1.1 Overview

The nature of urbanization in the developing countries is reflected by high population growth rate and unprecedented rural – urban migration due to extreme hardships in the rural areas. In general, urbanization in developing countries are characterized by

- Rural to urban migration.
- Transformation of agricultural society to non-agricultural Society.
- Change form a sparse rural settlement pattern to relatively dense urban settlement pattern.
- Change in occupational structure from agriculture to industry & service sector.
- Increased interactions and functional structure.
- Change in physical environment
- Increased modern amenities and services.

The last two characters have a direct link with this impact study of a river corridor development.

In contemporary Nepal, planning of the river corridors has not been carried out. Hence the role of planners in this regard has become more important than before. Realistic planning should be derived from rational thoughts. The planning should consider participation of all stakeholders, private sector, local people and other development agencies from the beginning. Involvement of political leadership is pivotal as mobilization of stakeholder is the major determinant of such planning.

1.2 Identification

Kathmandu valley is rich in small rivers and watersheds. Almost all the watercourses flow through the middle of the city. Hence they have a greater importance in urban planning and development. Lots of potentialities are hiding behind these rivers. These river corridors could be the second major attraction of the valley, first being the world heritage sites and its associated culture.

The planning intervention on City Rivers as water front development was very popular in Europe and America in fifties and sixties. Nepal has initiated only few years back from the study of 'Bagmati corridor Development'. Works have already

progressed much in Bishnumati link road. "Bagamati Corridor Infrastructure Development Project" has also been initiated by the KVTDC as a joint venture of HMG, KVTDC and LSMC. Now, Dhobi Khola River is on the verge of undergoing planning intervention through "Dhobi Khola Corridor Improvement Project"(DKCIP).

Dhobi Khola originates from the northern hill 'Shivapuri' of Kathmandu valley. It flows through the middle of the City towards south and confluences in Bagmati River at the center of the valley. It has medium discharge among the rivers of the valley, less width and flows siding Singh Durbar and Baneshwor Area.

DKCIP has proposed 4 lane arterial road to improve North-South linkage of the city. Ring road and Kantipath – Lazimpat - Maharajgunj road are the roads of this kind, which links north and south, though it has some narrow meandering strip at Panipokhari. The impact on transportation network could be more positive in this context as the metropolitan area of greater Kathmandu is ever expanding to the north south direction, which may be due to the shape of the valley and population might have exceeded beyond its carrying capacity. It is also interesting that the *Arniko* highway and *Prithivi* highway are running east – west. But settlement expansions are continuing at North-South though there is no outlet as such.

1.3 Objectives

Major objective of the study are

- To study the possible impacts (both positive and negative) of planning interventions made on city river corridors.

Other objectives are

- To find better planning interventions on city river corridors, suggesting the various measures and strategies.
- To review the various projects related to the Dhobi Khola Corridor Development.

1.4 Rationale

Nepal is a riverine country rich in water resources. It has big and small rivers flowing through its cities, especially in capital city Kathmandu. These rivers are being ignored for long time in the past and used as a waste disposal site and also as haphazard

urban development areas. Present conditions are leading towards slum development around these riverbanks.

Initiation of planning measures from capital city Kathmandu is a natural process, because every new concepts and innovations take place from the major cities, normally capital city, and then it goes to other places. Therefore, it is the right time to think and study about the impacts of proposed interventions and developments from the various sides of the city life. The academic sector, which is believed to be the origin of innovations, where most of the research works are conducted, should be involved in these studies. Authorities are making planning interventions on city river corridors as development measures, however many controversies are also arising from other sides. It is, thus necessary to study the positive and negative aspects. Identification of measures reducing the controversies and conflicts will help planning and implementation.

Since bulk urban land leftover is found in riverbanks, it is logical to go for such study. The environment of these river corridors is in a worse condition demanding immediate improvement. It is also the place which has high economic potential, which could be developed into a commercial and institutional center.

The Dhobi Khola Corridor Improvement Project is coming soon and the possible impact study of this proposed intervention would be more beneficial for the project.

In the proposed DKCIP the Kathmandu Metropolitan City along with the central government is trying a new approach of urban road construction with the people's participation. The modality of construction of this road and other development activities of the project may become a milestone in adopting such procedures for other urban roads like *Bagamati, Manohara* and *Hanumante* river corridors.

1.5 Scope and Limitations

The study includes river corridor development in general, and for proximate *DKCIP's* impact on the specified components such as socio- cultural, transportation, environment, urban planning, land development and management, and water and road linkages. The study has not covered in detail the legal and institutional aspects.

Spatial limit of the study has been restricted to the mentioned river corridor. For cases like transportation, cultural linkages, it has covered other networks and adjacent

areas of the corridor. So, it has been extended to Lalitpur and Bhaktapur but in no case beyond the Kathmandu Valley.

The study has been based on primary and secondary data. Primary data has been collected after collecting secondary data and analyzing its sufficiency and reliability. Suitable sampling method has been adopted so as to minimize the inherent percentage of error.

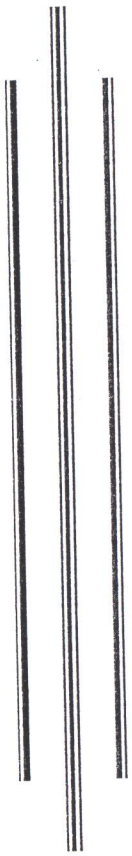
Data has largely been collected from River Use Survey, questionnaire, interviewing the concerned people/stakeholders, aerial photos, map interpretations and has tried to do realistic projections.

1.6 Study Components

- Review of proposed projects related to Dhobi Khola corridor.
- Impact on city infrastructures, such as transportation sector, sewerage, solid waste etc.
- Socio - Cultural Impact
- Urban economics components such as transportation system, installation of citywide network, land development and management, project financing etc.

CHAPTER- II

LITERATURE REVIEW



CHAPTER II

2.0 Literature Review

2.1 General

The literature study of some selected materials has been done to strengthen the study and to understand the evolution and development of human settlement with rivers. The studies has been undertaken to know the issues involved, what are the problems, characteristics and urban planning efforts on the particular subject. The study also aims in understanding the issues, which are different in literature than in this thesis and which are similar in approach to tackle them.

2.2 Water and Urban Development

The early of civilizations spread along fertile river valley where food and water were at hand. The Egyptian, Chinese and Indus valley civilization came up along the great river – the *Nile, Hwang Ho, Yangste Kiang* and the Indus respectively. Along the bands of the rivers these great civilizations flourished as centers of trade and commerce. The water bodies were means of sustenance for these civilizations. Between 5000 and 4000 BC man started using water to irrigate his fields and till the age of industrialization main use of rivers was for irrigation, fishing and navigation.

The next stage of development of urban settlement was the growth of cities by riversides. At that Time River was the only safe mode of transport. The boat, prior to the wheel, gave rise to a river transport system. Zurich in Switzerland on river Limmat and the London on Thames are the example how a watercourse shapes the settlement around. Since air, land and water are the principal physical needs for the existence of human settlement, this fact is manifested through the human settlement development along the riverbanks in the initial historic settlement. Next, the productive agricultural land along the riverbank provided surplus foodstuffs to human thus initiating them to adopt secondary occupation as craftsmanship, art and architecture. There are numbers of such early-developed settlements along the riverbanks flourished with art and architecture in different period of time.

In European countries and the USA, the important rivers are being studied as a matter of national policy. Schemes had been drawn up to prevent pollution of the Thames in the UK, the Delaware River in the USA and the Rhine and Danube in Europe.

Further, the growth of cities and city-states led to the insurgence of feudalism. The feudal lords fortified the settlements using the rivers or by constructing the moat around the fort as the most natural form of defense. Thus, during that period, water was a resource for sustenance, communication and defense of the settlements. But the story of commercial waterfront is different. Due to the increasing interdependence of cities on one another, exhaustive trade and commerce were started. Land routes couldn't guarantee the growth of cities, as they were costly to build, difficult to maintain and open to attack by Bandits and Barons. There was high risk to merchant caravans for loot / ransom. This gave rise to water based transportation system in many countries and gave rise to cities with a commercial waterfront. (Lindh, G. 1983)

Furthermore, the tendency of road being built along the river was come into being due to its commercial viability following the urban development expanded from river to inner side.

2.3 Intervention on Thames and tributaries

The Thames had long been regarded as a noteworthy Salmon River before industrial revolution. Slaughterhouses, coal wharf; cow houses, tan pits and fish markets all deluged the river with their waste in 19th century. The increasing use of water closets caused cesspits to overflow into the drains, resulting in considerable pollution of the Thames and it's tributaries.

Central London was always morosely affected by pollution, River was smelly, having black water with a floating scum of filth, corrosion of metals in ships and discoloration and damage to paint word, both float and ashore. The pollution even killed Queen Victoria's husband when typhoid spread in 1886. The death of Prince Albert was certainly caused by infected drains at Windsor castle allied to primitive local sewerage. In the adjacent Thames, princes Alice sank after a collision in the vicinity of Barking; a notorious area polluted not only by sewage but highly toxic effluents from the nearby Europe's largest gas station in 1879.

An intervention was made in 1853 due to the public outcry, and then hundreds of kilometers of main sewers were constructed. But, as a result, Thames converted into a dead river. Between Flam in west London and Tisbury, out towards the Thames estuary, there were no fish and other aquatic life forms due to contamination over a period of more than a century had totally killed the River Thames.

"The Thames water Authority" was established and it administered the various laws passed to prevent the river pollution. Now, prior approval was required from the Authority to discharge effluents on it.

A mechanization program undertaken by the Greater London Council replaced the old open barrages by roll-top ones which moved the waste down the river to the adjacent county of Essex, where it was used on landfill scheme. Today, the Thames, size of which is around one tenth of *Ganga,* has a very high quality of effluent and it has been turned into the cleanest metropolitan estuary in the world. The cleaning up of the Thames is an environment success story but it took 15 to 17 years to achieve it. The Thames Water Authority modernized sewage plants, built reservoirs, and installed computers to monitor water quality. They have proved that, restoration of river is one thing but keeping it restored is in fact a continuous process of constant co-operation between various authorities, research organizations and industry in searching for new innovations to tackle new problems or unsolved old ones. One such innovation of mechanization now prevents any domestic waste from spilling into the Thames. (Ager, D.V. 1983)

2.4 History of settlements and River views in India

2.4.1. Indigenous Settlements

All the older civilizations in India have developed along major river systems. And most of the settlements have been developed near to water bodies either natural or man-made. The indigenous system of articulation of the city system interface has been a direct outcome of the socio cultural ethos prevailing in the different part of the country. The daily life in these settlements revolves around the water bodies. Water is considered as source of sustenance, communication, and defense. Water is a sacred entity and was worshipped. The existing water bodies

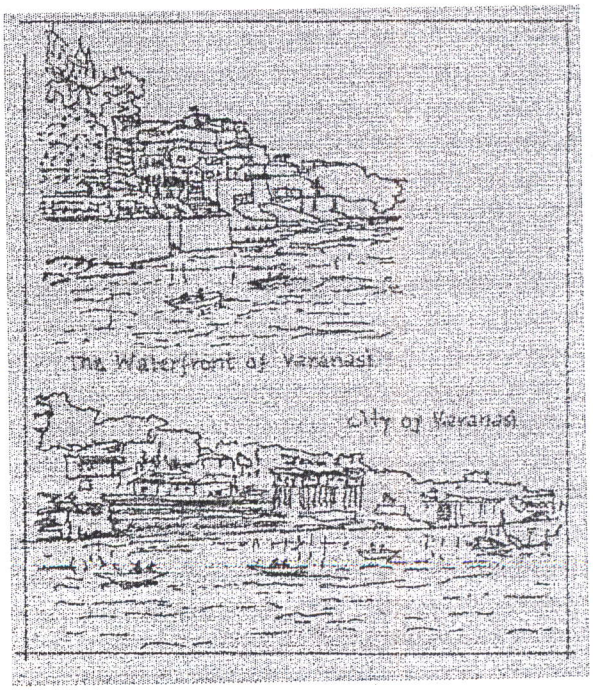


Fig 2.4 a

dictated the morphology of the indigenous settlements, some around the water bodies and some a little away from them. The strong response of settlements to watercourses has been an outcome of:

- Functional Needs – Water, trade, transports etc., daily functions like bathing, washing, rituals etc.
- Secular functions – Processions, *Utsavs*, markets, and in general, the hub of the social and cultural life.
- Religious Significance – The sacredness of the water and the practice of worshipping.

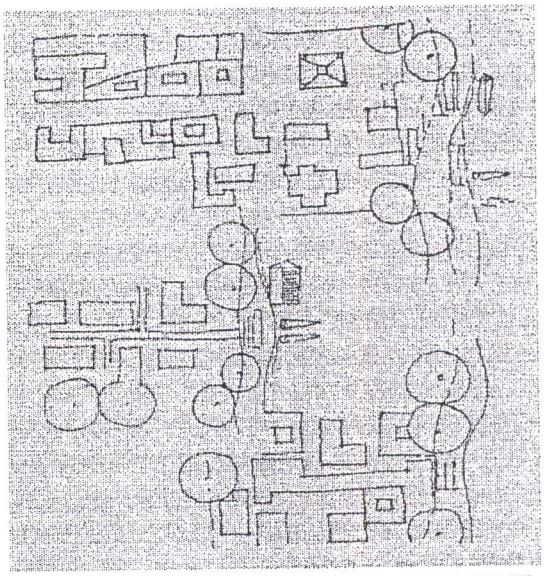


Fig. 2.4.b RIVER IN INDIGENOUS SETILEMENT
(Water body in city structure as multi function provider space/courtyard)

2.4.2. Islamic Settlements

The extended period of Muslim Rule in the country did not produce significant changes in the indigenous approach to land water interface. They exploited the "aesthetic significance" of the water bodies to be used lavishly to create romantic natural settings for their monuments but never tried to access the water bodies.

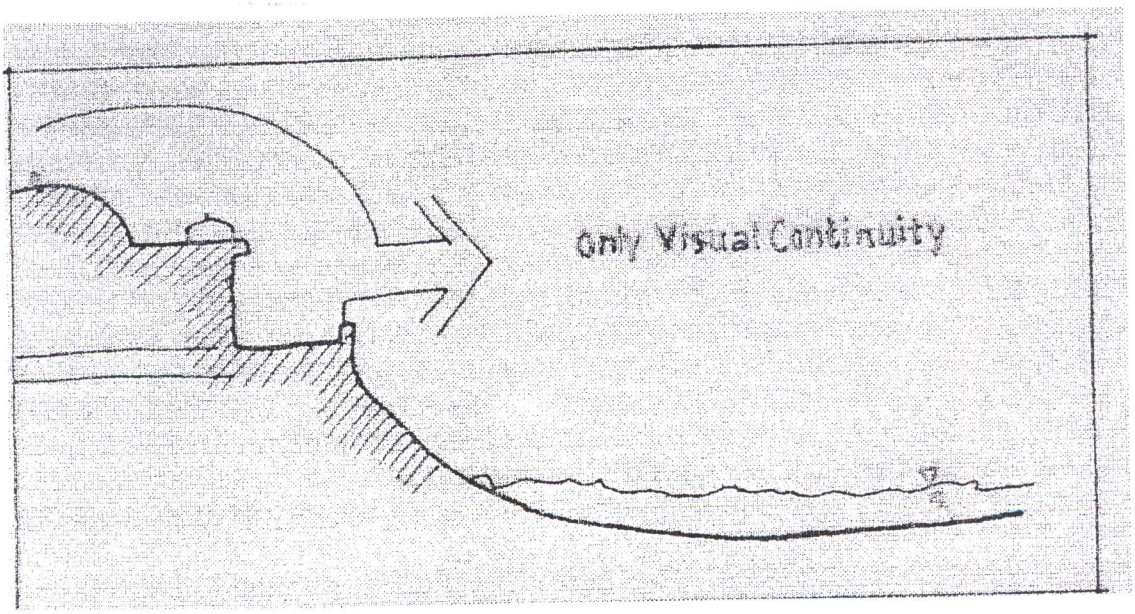


Fig. 2.4.c. RIVER IN ISLAMIC SETTLEMENTS.
(Aesthetic significance, Suitable settings for palaces etc.)

2.4.3. British Settlements.

With the emergence of the European traders in the early 16th century, the water bodies became the favorites locations for putting important public structures as well as for ancillary services like hotels, churches, institutions, fortifications, and residences, Structures on waterfront were treated as objects in space. During this period only the modern system of water supply was introduced.

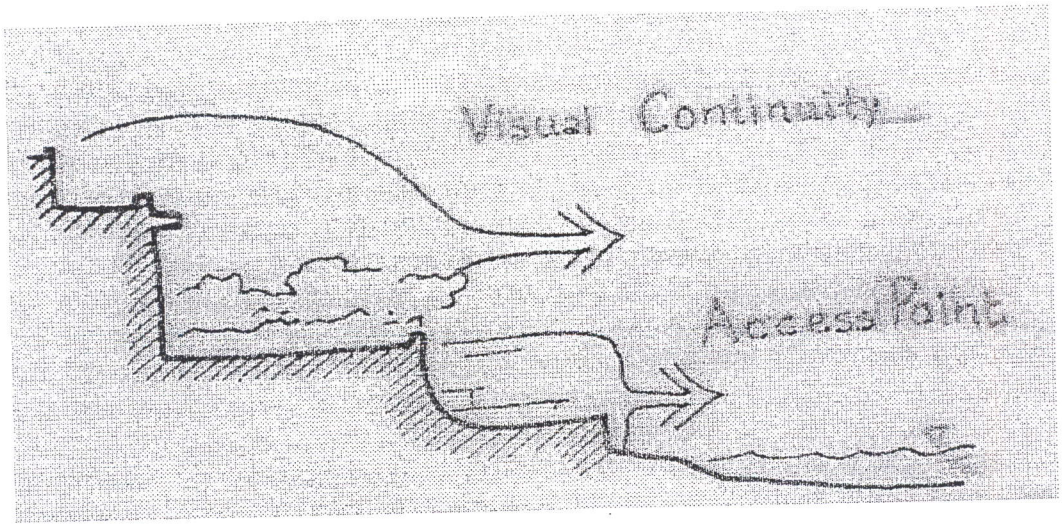


Fig 2.4.d. RIVER IN BRITISHERS' SETTLEMENTS.
(Tried to assess water bodies' entry point, also located public buildings)

2.4.4. Post Independence Settlements.

Dependencies on technological solutions were increased. Modern water supply system and large reservoirs were considered as the only solution for water related problems. This led towards the neglect of locally available water recourses as now water can be transported from far away places. The wetlands are taken as wastelands and can be reclaimed for development purposes. These are considered as suitable places to dump wastes. The change in consumption pattern demands for more resources, which cannot be fulfilled by existing resources. The change in attitude towards water bodies finally leads to dependence and degradation of water bodies. (Ando, M.K. 1996)

2.4.5. Modern Urban Settlements.

These days all the human activities in the growing urban settlements lead to the problem of pollution and eutrophication not only in the standing water bodies such as lakes but even in the major flowing rivers like *Ganga* and *Yamuna*. Large scale

deforestation agriculture and grazing due to road construction, the efforts of making land available for development led to problem of sedimentation and many water bodies got extinct. Water is being transported for kilometers of length and thus the existing resources being neglected. Land centered planning considered water bodies as unnecessary, the area, which can be reclaimed for settlement, and the area, which is most suitable for dumping the wastes. The religious and sacred values of the water bodies were lost. In the place of public and social activities on the water edge, the industrial, residential, tourism and commercial activities spreads along the shore. The water bodies are being encroached and also being abridged for the convenience of crossing. This resulted in growth of urban settlements on the both sides of the banks of water bodies.

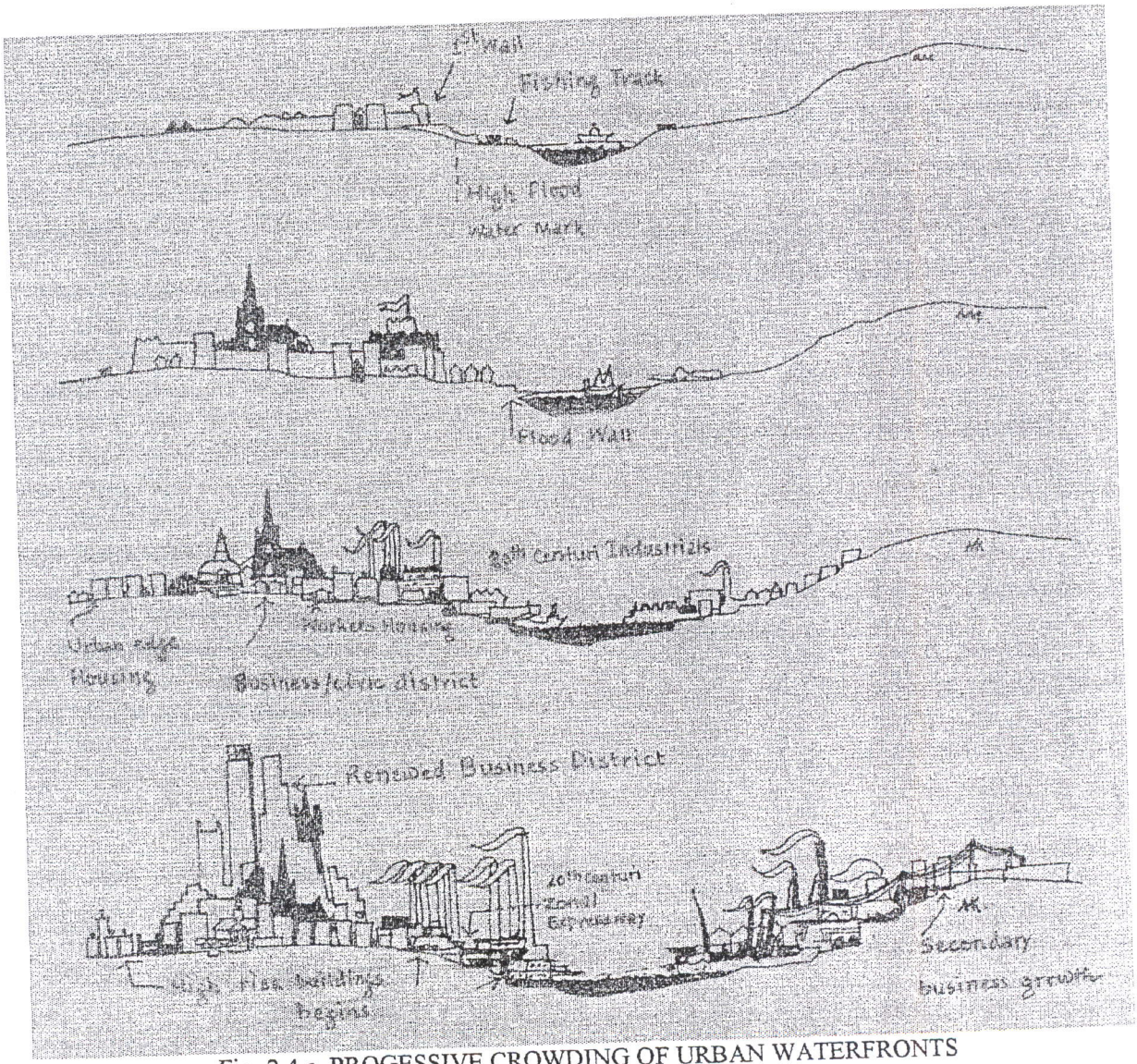


Fig. 2.4.e. PROGESSIVE CROWDING OF URBAN WATERFRONTS

The problems of encroachments are more pronounced in urban settlements. The impacts of human activities on the water body not only led to the degradation and

depletion of water bodies but it also led to changes in the hydro-geological regimes consequently affecting the water level fluctuations. This has resulted in more flooding in urban settlements and this phenomenon is becoming more and more pronounced in most of the settlements.

Therefore, both urban development and water bodies used to be influenced by each other and wherever the urban development took place in a balanced and integrated way with the water bodies those settlements flourished and survived throughout the history. In the present context also, water has the function of sustenance, recreation etc, but neglect and thoughtless planning led to the deterioration of water bodies as well as urban environment.(Negi, N.K. 1984)

2.5 River Corridors of Kathmandu Valley

The problem of environmental degradation is not indecent in Nepalese culture, but this core cultural spirit, which is rather environment conserving, has not been put into practice for a number of reasons due to the breakdown in traditional and cultural perceptions towards the environment; the pressures and needs of modern development; the lack of balanced perception of development and environment. Similarly the disappearing local traditional groups like *Guthi* which used to gear towards conservation; individual attitudes of self interest; lack of infrastructure and facilities, and distrust between the people and government are the other reasons behind the degradation of river areas. Regarding religion and people, "there is a gap between what is professed by the religion and culture and what is actually practiced". The backdrop for this statement is that, both Hinduism and Buddhism of Nepalese culture recognize inseparable and integral relationships between man and nature. Their scriptures are full of appreciation for nature; river being major one. Despite this positive spirit towards the environment in religious and cultural tradition, people are not behaving, as they should.

Some social indicators regarding the degree of people's awareness about river and environmental are;

- Positive towards education and exposure to environmental issues;
- Positive towards the level of development of the area in which they live
- Positive towards the availability of municipal services.
- Positive towards the intensity of environmental problems and degrees may vary depending upon the cultural background of the neighborhood.

The chain of causes and effects are;

- Urban activities of large population in limited physical space of the Kathmandu Valley.
- Institutional failure in growth management including urban activities, pollution control and residual management. (HMG/N, Standly Int. Ltd. Et al., 1994)

Sand is one of the Shiva's symbol and people usually take some home for a *puja* ceremony. People of Kathmandu Valley have strictly followed the *Ne Muni's* (One of the primitive sages, from whom Nepal finds it name) directives and respected the river as divine and holy. People of all castes and social status purified their body and soul through ablution in the sacred river water and they are protecting, decorating the riverbanks from centuries. People have forgotten their divine link with those river bank '*Tirthas*' and the government has forgotten its social and administrative responsibility towards the *Bagmati*. Afterwards the degradation of river's ecology have started due to so called development of Kathmandu Valley, education facilities, real state ventures and industries in an unplanned a binary way. These have destroyed the Bagmati River by overdrawing water/sand. Untreated effluent from factories, hospitals, slaughter houses, schools and governmental buildings are discharged into the river system at various points in the Valley. Baidya, H.R. 1988).

Sharing the experience of urban waterfront development pattern of Hong Kong City, historically, water had been used as a means of transportation and communications, as medium of commercial transactions and local source of economic prosperity. With the change of time it has been used as a vacant space on which land reclamation can be done to accommodate the urban amenities. With the growing population and decreasing vacant land many agencies plan land development schemes and take many years or decades for implementation. City has got the experience of urban renewal, housing development or city center revitalization works and the present waterfront projects are the latest opportunity for coastal cities to make correction in earlier form of development as well as to enhance quality of urban life in the city. (Shrestha, B.K.1996)

In the later days after invention of locomotives, the road corridor has emerged as a major pull factor for human settlements instead of river corridors due to availability of fast and safe mode of transportation as well as for trade and economic activities. Lack of proper planning has created congested as well as polluted road corridors to live in and in the mean time such road corridors are mushrooming

throughout the south Asia. In Nepal, in the last two decades many such corridors have developed and grown like *Kathmandu-Dhulikhel* road corridor and *Biratnagar-Itahari* road corridor etc. Planned approaches should be taken towards the development of the road corridors along with the river corridor in order to stop the encroachment and to prevent the traffic congestion.(Lal, A.C. 1999)

Emphasis on immediate need of initiation of planning intervention in sewage, solid waste, squatter settlement and river training work should be given in order to improve and develop the area around the Bishnumati river in a healthy manner. Some of it has already been started such as construction of toilet, reed bed treatment plants, sand treatment works and establishment of green belt at the bank etc. These planning interventions have helped improving environmental conditions only to some extent. The problems regarding water quality have arisen because of ecological imbalances caused by the waste disposal and if our associated infrastructures has to be sustained for future, study of riverine ecology and the effect of the water quality should be carried out.(Lamichhane, R. 1999)

Major problems and issues of *Bagmati, Bishnumati* and DhobiKhola are;

1. Environment Degradation
2. Sand Extraction
3. Accessibility
4. Dilapidated Archaeological and religious buildings and sites
5. Land Encroachment

The planning approach has been developed identifying the issues and if encroachment is allowed to continue at the present rate, it'll lead to a situation, where the betterment of the river environment may not be possible for a very long time and hence planning interventions are inevitable. Following criteria are proposed as a base.

A) Environmental Conservation Aspect

✓ Treatment of sewage and solid waste before disposal

✓ Buffer zone between river and settlement to reduce encroachment and pollution.

✓ Protections of natural flood plain from urban expansion, allowing the surrounding area to be submerged during heavy floods for few days.

B) Land Development

✓ No construction zone of 20 m. width from the bank of the river on either side with

- Permission to retain existing buildings but no further additions, legalizing for certain compounding fee.
- A paved access road of 6.5 m. along the no-construction zone demarcation line.
- Land development along the riverfront for recreational and cultural activities with properly designed landscaping.
- No capital intensive and major structures along the flood prone areas.
- No construction zone of green belt Park and toilets.
- Self-manageable development and local level participation in operation and maintenance.
- Land Pooling and GLD along the river corridors
- UN Park at flood plain behind *Prasuti Griha.*
- Archeological important spots to be demarcated as conservation zone and to be planned accordingly.

The Recommendations on six difficult areas are;

1. Sewerage
   - Sewer cleaning works to clean all choked sewers. As short term project for 1 year initially along with repair and maintenance of broken pipes etc; then once in a 3 years.
   - Reed bed treatment plant as a natural waste treatment method or constructed wetland method at Bagmati-Dhobi Khola confluence.
   - Conventional treatment plant as a long-term solution as recommended by "SNOWY MOUNTAINS ENGINEERING CORPORATION AND CEMAT CONSULTANT (P) LTD, 1991 incorporated in final report Volume III of Greater Kathmandu Drainage Master plan studies. Six new treatment plants along with interceptor sewer on both sides of *Tukucha, Bishnumati, Bagmati* and *Dhobi Khola* rivers have been proposed. No wastewater is allowed into river without proper treatment to make river free of ill effects of sewer.

2. Solid Waste Management

The vermiculture for treating solid waste has been emphasized as a long team program. It is a technique through which the degradable wastes generated is decomposed with the use of certain species of earthworms.

- Weed collection from the riverbeds because quantity of weeds exceeds the self-cleaning capacity
- Collection of solid waste already thrown into the river
- Public awareness program relating the generation, separation and safe disposal focusing "what to do and what not to do" in and around river corridors
- Sanitation and public health improvement by proposing public toilets and slaughterhouses, motivating from the example of Tankeshowori, where toilets are earning up to Rs.10 to 12 thousand annually, etc are the programs recommended.

3. Land Development

Land development has been proposed as a long-term project. Land poling, GLD are the techniques proposed as suitable because of their self-sufficiency. Possible establishment of Reed bed Treatment Plant for sewage, collection centers for solid waste management and overhead tanks, streetlight are some of the major recommendations. The Jurisdiction of the authority extends to 100 m. form the banks on either side of the rivers.

'Land sharing program' has been proposed along with squatter up-gradation and resettlement program. Public spaces like park, plantation, children parks like riverain environment has been proposed as a buffer zone to enhance aesthetics and soothing environment.

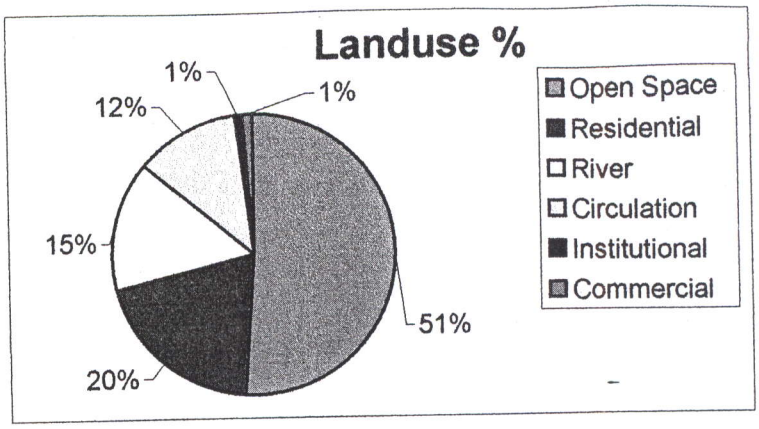
More precisely for better circulation, an access road of 6.5 m. width has been proposed throughout the stretch along with plantation and parks. Leaves, revetment and retaining walls have been proposed as river training works, also for river slope stabilization and erosion protection in these river corridors.

Finally, proposed alternative sources of financial management for conservation and development of these river corridors are

- Introduction of sand extraction tax
- Introduction of waste management tax
- Land Sharing for squatter up gradation
- Encouragement of private sectors for development on public spaces and commercial centers.

The proposed land use of Dhobi Khola River corridor was 51% open spaces, 20% residential, 15% river, 12% circulation, 1% Institutional and further 1% as commercial. Further divisions of these allocations made were:

LAND USE %	
Open Space	51
Residential	20
River	15
Circulation	12
Institutional	1
Commercial	1
Total	100



Open Space	
Organized Park	6
Plant/Forest	25
Cultivated	20
Total	51

Residential	
General	3
LAND POOLING	9
GLD	8
TOTAL	20

CIRCULATION	
Metalled	7
Non-metalled	5
TOTAL	12

Table/Chart 2.5.1 (Source: HMG/N, 1999, U.N. Park Development Committee)

Giving birds' eye view to the different literatures, it has been found that "Detailed Feasibility and Engineering Design of sewerage system from *Shankhamul* to *Teku Dovan*" has recommended interceptor sewer along the banks of Bagmati, Bishnumati and Dhobi Khola River. It has also suggested construction of overflow structure at every incoming sewer lines and used as combined system. Only dry weather flow will be diverted to the system. It has also recommended the extension/rehabilitation of the *Dhobi Khola Treatment Plant* to treat an average sewage flow of 157 mld. New pumping station has been proposed for *Patan* north area, near Bagmati River, where the Dhobi Khola River discharges ultimately.

Dhobi Khola Sewerage Treatment Plant could be constructed for the area covering the Dhobi Khola sewerage zone and up stream areas of the Dhobi Khola-Bagmati Junction as action plans. (Stanley Int. Ltd. Et al., 1994)

A master plan level study identifying strategic planning for the development of various infrastructure facilities within the valley, has recommended that, in ascendance with the land use and environmental strategy, trunk interceptor sewers should be extended along major rivers within the greater Kathmandu to serve both existing areas and the proposed accelerated development areas. Their alignment and secondary networks should be considered as components of the proposed local area Action Plan. In order to facilitate the future development, river areas of the Kathmandu will be the only possible route for laying major transport corridors. It is therefore necessary that

sufficient land should be reserved for future development through land use and development control regulations. The urban spaces that could be dedicated for new network constructions are along the riverbanks of

Bishnuamti River

Dhobi Khola

Bagmati River

Manohara River

There should be the construction of inner ring road in the Kathmandu City.(Halcro Fox 1969)

Another detailed study on the various alternative routes for the proposed inner ring road had recommended the following components for inner ring road;

North section:	Indian Embassy- Bishalnagar- Sano Gaucharan
West section:	Bishnumati Link road
South section:	Bagmati Link road
East section:	Dhobi Khola Link road

(Source: JICA Report)

As a part of this inner ring road, the construction of Bishnumati Link road (BLR) has already been started. The Central Sector Development Plan, one among five sectors of KMC, has identified the east section of the inner ring road as "Dhobi Khola Link road" having potential for development.

"Urban Land use strategy", has recognized the flood plain areas of Dhobi Khola corridors within the existing municipal boundaries, as accelerated development areas or topmost urban expansion areas to come and stay, and stated that it should get first priority in development to maintain greater Kathmandu as a compact city.

Greater Kathmandu Drainage Master Plan studies (GKDMPS), HMG/DWSS, Snowy mountains Engineering corporation in association with CEMAT, 1990, has also suggested the interceptor mains along the Tukhcha, Bishnumati, Dhobi Khola and the Bagmati river. It has again recommended six conventional type treatment plants at Sanepa, Manohara and east bank of Bagmati at the confluence of the Bagmati and Bishnumati, Dhobi Khola Junction, Nakhu Junction, Kodhu. But in contrary to other reports it has given the view of the treatment plant at Dhobighat to be abandoned and reclaimed, to be sold to buy land at other locations.

2.6 Salient Features of Legislation Covering Kathmandu Valley

2.6.1 Environmental Protection

Environmental Protection Act (EPA), 1996

- The Act recognizes the interdependence between development and the environment by minimizing the impacts of environmental degradation on people, and plant species and their physical surroundings.
- The Act obliges the proponents to undertake IEE and EIA of proposed plans or projects which may cause changes in existing environmental conditions
- Empowers MOPE to prohibit the use of any matter, fuel equipment or plant, which has adverse effects on the environment and authorities to MOPE to clear all EIA reports.
- Has a provision for the polluter to compensate affected persons from polluting activities.
- Empowers the government to provide additional incentives to any industry, occupation, technology or process, which has positive impacts on environmental conservation.
- Establishes an Environmental Protection Fund to be used for environmental protection, pollution control and heritage conservation.
- Gives the government authority to declare specific areas as environmentally protected areas.

Environment Protection Regulations, 1998

- Provides certain roles for Village Development Committees and municipalities in environmental assessment, pollution prevention control.
- Obliges the proponents to ensure public consultation before finalizing the Terms of Reference and approving the EIA reports of any development proposal(s).
- Formulates and enforces environmental standards to minimize environmental pollution.

2.6.2 Legislation of Urban Growth and Development:

Town Development Act, 1998

- Develops extension of towns with provisions for necessary facilities and services.
- Determines land utility zones and regulates use of lands and natural resource for town development. Initiate land development program for urban activities.

- Checks activities that affect public health; regulates, controls and prohibits actions that pollute the environment. Orders demolition of construction built against standards.

Kathmandu Valley Development Authority Act, 1988

- Provides for development of the Kathmandu Valley into a principal administrative, tourist, cultural and economic center; plans physical development of the valley and contains its haphazard urbanization.
- Establishes authority for planned development of the Kathmandu Valley. The Act has created the Kathmandu Valley Physical Development Committee and Town Development Committee.
- Determines and demarcates land utility zones for physical development; prohibits adverse use of natural resources, government land and immovable properties, demolishes unauthorized construction.
- Regulates, controls and prohibits pollution having an adverse effect on public health, scenic beauty and tourist areas.

Municipality Act, 1991

- Prepare municipal development plans and establishes basic community infrastructure including public health, recreational facilities and slaughterhouses. Regulates construction according to municipal plans.
- Provision of management of public conveniences, means of transportation parking system for vehicles, pollution control and waste management, maintenance and protection of public road plantations.
- Regulates land use for town development planning; provides for buildings in public places or built against established standards to be demolished.
- Protects areas of drinking water, flood control and natural and cultural heritage sites.
- Provides for safe and clean drinking water in the municipal area.

2.6.3 Local self Government Act, 1999

- Empower local authorities to administer and manage local resources.
- Gives major responsibilities to DDC and empowers VDC and DDC for staff recruitment.

- The Act requires and empowers Village Development Committees to prepare and implement programs on forest and biodiversity conservation and prevention of soil erosion in the village development areas.
- Municipalities are required to provide support to environmental conservation by controlling water, air and sound pollution; and protecting the forest areas and other natural heritage sites of the municipal areas.

2.7 Conclusion

Hence, it has been concluded that, as most of all ancient cities in Kathmandu valley were developed along riversides it provides ample of utilities for nearby residents. Now, we should develop its potentiality synchronizing the development of surrounding areas.

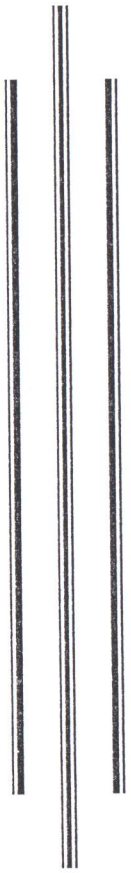
The gap between the actual practice and professed by the religion and culture have adversely affected the rivers. Riverbanks are used as dumping sites for all types of wastes. Private individuals are encroaching upon riverbanks.

More study has been made by the report to the physical/tangible segment of development and preservation and much less has been mentioned about the cultural, social, religious, spiritual and economical aspects.

The most significant way in which HMG can demonstrate it's tangible leadership in cleaning up the Bagmati is by way of providing sewage treatment for it's most populated institutions like army, police, jails etc.

CHAPTER- III

RESEARCH MORPHOLOGY



CHAPTER III

3.0 Research Morphology

3.1 Nature of the Study

This study is descriptive with huge effort on data analysis and interpretations. synthesizing them to find the impact statements, ultimately leading to some recommendations on the study matters.

3.2 Research Questions

1. Since the river is small with low discharge, what are the expected changes on river, on the verge of construction of DKLR?
2. Is the economic impact sufficient enough to push the planning intervention?
3. Is the socio-cultural impact of planning intervention positive and rational?
4. What would be the possible impacts and programs of planning intervention to get the positive impacts?

3.3 Expected Output

The Outputs of the study is presented in terms of impact statements, strategies and recommendations. These outputs are based mainly on the study components mentioned above and laid within the scope and limitations of the study.

The study has tried to generate the clear-cut impact on various sectors or components mentioned. Some of the outputs been possible impacts of planning intervention on road development, land development, sewer lines, socio-cultural sector, city as a whole for transportation sector, and others at a corridor specifically and on river environment and on urban system in general.

Strategy and recommendations envisaged by the impacts to come for the sustainable development of that city as a whole.

3.4 Study Process

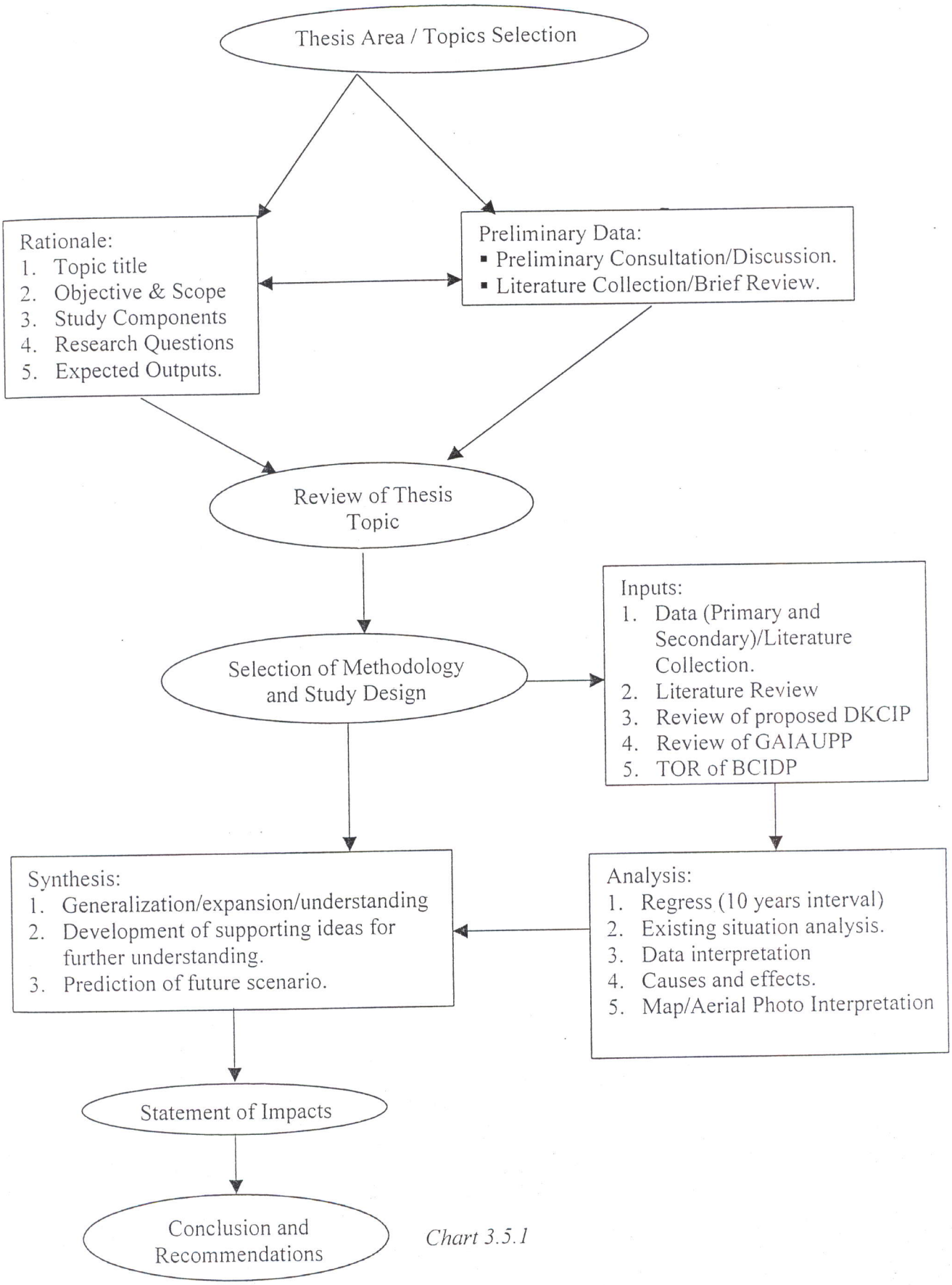


Chart 3.5.1

3.5 Methodology

The study has followed a descriptive method and has interpretive type. The design of the study mainly depends on some primary data, the previous studies, review of the related literatures, reports, maps, aerial photographs etc. and historic facts, site observation, interviews with authorities and questionnaire survey to people has been incorporated to fill the data gaps. The accumulation of facts leads to predicting the future.

Some major features of the Methodology are

a) Data collection and literature review:

Among the secondary data and literatures, major focus has been given on collection of pertinent materials on the above-mentioned study components. Various journals and literatures regarding the riverside development, transportation, sewer and solid waste management, urban economy has been collected and reviewed in order to find the relevance with the topic chosen. District profiles and other secondary data have been consulted. Aerial photographs of year 1954(1:25000), 1964(1:12000), 1981, 1998(1:15,000) are collected and converted to scale 1:8000 and Satellite image of year 2001(IKONOS) has been collected for interpretation. Recent Digital Maps of the area and photographs has been taken

b) Primary Data with Field Survey:

Few weeks of time has been devoted for the field survey in order to fill the data gap within the river corridor. People who directly affect by the planning intervention have been interviewed along with the stakeholders, concerned authorities and experts. People's problem, their desire and impact they foresee have been focused on the field survey.

In addition of that structured household questionnaire and checklists survey with valid statistical sampling, river use survey has been made to know the existing conditions and to forecast the future strategy.

c) Data Presentation:

These collected data have been presented in the systematic way as deemed necessary. Graphs, charts, tables have been given priority. Photographs and charts have been placed in the middle of texts for effectiveness along with annexure. Linkage maps

with a linear diagram were also prepared to show the source and destinations of various goods, commodities, people, transport and related markets.

d) Analysis and synthesis:

Data analysis consists the regress of the study area preferably at 10 yrs. interval along with the existing situation analysis. After critical analysis, synthesis have been drawn. Generalization of the overall situation has been made with necessary explanation in the synthesis part. Appropriate planning tools have been applied and prediction has been made for future.

3.6 Time Schedule and Budget

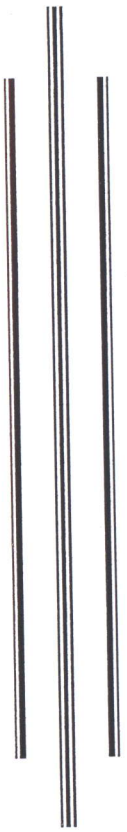
The study has been completed with a period of 4 months. The details regarding the study are

1. Preliminary proposal submission	-	August 14, 2002
2. Final Proposal	-	August 26, 2002
3. Preliminary Presentation	-	August 26, 2002
4. Literature-collection/Data collection	-	August 12 – August 31, 2002
5. Desk Study, Literature Review	-	August 15 – Sept.15, 2002
6. Field Survey	-	Sept.1–Sept. 28, 2002
7. Mid term report preparation	-	Sept.29–Oct.2, 2002
8. Mid term Presentation	-	Oct.3 – Oct. 4, 2002
9. Gapped data collection	-	Oct. 6 – Oct. 11, 2002
10. Continued the Analysis	-	Oct. 21 – Nov.12, 2002
11. Final report preparation	-	Dec 15 – Dec 27, 2002
12. Final Presentation	-	Dec 31, 2002
13. Final Submission of Thesis	-	Jan 7, 2002.

Table 3.6.1

CHAPTER- IV

PROJECT REVIEWS



CHAPTER IV

4.0 Project Reviews

4.1 Proposed DKCIP (Dhobi Khola Corridor Improvement Project)

4.1.1 General

DKCIP (Dhobi Khola Corridor Improvement Project) is a joint programme run by KMC (Kathmandu Metropolitan City) and the European Union (EU). It is currently being studied by KVMP (Kathmandu Valley Mapping Programme). The project aims at environmental improvement through integrated corridor development of the Dhobi Khola river corridor. The particular aim of the project is to finance the public works in the corridor to a large extent from the accrued land values that will result from upgradation of the area. The construction of the Dhobi Khola Link Road (DKLR), training and stabilisation of the Dhobi Khola River, the installation of trunk sewers and the servicing of remaining land in the corridor with infrastructure to stimulate urban development are some of the major aspects of the project.

4.1.2 Objectives and Scope of DKCIP

The immediate task of the proposed project have been to undertake all those actions needed now to ensure that adequate land remains available for construction of the DKLR and other essential public utilities at any time in the future. In view of the ongoing urban development and densification process, particularly in the central areas of the city, without urgent intervention by KMC, all lands along the Dhobi Khola have been developing and no space has been anticipated to be left for construction of the DKLR, an interceptor sewer and other future trunk facilities. It would be possible only at very high cost of land acquisition and compensation for building demolition.

So, the specific objectives of the project are;

- To improve intra- and inter-city traffic flow in Kathmandu.
- To reduce traffic in the city centre by diverting city core traffic.
- Environmental improvement of the Dhobi Khola river corridor.
- To support the adjoining Ghattekulo Area Upgrading Project (see annexure-1)
- To create accessible and serviced plots to accelerate urban development in the corridor.

Scope of DKCIP

The infrastructure-upgrading plan has included road and access, drainage, solid waste, water supply, electricity and telecommunication. In the first part overall infrastructure upgrading plans and determined the indicative cost estimates are there. As the second part, a pilot project for implementing infrastructure-upgrading scheme have been proposed to be selected after discussion with KMC, KVMP and other line agencies. It is in process. Detail engineering survey, design, preparing detail maps and drawings, detail cost estimates, technical specification, and tender documents for the selected project has proposed to be carried out.

4.1.3 Project Area

Proposed DKCIP study area covers the downstream part of the Dhobi Khola, from the Kathmandu Ring Road at Dhumbarahi to its confluence at the Bagmati River, a total length of about 4.5 km. However, regarding land drainage and sewerage the entire catchment of the river have been taken into account.

The width of the study area, effectively a land corridor, extends minimum of 60-meter perpendicular from the top of the riverbank on both sides of the river.

The project area constitutes those lands located within the study area that have been identified as needed for the type and extent of development envisaged in the corridor.

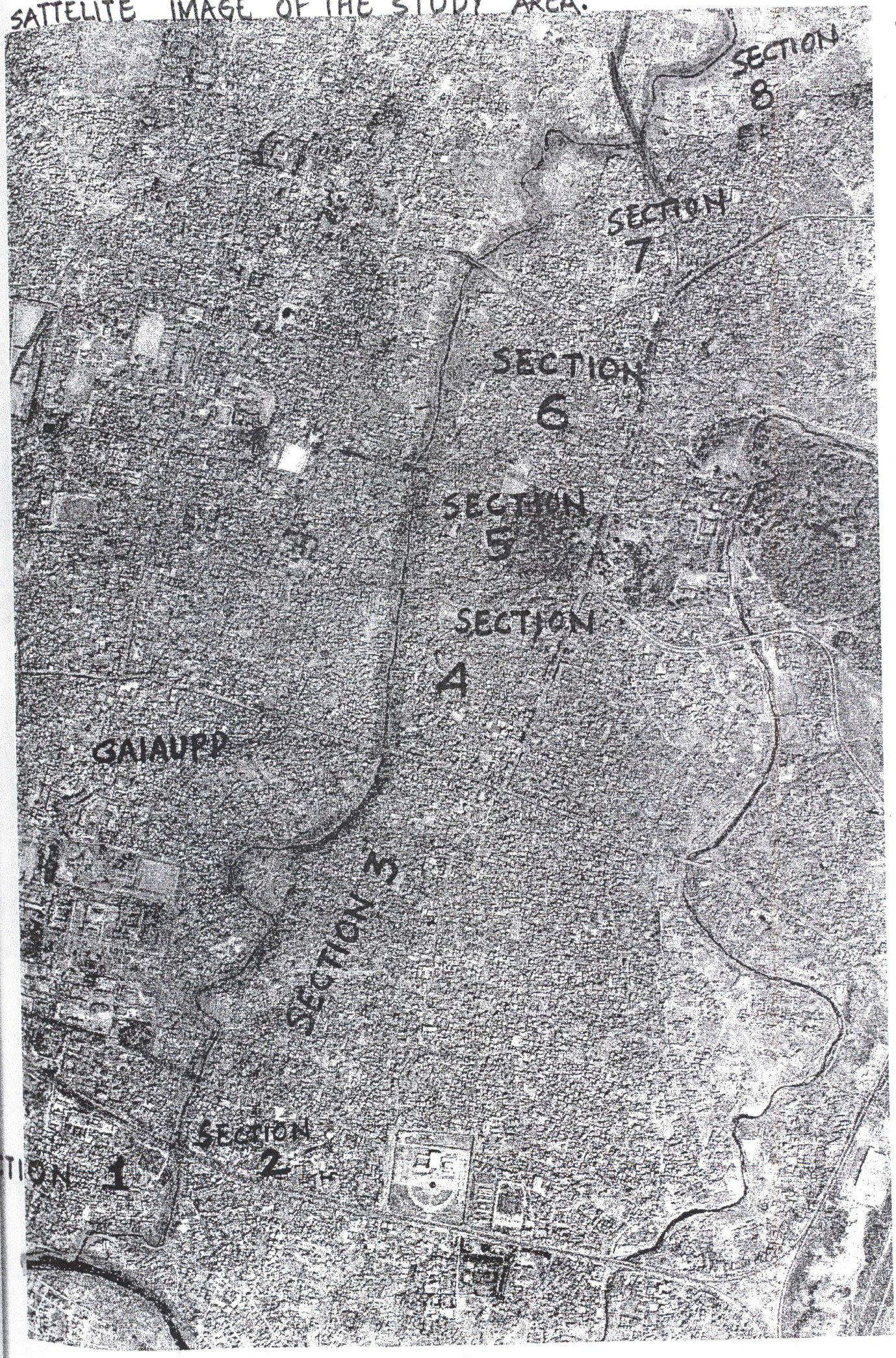
The right bank pockets at the Ghattekulo section and west plots of ring road bridge upto the Khahare Khola (Dhumbarahi area) have been identified for the Land development. The boundaries of the Project Area determined by KVMP and approved by KMC as one of the first actions in the planning and design stage of the project. After approval, KMC has decreed already a moratorium on development at the corridor.

4.1.4 Project components

4.1.4.1 General

The project is of integrated corridor development. This needed to ensure that various functions of the corridor such as river flow, land drainage, trunk services, road traffic and future land uses are fully compatible with each other and well performing. Conflicts among these are kept to a minimum. The main construction and development components of the project are

SATTELITE IMAGE OF THE "STUDY AREA."



4.1.4.2 The Dhobi Khola Link Road

Principle of road development

In order to achieve an integrated development of Dhobi Khola area and to bring public participation in the development activity, a land development tool - Site & Service has been proposed. In accordance to Land Acquisition Act (2021), land required for road and land adjoining the road has been planned to acquire. The developed plots have been proposed either to distribute among the original landowners or sell in the market. The principle for adopting this approach is to generate financial source for land acquisition and construction costs within the project itself.

The road has been proposed to be designed as the major arterial road for the city. Therefore, intersections from the secondary roads are proposed to minimum as far as possible. The alignment of the proposed road has been cited with a view to minimise the construction cost (including land acquisition cost) and to enhance the smooth traffic flow. The various options needed to be studied regarding the road alignment such as road in east/west bank or on the both sides depending on the topographic features, river hydrology, existing buildings and availability of vacant land. Other criteria identified, which needed to be adopted, for fixing the alignment of this road by DKCIP are:

- Enhancement of land development
- Effect on religious/cultural monuments
- River enhancement

The DKLR has been proposed to be built following a minimum standard of an arterial road, consisting of two separate carriageways of 7 meter width, each comprising two lanes in each direction. The road alignment has been proposed to be designed so as to smooth traffic flow, while minimising its construction cost. Local conditions have been considered to be the determinant factor for location of the two carriageways, either together on the left or right bank, or separated on each side of the river. At a later stage the DKLR have been envisaged to be extended across the *Bagmati River* to be connected with the *Bagmati Link Road* on the south bank of the *Bagmati River*. Land for extending the DKLR to the *Bagmati River* have already been acquired under the project and kept in reserve for future construction of the road.

To ensure a maximum of free flow, access to the DKLR has been proposed to be restricted by providing a limited number of intersections with existing local roads. No direct access has been allowed to any land and buildings adjoining the road. The

DKLR have been cited to be constructed in stages to permit upgrading of its standard over time or to meet higher traffic demand. For instance, initial construction could provide intersections at grade, permitting later date construction of crossings at different levels, i.e. over- and under-passes.

The proposed draft report on the design of Dhobi Khola link road consists of double lane 7-meter wide road, 2-meter wide footpath and 3-meter wide cycle track along each bank of the river, except near *Bagmati river* confluence, where the road leaves the Dhobi Khola in *Buddhanagar* and heads towards south east. The cycle track is proposed near the riverbank, where tree plantation has also been planned. 5-meter wide track has been designed in between *Buddhanagar* and *Bagmati* river confluence area at the sides of the road for footpath and cycle track. 1m wide medians have been kept in the middle of the road. During the fixing and design of road the consultant has claimed to have studied various possible alternatives to fit with the proposed geometric standard so as to develop a cost effective North-South link as an inner ring road. The trunk sewer have been proposed below the footpath except at bridge intersections, where the sewer line passes from underneath of the bridge.

Three Proposed alternatives are:

Alternate – 1

The road alignment under first alternative have followed both banks of the river up to *Buddhanagar* and heads towards south east leaving the existing Dhobi Khola up to *Bagmati* river. A skew bridge has been proposed at *Buddhanagar* to link the right bank road alignment. Construction of a bridge over *Bagmati River* close to the end point of proposed Dhobi Khola link road would have stated to link Kathmandu with Patan, and also stated to be solving the problem of traffic congestion at *Thapathali Bridge.*

About 600 m stretch of the Dhobi Khola in steep area (*Baneshwor height*) has been shifted from left bank towards right bank by about 6m just sufficient for the construction of 2 lane roads, pedestrian and cycle track as well as for sewerage structure. The report has proposed this option because it cites the construction of sewerage structures in the left bank is a must to give continuity of sewerage, which needs some space for sewerage construction and service road.

Alternate-2

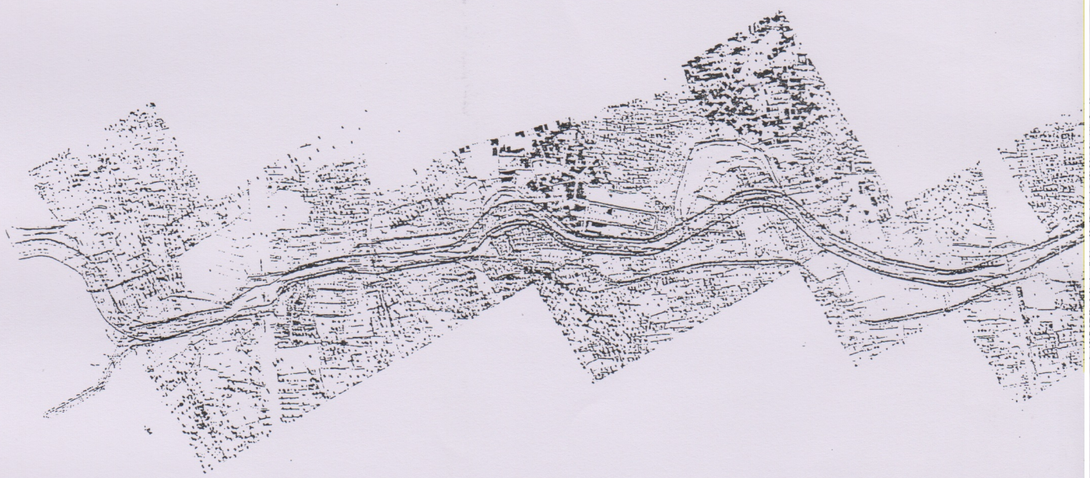
The alignment proposed under second alternative has followed both banks of Dhobi Khola throughout the proposed section and a skew bridge has also been proposed before the confluence of *Bagmati River* upstream.

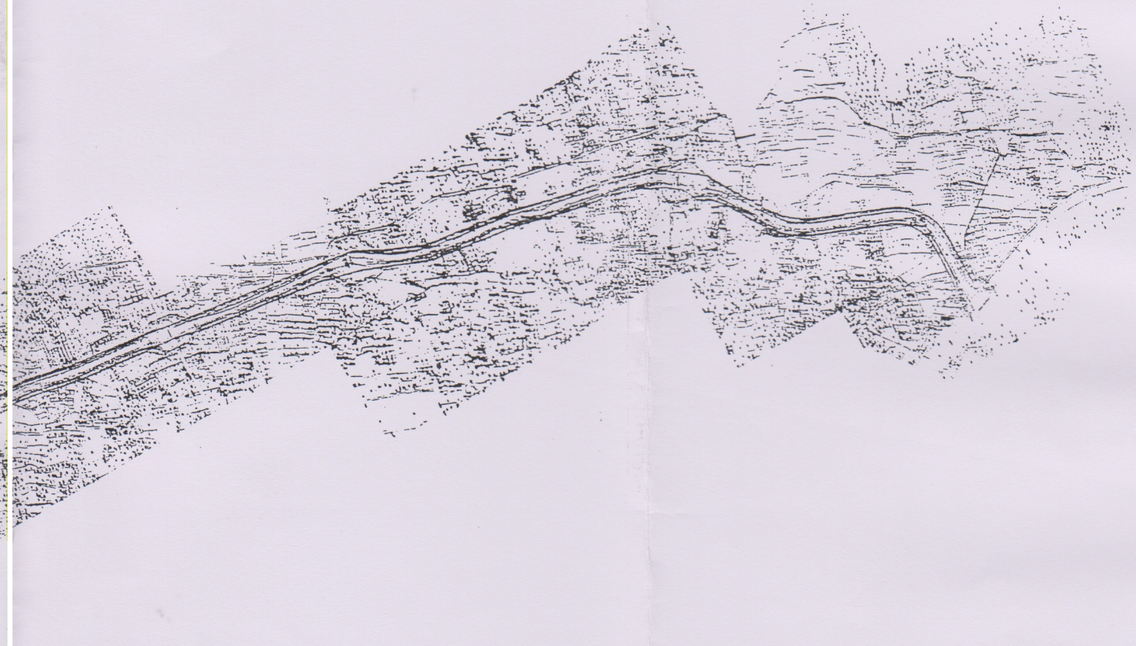
Alternate – 3

An alignment passing through *Baneshwor Height* (along existing road and track) has also been mentioned by report as an alternative alignment along the left side of river to avoid construction of road in the steep area close to the river. The option to upgrade/widen the nearest existing road at steep area (*Baneshwor height*) have been found technically and financially unjustifiable, as the technical standards of existing road itself is very poor, topography have not allowed for good geometry of road and the area have been found densely built up.

Similarly, two different options have also been worked out at existing bridge approaches as mentioned earlier.

Based on the economic factors, geometric design parameters and future development of Dhobi Khola link road, the report has chosen the first alternative for its detail engineering design and implementation.





LEGEND:

- EXISTING ROAD
- EXISTING WATER LINE
- EXISTING BANK
- ROAD CENTER LINE
- ROAD FORMATION
- FOOT PATH
- PROPOSED RIVER BANK
- TRUNK SEWER LINE

KATHMANDU METROPOLITAN CITY

KATHMANDU
VALLEY MAPPING PROGRAMME

PLANNING AND ENGINEERING
DESIGN OF MACRO INFRASTRUCTURE FACILITIES
OF
DHOBI KHOLA CORRIDOR IMPROVEMENT PROJECT
(PACKAGE-1)

DKLR INDEX PLAN

ATE:

ESIGNED BY: CHECKED BY

RAWN BY: APPROVED BY:

SCALE (m)

0 180 360M

ITECO Nepal (P) Ltd.

Jin Bahadur, New Baneshwor, Kathmandu, Nepal
P.O.BOX NO. 2147, KATHMANDU, TEL. 493764

DATE :

DRG. NO. :

SHEET NO. :

Tentative Intersection Control Policy & Capacity Analysis

The project report has analysed the network traffic volumes for DKLR for different conditions and assessed the type of control policy required at the various intersections. The assessment is based on the general yardstick adopted by traffic engineers where signalisation is deemed necessary if the sum of the critical traffic volumes at the intersection exceeds 1000 vph or 2000 pcu/h warranted at potential intersections at Ring Road – Dhumbarahi, Purano Baneshwor Bridge and Hanumanthan Bridge sites under the 2004 'No Build Conditions'. However, all the potential intersections except Buddhanagar Intersection would require signal control by 2009. The latter Intersection would also require signalisation by 2014. The results of these assessments have said to be only tentative, since more accurate results can be obtained from detailed signal design analysis, which is outside the scope of the study. The Consultant has also calculated tentative capacities of the various intersection of DKLR based on the critical lane volume approach. The critical lane volume approach assumes roughly the likely capacity of the intersection by taking the most critical of the sums of the left plus through traffic volume in a lane and the right-turn flow across the former approach of the intersection in question and is frequently employed for capacity assessment at planning level. Table below summarizes the result of the capacity analysis in this approach. As shown in Table, all the potential intersections listed are likely to work satisfactorily till 2009 under No-Build require lane-additions, grade separations or traffic demand measures to reduce the traffic load.

Intersection Control Policy Assessment

Intersection	2002 Ex.		2004 NB		2009 NB		2014 NB		2019 NB		2020NB	
	Total Vol.	Control Policy	Total Vol.	Control Policy	Total Vol.	Control Policy	Total Vol.	Control Policy	Total Vol.	Control Policy	Total Vol.	Control Policy
Ring Road – Dhumbarahi	4375	unsignal	5200	signal	8000	signal	15115	signal	16475	signal	17095	signal
Handifaon Bridge	2715	unsignal	3600	unsignal	5535	signal	11240	signal	11350	signal	11840	signal
Kalopul	3525	unsignal	4315	unsignal	6640	signal	12750	signal	13610	signal	13885	signal
Ratopul	3555	unsignal	4460	unsignal	6700	signal	12885	signal	13750	signal	14015	signal
Purano Baneshowor Bridge	5105	signal	6205	signal	9530	signal	18350	signal	19605	signal	19955	signal
Hanumanthan Bridge	4020	signal	5180	signal	7955	signal	15315	signal	16295	signal	16665	signal
Bijuli Bazaar	4510	unsignal	5495	unsignal	8430	signal	16260	signal	17340	signal	17710	signal
Brihaspatti Collage	855	unsignal	1150	unsignal	1750	signal	3365	signal	3550	signal	3650	signal

Table – Tentative Capacity Analysis

Intersection	2002 Existing			2004 NB			2009 NB			2014 NB			2019 NB			2020 NB		
	Sum of Critical Lane Volumes (pcu/h)	Capacity of cum of Critical Lanes (pcu/h)	REM	Sum of Critical Lane Volumes (pcu/h)	Capacity of cum of Critical Lanes (pcu/h)	REM	Sum of Critical Lane Volumes (pcu/h)	Capacity of cum of Critical Lanes (pcu/h)	REM	Sum of Critical Lane Volumes (pcu/h)	Capacity of cum of Critical Lanes (pcu/h)	REM	Sum of Critical Lane Volumes (pcu/h)	Capacity of cum of Critical Lanes (pcu/h)	REM	Sum of Critical Lane Volumes (pcu/h)	Capacity of cum of Critical Lanes (pcu/h)	REM
Ring Road – Dhumbarahi	1800	5556	OK	2140	5556	OK	3293	5556	OK	6343	5556	verset	6775	5556	verset	7060	5556	Overset
Handifaon Bridge	1220	4644	OK	1450	4644	OK	2238	4644	OK	4298	4644	OK	4582.5	4644	OK	4825	4644	Overset
Kalopul	1610	4644	OK	1910	4644	OK	2948	4644	OK	5650	4644	verset	6030	4644	Overset	6297.5	4644	Overset
Ratopul	1630	4644	OK	1940	4644	OK	2948	4644	OK	5825	4644	verset	6110	4644	Overset	6022.5	4644	Overset
Purano Baneshowor Bridge	2123	4644	OK	2588	4644	OK	3968	4644	OK	7643	4644	verset	8170	4644	Overset	8315	4644	Overset
Hanumanthan Bridge	2058	4644	OK	2510	4644	OK	3850	4644	OK	7410	4644	verset	7925	4644	Overset	8060	4644	Overset
Bijuli Bazaar	1573	5556	OK	1935	5556	OK	2963	5556	OK	5728	5556	verset	6167.5	5556	Overset	6227.5	5556	Overset
Brihaspatti Collage	625	4644	OK	820	4644	OK	1368	4644	OK	2430	4644	OK	2532.5	4644	OK	2605	4644	Overset

Table4.1.4.2.1

4.1.4.3 Dhobi Khola River

Dhobi Khola is a relatively small river with strongly fluctuating seasonal flows, causing frequent flooding in the monsoon period. Regular changes of its river course, construction of a major road, such as the DKLR, next to the river requires that the banks of the river be stabilised and other measures be taken. It is necessary to minimise flooding, soil erosion, subsidence of the road and damage to buildings and other structures in the corridor. The report has stressed on to straighten a number of sharply curving meanders of the river to better agree with the road alignment and to reclaim idle public land for revenue generating development.

Hydrological Study:

The project has identified the objectives of hydrological study as:

a) To provide hydrological information and solutions to ensure that the Dhobi Khola can convey all storm water and the flood discharge freely without disturbing planned developments in the corridors.

b) To propose economically viable and environmentally friendly structures for river training works.

S.N.	*River Section*	*Theoretical Waterway Under Regime Condition*	*Actual Waterway width measured*	*Recommended width of waterway considering local constraints*	*Highest water Depth during flood*
1.	Chabahil	49 m	16m	14m	3.0
2.	Babar Mahal	54 m	18m	14m	3.6 m

Table 4.1.4.3.1 (Source: Iteco Nepal P.Ltd.)

4.1.4.4 Trunk sewer

No development in the corridor has been possible to be seriously considered and undertaken before pollution of the river by raw sewage has been arrested. Therefore, the installation of a trunk sewer (or interceptor drain) has been identified as prerequisite. This sewer will eventually have to convey most of the fluid, if not all waste water generated in the area expected to be developed in the catchments of the DK River. This requires that estimates be made of the total sewage discharge from the entire catchments area, at present and in the future, in order to calculate the capacity and size of the trunk sewer downstream.

This downstream part of the trunk sewer, as part of the project, have proposed to be constructed from the Kathmandu Ring Road to the Bagmati river, where it

would discharge the sewage in the Bagmati river till such time that the planned Kathmandu sewage treatment facility would be implemented.

Environmental Study Outcomes:

The project report has drawn following as conclusions of the environmental study.

i. The Proposed alignment has given adequate attention in relation to:
   - River training work
   - Road Safety
   - Avoidance of demolition of existing houses
   - Management of drainage system

ii. Road alignment and ROW have been designed in such a way that high flood levels have been considered based on available hydrological information.

iii. The Construction of the DKLR (provided the designed capacity is not exceeded) will reduce the traffic on adjoining routes and hence it will improve the traffic conditions.

iv. No major cut-and-fill equalization activities are part of the project.

v. DKLR project can act as a means of effective communication; it can provide a public opportunity for leisure (thus allowing for contact between people living along the street and those who use it) and it can also be used as a means of raising awareness on Dhobi Khola river pollution.

vi. In terms of money, the proposed scheme is obviously likely to be more expensive than a conventional street without environmental considerations.

vii. The level of increase in localized vehicular emission is expected to be within the tolerable limits.

viii. An important aspect on DKLR in relation to living conditions has been stated to be the problem of noise.

ix. Disruption caused to existing communities, including some illegal occupants on public lands, can create uncertainty for some of the inhabitants and can have a considerable impact on the surroundings.

x. The result of the opening and widening of the road can transform the character of the whole area from what would otherwise be classified as near village area to fashionable residential area.

xi. There are no areas of architectural or historic significance, which will need to be protected from the increase in traffic volume.

xii. In the case of DKLR, the river itself is of prime importance and needs to be given adequate attention for preventing further pollution.

xiii. An important issue, being voiced by all people concerned, was the loss of private land and property and their compensation.

xiv. DKLR can be regarded as an opportunity to improve the overall environment of the command area.

4.1.5 Land development and project financing

The report states that, "large parts of the flood plains of the Dhobi Khola were being cultivated but as from about 1990 urban development started, most of it was used for housing. However, poor access and infrastructure is preventing development beyond present limits and from reaching the population density of about 300/ha, desired and justified for this central part of the city."

The DK corridor as proposed to be developed under this project covers only a minor part of the river's flood plains. However, more land has been proposed to be added to the corridor than strictly needed for the river, road and other utilities. Additional land has been proposed to be acquired by KMC and subsequently provided with access, infrastructure and subdivided in new parcels which to be sold at improved market rates. Revenues generated from this land sale and possibly other sources of project income, be used to make the project self-financing to the maximum extent possible, at least with regard to the construction of the DKLR.

Land required for the DKLR, public utilities and other uses proposed in the corridor have been planned to be acquired on the basis of the provisions of the Land Acquisition Act (2021) and other relevant legislation. The amount of land and number of buildings to be acquired is to be assessed by means of field surveys. Data has been collected on the use, age, size, construction standard and condition of buildings and structures. For the acquisition of land and legal buildings and structures, compensation

be paid on the basis of current land market prices prevailing for each location, and per unit of built floor area on the basis of current construction cost units, respectively.

Legal property owners whom land and property have been proposed to acquire, but who desire to be relocated in the same area, have been said to be the first to be issued a new plot of land of equal value as their original plot and in a location to be jointly agreed with KMC. In this land readjustment process, *the basic principle* will be applied of paying compensation, either in land or money, to an extent that equals the original land value, i.e. the market value of each parcel at the date of acquisition by KMC.

Land Development Planning and Programming

Based upon the DKLR alignment obtained from the package 1 of DKCIP, for the integrated corridor development, the pockets for land development have been identified, apart from the land adjoining the DKLR:

1. POCKET A Area towards the northern sector consisting ward no. 4, 7 and Partly ward no. 5
2. POCKET B Area between *Bhatkeko pul* and *kalo pul* consisting of ward no. 7
3. POCKET C Area between *Bhatkeko pul* and *kalo pul* consisting of ward no. 7
4. POCKER D Area in *Ghattekulo* consisting of ward 32
5. POCKET E Area in *Ghattekulo* consisting of ward 32

Among the five pockets identified, in Pocket A the block layout planning and sample readjustment has been carried out. The other pockets shall be developed accordingly as soon as the DKLR proposed by the consultant of package I, is finalized and approved by KVMP.

Total Area

	Ropani	Anna	Paisa	Daam	Sq. m.	
Development Area I (Phase I)	724	6	3	2.38	368735.46	50.07%
Development Area II (Phase II)	722	5	3	2.87	367686.62	49.93%
Total	1446	12	3	1.24	736422.08	100.00%
Pocket A Phase I	724	6	3	2.38	368735.46	50.07%
Pocket B	42	10	3	2.21	21724.37	2.95%
Pocket C	56	2	0	2.68	28572.95	3.88%
Pocket D	45	11	2	1.59	23274.00	3.16%
Pocket E	37	8	1	2.43	19100.29	2.59%
Parcels along the Link Road and Dhobi Khola	540	4	3	1.97	275015.02	37.34%
	1446	**12**	**3**	**1.24**	**736422.08**	**100.00%**

Table 4.1.5.1

The Land Development Approach

Site and services approach has been proposed for the implementation of land development in the whole corridor. Special preference has been given to the landowners whereby they can decide on whether to have cash or land as compensation for land development purpose.

Although the site and services approach is considered for implementation, the land pooling modality has been proposed to be followed under the approach in the various pockets identified for land development.

It has been recommended that the KMC and the Department of roads (DOR) both jointly undertake the implementation of the project. The DOR can undertake the construction of DKLR whereas the KMC can undertake the land pooling schemes in the various pockets. The land pooling schemes has been stated to be financially self-sustainable but at initial stages the seed money should be borne by KMC from its revenue sources.

Population Density

The population density for the planning area has been tentatively proposed to be *550 persons per hectare*, based upon the following assumptions:

Residence Use	60%		
Ideal / Ultimate Plot Size	127.17	Sq. m.	
No. of Plots per Hectare	48		
No. of Households @ 2 per Plot	96	hph	
No. of Households @ 2 per	576	pph	
Total Population for the Area			
Area (in Hectare)	32.6	Tentative area for land development in the northern part (ward 4, 5 and 7) only.	
Total Population	**18778**		

Table 4.1.5.1

Planning Concept

For planning purpose, the urban area has been identified as it could be broken down into discrete modules, which can be repeated to form a site plan. The project has considered the neighbourhood module, a neighbourhood boundary, containing sufficient population to warrant common facilities serving daily needs.

The following design principles have found to be taken into consideration:

- Circulation should border the neighbourhood unit as a corridor to one side or as a loop road.
- Vehicular and service access provided on streets should be designed to present a discontinuous pattern to avoid through traffic.
- Schools and open spaces should have a direct relationship to residential areas:
- Street and pathway layout should be planned to channel surface runoff water with natural slopes, away from buildings and activity centres, into the natural or existing lines of drainage.

Block module

A Block module is a group of individual plots bounded and served by public roads and walkways. It is the basic component of residential subdivision. The following general guidelines have been found to be taken into consideration while formulating the block layout plans:

- Longitudinal axis of a block should be laid out perpendicular to major roads of the neighbourhood.
- In blocks adjacent to major roads, end plots should orient to the major road thus increasing their commercial potentiality and land value.
- Intervals between the roads should be long enough to minimize public land use at least 100m but not more than 200m.
- Access to plots must be sufficiently wide to permit passage of fire trucks and other emergency and service vehicles.
- Open spaces and playgrounds and other community facilities should be located within easy view of the residents for better supervision and policing.
- Generally only one access point should be provided to each plot, thus negating the idea of alleys and blocks with two to four plots.
- Cluster arrangements can help promote social and cultural integration of surrounding families, essential to mutual self-help decision-making and maintenance activities.

The block layout

It has been identified that the efficiency of a design and the cost per sq. m. can be improved with a careful design for block layout and circulation pattern. The following have been found to be considered in all the three alternative block plan layouts:

- The block layout is guided considerably by the existing situation of the area development trend of the area and other relevant data and information.
- The existing built up area has been incorporated within the project area except in some cases where some of the buildings need to be demolished.
- As the length of the block increases the density is increased thereby reducing the cost of the plots per net meter square. Whereas if the blocks are too long, circulation in the neighbourhood becomes difficult. Bocks in the range of 90 to 110 m are considered to be effective both from cost and circulation point of view. As far as possible the block lengths and the depths have been considered to make the maximum use of this standard.
- Considering 4 *anna* plots to be ideal the block lengths are considered within the range of 1m and block depth intended to keep accrued to keep accrued to 30 m.

(breadth to length ratio to be 1:2). The block orientation is governed by road network.

Water Distribution Layout

A network of water supply system has been prepared for the project area. *Entry from eight source points* is taken to complete the water supply network. Galvanized Iron Pipe (G.I. Pipe) of varying diameter (6", 4", 3" & 2") is used with necessary valves & fittings. Minimum pipe size provided along the plot is 2" diameter. A set of parallel pipeline is provided along 8m & 10m roads where as a single pipeline has been provided in rest of the roads. A closed loop network of water supply system is provided wherever applicable.

Drainage Plan

A complete drainage network has been provided for the project area. Combined sewerage system has been used for designing the drainage network. Existing drainage and sewer line has not been taken into consideration while providing drainage network because of the inadequate sewer size. Sewer size ranging from 20, 30, 40, 45, 50, 60, 70, 80 and 90 cm diameter are used. Cement concrete pipe (Hume pipe NP-3) is used for the sewer line. The outlet of the entire sewerage network is toward the trunk sewer along the Dhobi Khola Link Road.

Brick masonry circular manhole of 1 m internal diameter has found to be provided at suitable locations. Bed depth of sewer line is varying according to the slope and site condition but maximum depth has been kept within 2.0 m. Manholes have been provided at bends, joints, at the point of varying pipe size and at a distance of 30 m in straight reach as for as possible.

Brick masonry Street inlets have been provided near all manholes to collect the storm water from roads and footpaths.

4.1.6 Development Controls and Buildings Guidelines

The land development areas within Dhobi Khola Corridor Improvement Project have been proposed to be developed as *Residential Zone*. As per the location factor and use, the whole areas have been proposed to be divided into the following sub-zones;

- Commercial sub-zone (under "Commercial Zone – 3" as per Land use Regulation and Guidelines, 2058)

- Planned residential sub-zone (under "Residential Zone – 2" as per Land use Regulation and Guidelines, 2058)
- Open Space.

1. Commercial sub-zone

   Residential zone within 25 meter from the center of the link road ('link road' here refers to the "Dhobi Khola Link Road of proposed 12 meter Right of Way along both the side of Dhobi Khola) lies within this sub-zone.

   Use within this sub-zone should be as per "Commercial Zone – 3" in Land use Regulation and Guidelines, 2058. In addition, schools and campus i.e. academic use has proposed to be prohibited within this sub-zone.

2. Planned residential sub-zone

   Area other than 'Commercial sub-zone and 'Open space' lies within this sub-zone.

   Use within this sub-zone should be as per "Residential Zone – 2" in Land use Regulation and Guidelines, 2058.

3. Open Space

   Area specified for the green open spaces as per the plans lies within this sub-zone.

   Beside vegetation and other small structures supporting landscaping, any other structure is prohibited. Building for other public use is prohibited. Public uses like school; community hall etc. should be accommodated within Planned residential sub-zone.

   Open spaces should be left open as lung spaces for the land development area.

Plot Sub-Division Regulation

- Minimum plot size to be maintained is 2 Ana and 2 Paisa (i.e. 80 sq.m.)
- Minimum frontage to be maintained is 6m.

Other Regulation

Controls other than mentioned above has been assumed to be formulated by the physical planning advisory committee as per the requirement, but being within the jurisdiction of the Urban Planning and Building Ordinance, 2058, Kathmandu.

4.1.7 Contribution Required

The feasibility analysis has been carried out for the pocket A. It has aimed to show cost benefit and effectiveness as well as social benefit for the landowners/tenants after the implementation of the land pooling, on the sole basis of tentative cost estimate, landowners contribution shares, socio-economic and land value survey, so that final decision could be made whether the project is feasible.

Calculation of cost of the overall project area within the delineated boundary to know approximate amount of investment excluding landowners contribution on the basis of provided layout plan has been found to be carried out.

Average Contribution Ratio *Table 4.1.7.1*

INPUT	CONTRIBUTION RATIONS BY CLASS OF PLOT			LAND ACCOUNT			(Square Meters)
A	11%	Good road access		INPUT	Road Area		86,237
B	16%	Average road access		INPUT	Open Space		18,437,
C	22%	Limited road access		INPUT	Khola		15,075,
D	33%	No road access		INPUT			
E	45%	Parcel along the river road		Land for infrastructure/OS			119,749
F	45%	Parcel along the river basin		Re-plotted Plots			236,487
H	33%	Ayog ko Rokka					
				Reserve Pots			12,499
Average contribution ratio			32.91%	INPUT	Total Site Area		368,735

4.1.8 Project cost and financing

The cost of the project consists of the following cost components:

- Construction of works,
- Land and property acquisition/compensation costs,
- Consultancy and administrative cost (studies, planning & design, supervision, office expenses, etc.

For the financing of the public works in the corridor, the project has been designed to generate, as much as possible its own income from land sale and other potential revenues. However, since investments have to be made for all the works before land can be sold and the revenues are generated, one or more grants or loans

need to be procured, either from the government, a commercial financing institution, or from a donor source, before the project can start implementation. Such loan has said to be creating a risk for KMC that may need to be shared or insured by a third party.

Cost Estimate *Table 4.1.8.1*

Proposed Cost Estimate of the project by package 1:

1. River training works		Rs. 74,788,573.31
2. Road works, (Option 1) left alignment		Rs. 74,666,843.47
Right alignment		Rs. 67,022,570.33
	Total road works =	Rs. 141,689,413.8
3. Sewer construction,	left Bank	Rs. 31,681,443.49
	Right Bank	Rs. 26,390,122.46
	Total sewer cost =	Rs. 58,071,565.95
4. General items		
i)	Insurance, water diversion, material testing, contractor's facilities etc.	Rs. 10,000,000.00
ii)	Dismantling of Existing structures	Rs. 5,000,000.00
iii)	Existing bridge renovation works	Rs. 10,000,000.00
iv)	Road marking	Rs. 3,854,144.00
v)	Traffic signals for 4 way intersection	Rs. 9,312,000.00
	Total	**Rs. 381,166,144.00**
Total cost except land acquisition		**Rs. 312,715,697.00**
5. Land & property Acquisition for		
	Road works, Left Bank	Rs. 278,422,119.07
	Right Bank	Rs. 255,37,400.53
Total land and property acquisition cost		Rs. 533,495,519.60
	Total	**Rs. 997,916,430.95**

Vat 10%	Rs. 99,791,643.09
Total Cost of the project =	**Rs. 1,097,708,074.04**

4.1.9 Feasibility Check On Land Pooling Project At Pocket A

DHOBIKHOLA CORRIDOR - PACKAGE II

A (Input) TOTAL AREA OF EXISTING PLOTS 352,485	B (Input) OVERALL CONTRIBUTION RATIO 32.9%	C (Input) GOVERNMENT OR COMMUNAL LAND 16,250
D (Input) AREA REQUIRED FOR INFRA & OS 119,749.1	E {A X (1-B)} TOTAL AREA OF REPLOTTED PLOTS 236,487.0	F (A X B) LAND CONTRIBUTION 115,998.2
G {C+F-D} AREA OF RESERVE PLOTS 12,499.4	H (Input) COST OF INFRESTUCTURE 127,171,002	I (Input) LAND VALUE AFTER POOLING (Rs. per unit area) 12,580
J (G X I) REVENUE FROM SALE OF RESERVE PLOTS 157,244,268	K (H + L) TOTAL COST (Rs) 142,171,002	L (Input) MANAGEMENT COST (Rs) 15,000,000
M (Input) LAND VALUE BEFORE POOLING (Rs. per unit area) 6,290	Checks: The project is financially viable with an estimated surplus of	15,073,266

Chart 4.1.9.1

4.1.10 Project partners and participants

The project has been undertaken by KMC in close co-ordination with KVTDC. KVMP has been assisting the launch of the project by commissioning and supervising the execution of a technical and financial feasibility study. This study has been out-sourced to a qualified, local consulting company. Other partners have said to be relevant Central Government agencies and utility companies.

The main stakeholders identified by report are landowners and residents in and around the corridor. They should be made true participants in the project and be involved as stakeholders in decision making from the outset.

4.1.11 Project staging

The project has been proposed to be carried out in a series of cyclical stages of planning, design, financial analyses and stakeholder consultations. The first stage being a feasibility study in which the technical and financial implications of the proposed development of the corridor have been broadly assessed. The results of this study, i.e. the proposed plans, designs and financial arrangements, require a broad consensus and commitment from all stakeholders before a decision is made to proceed with the project.

Basically, the project has following steps and stages.

Construction Staging And Investment Plan

The report has divided the construction of Dhobi Khola link road in three stages considering the nature, type and volume of works and efficient implementation of the project as follows:

STATGE – I Acquisition of land and properties and opening of access road

Before the start of civil structures, the land and properties are to be acquired by the project and any dismantling works are to be carried out. Then the access roads are to be built, wherever necessary to ease the movement of the project personnel. The access road is to be built considering the future use of the link road.

STAGE – II Construction of trunk sewer and river training works

The construction of trunk sewer and river training work has been proposed to be started during dry season under the second stage of construction.

STAGE – III Construction of roads and other structure

The construction of road and other related structures have been proposed to be started after completion of construction phase II.

STAGE – IV Construction of bridge

The construction of skew bridge at *Buddhanagar* and all other works such as road furniture, installation of traffic signs, traffic signals etc. have been proposed in the

fourth stage of construction after the completion of construction of I, II and III stage of works.

The stage – I, II and III works are expected to be completed in two working season, where as stage – IV work has been planned for third year and expected to be completed within 2 dry seasons.

It is quite clear that the cost generated by the land pooling in this area may not be enough for the construction of road and trunk sewer. Therefore, adequate fund should be managed before implementation of the project so that works are not stopped prematurely. However, need of phase wise construction also been indicated if funds are not managed for all works.

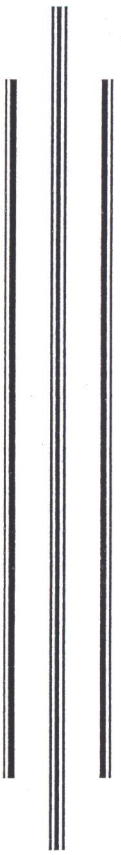
Implementation plan for the project work has been prepared based on the construction stages, which is shown below.

Project Planning Schedule *Chart 4.1.11.1*

	Activity	2002										2003	2004
		M	A	M	J	J	A	S	O	N	D		
1.	Project Brief	●											
2.	Approval Brief by KMC/KVTDC	●											
3.	Feasibility study			▬	▬	▬	▬						
4.	KMC approval Project area				●								
5.	Development Moratorium				·····	·····	·····	·····	·····	·····	·····	·····	
6.	Stakeholders meeting(s)						●						
7.	Project approval KMC/HMGN						●						
8.	Detail design DKLR, river works, trunk sewer							▬	▬	▬	▬		
9.	Construction DKLR											▬	▬
10.	Land acquisition / readjustment							▬	▬	▬	▬	▬	
11.	Land dev. planning and design							▬	▬	▬	▬	▬	
12.	Land servicing: construction											▬	
13.	Land sale/auctions												●●●

CHAPTER- V

ANALYSIS



CHAPTER V

5.0 Analysis

5.1 Study Area Division:

The whole study area of Dhobi Khola corridor has been divided into the eight distinct sections, starting from Dhobi Khola Bagmati Confluence at south to the *Kapan V.D.C.* at North, beyond ring road.

Section 1*: Bagamati - Dhobi Khola* Confluence to *Banewshor Bridge*

Section 2: *Bijuli Bazar* (Baneshwor Bridge to Anamnagar Bridge)

Section 3: *Ghattekulo* (Anamnagar Bridge to Maitidevi Bridge)

Section 4: *Maitidevi* Bridge (Seto pul) to *Ratopul*

Section 5: *Ratopul to Kalopul*

Section 6: *Kalopul* to *Bhatkyapul (Handigaon)*

Section 7: *Chabahil* (*Handigaon* pul to Ring Road Bridge)

Section 8: Dhobi Khola Beyond Ring Road (*Kapan Area*)

5.2 Data Interpretation

5.2.1. Primary Data

5.2.1.1 River Use Survey

The impact study has been felt necessary to carry out the current river use survey. Hence the stretch of around 100 m. has been taken at each section from section 1 to section 7. Data of river use for 2 hours each in morning, afternoon and evening have been carried out for section 1, whilst 1 hour survey only done for same 3 times in the rest of the sections. In order to get the average and realistic figure, survey has been carried out in different days at the same section at different timing. Data have been collected at both the riverbank at the same time and added up.

1 hour data taken thrice daily has been converted into the daily average data. Two factors '1.2' and '2' has been adopted consulting with the different people and manipulating them, failing to find any standard norms and procedures to do a river use survey. Variables having higher pitch or the time specific items like ritual functions and baths, which would be dominant in the morning and evening have been given multiplying factor of only 1.2 where as for continuous type of variables like commuters, use as urinals etc. have given the factor as 2.

Total of 5662 *commuters* per day have been found to be using the riverside roads for their daily life. The *Bijuli Bazar* section has been found as a busiest section

with 2042 person per day. Worthy to note is, these figures haven't included the people that came for the other purposes included in the survey.

Around one hundred scavengers are found to be collecting the solid wastes from the riversides whereas figure of people disposing solid waste have been found around 136 per day. The number of disposers and scavengers are proportional and disposers have found to be using small polythene bags or small buckets as their container. Normally one bucket per person have been found, where as scavengers have found to be using large size jute bags (more than 200 kg. rice bags) to carry their collection. The large amount of deficit solid waste thus have been found to be dumping by the local institutional collectors, who are collecting service charge from the individual households for collecting their domestic waste and ultimately disposed at the riverside through 2 wheeler carts, leaving the unhygienic, pity riverbanks.

Much cultural and religious linkage of people to the river hasn't been found there. The temples built at Dhobi Khola Bagmati confluence are one of the sources of drawing religious people. The next one is the funeral place at Chabahil, which lies more than 100 m. west of the river. Markably, people who were using the place for cremation in the past have been found using other sites like *Pashupati Aarya Ghat* due to various reasons. Very few people of *Handigaon* have been found still using that place as a funeral site.

The riverbanks have been found to be used by the significant number of children. Culture of using riverbanks as urinal plane is still there, which might be due to lack of new public toilets on the roadside. As high as 6000 people per day has been found to be walked on the corridor.

Around 150 persons per day have been found to be using riversides to take a stroll, for morning walk or as a place for chatting with friends.

Section 1 has a low residential density and hence very less solid waste disposals at the river. Number of scavengers is very less as well. River water is almost sewage because it's near to the confluence. The newly built temples including *Mahadev* temple at the confluence have been found to be drawing more people. Significant numbers of kids are found playing at river sides and number of people who go through to stroll and stay there to spend their spare time has also been found around 20 per day. Around 100 commuters per day have been recorded at this section.

The ***section 2, Bijuli bazar*** of Dhobi Khola has a household collection system of solid waste. Major solid waste disposers are the students and people who are in rent.

River Use: *Section 1 : Bagamati Dhobi Khola Confluence to Banewshor Bridge (chart 5.2.1.1.1)*

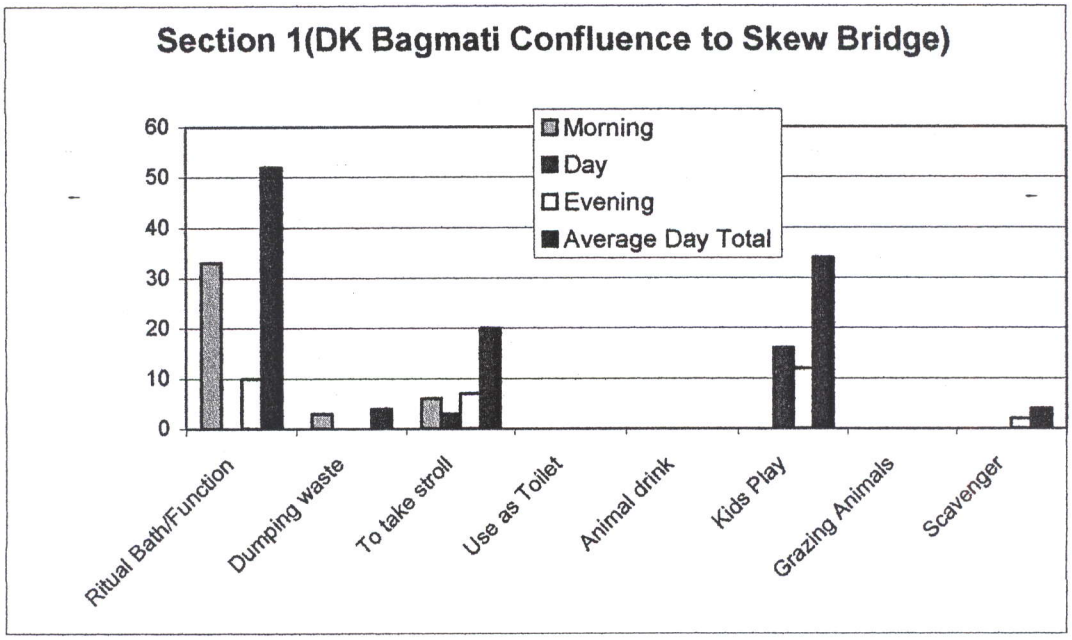
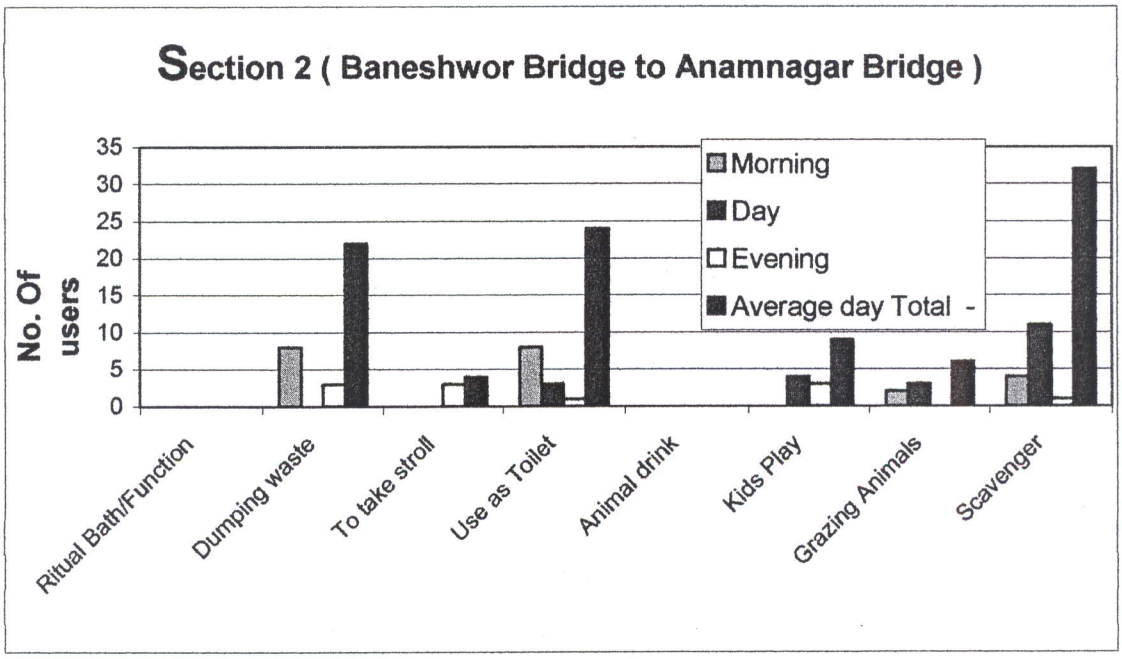
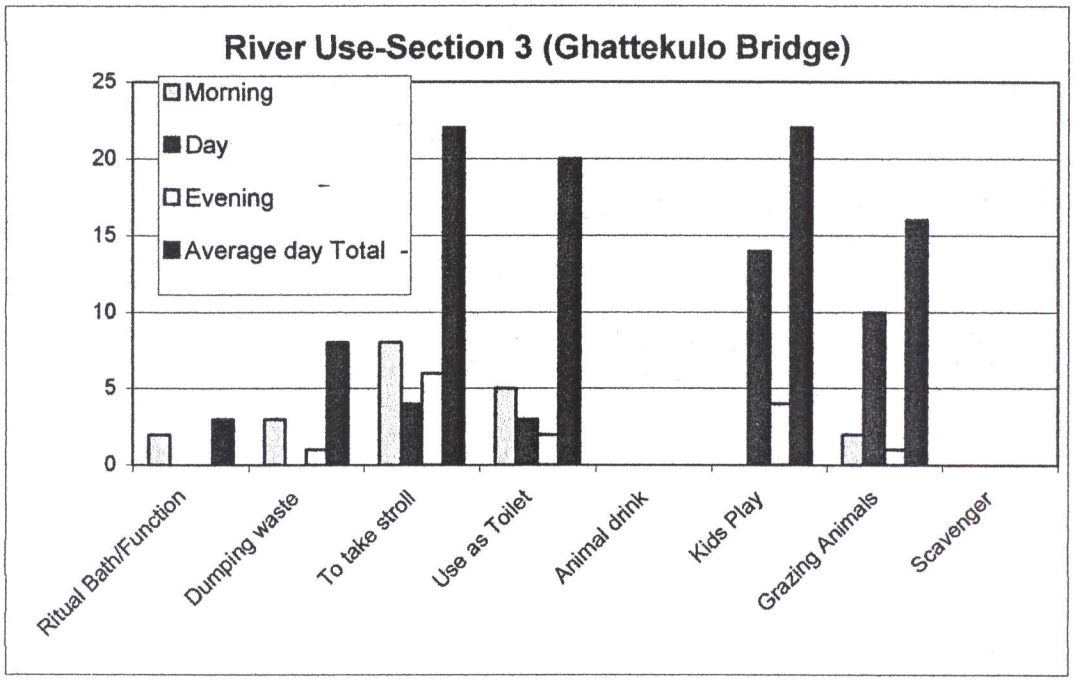


Chart 5.2.1.1.2



Bulk amount of solid waste disposal collected through two wheelers/carts have attracted more scavengers and hence the scavengers figure is highest among all at this section. Number of commuters have also recorded highest at this section, which may be due to the surrounding institutional areas like *New Baneshor*, Singha durbar, *Babarmahal* and *Anamnagar*.

Strolling people, kids play, animals grazing and drinking water by pets have been found virtually nil because the river banks are very narrow and no open spaces at all. But use of riversides as urinal place have found higher. Chart 5.2.1.1.3

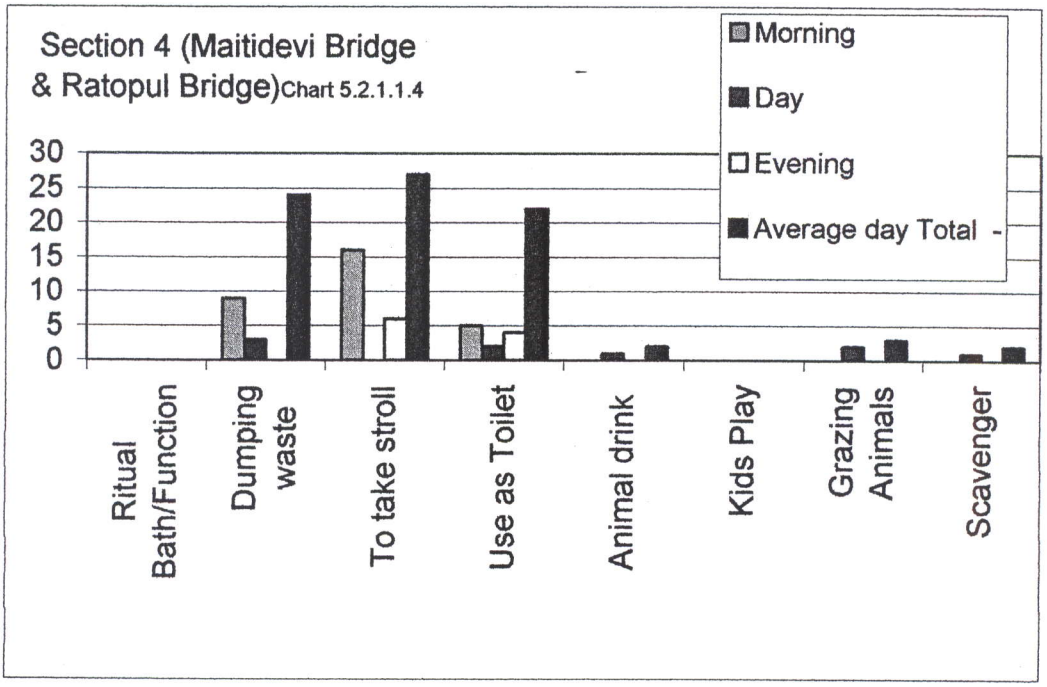


Section 3 is the longest one and having haphazard urban sprawl with low infrastructures throughout the corridor. The area between the Anamnagar Bridge and Maitidevi bridge, have also recorded higher commuters, nearly 1600 per day. It might be because of huge settlements nearby. Solid waste dumping is comparatively low at this section hence scavengers are less too. Number of people who have found to take stroll per day is 22 and to use riverside as urinal is 20 per day. Because of squatters at two locations, ducks, hens and some goats have been found. This is the only section where the occupation related to the name of the river has been found. Near the squatter, downstream of Maitidevi, after steep slopes, traditional *'Washermen'* i.e. *'Dhobis'* are found to be washing clothes but not with river water. They are found to be using a public tap very near to the river.

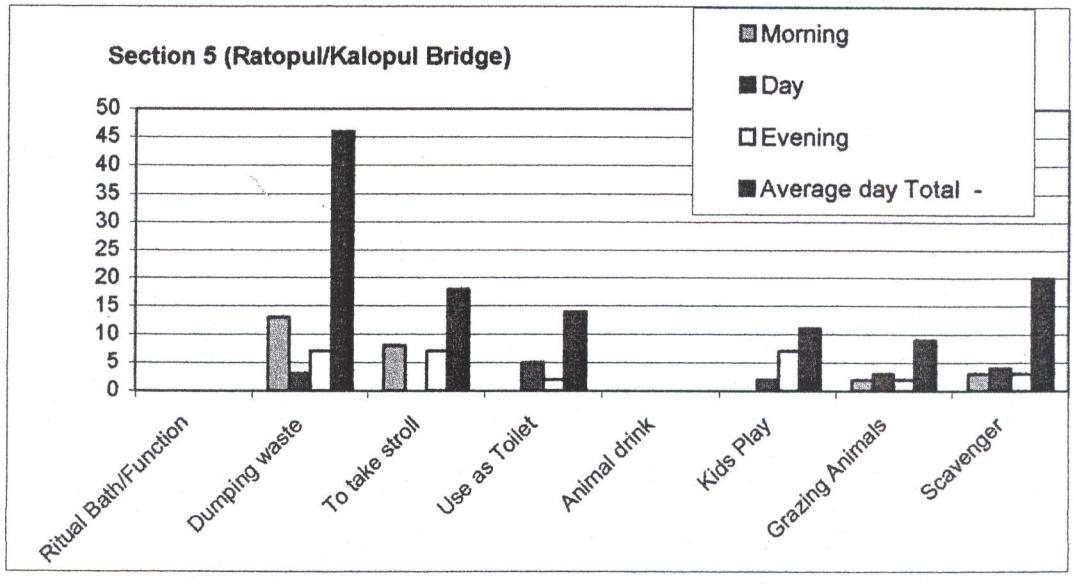
Section 4 is between *Maitidevi* Bridge and the *Ratopul*. Road is earthen and little narrower. Nearly 600 commuters per day have been found to be using the road and dumping waste at the riverside have been found more by people and students who are in rent. Around 20 people per day, which is not a much different figure from other sections have been found to be using riversides as urinary place. Due to non-availability of vacant space at the riverside, kids play have been found nil. Only 2 scavengers per

day have been found to be collecting waste materials, which might be due to the deeper river and difficult access to the riverbed.

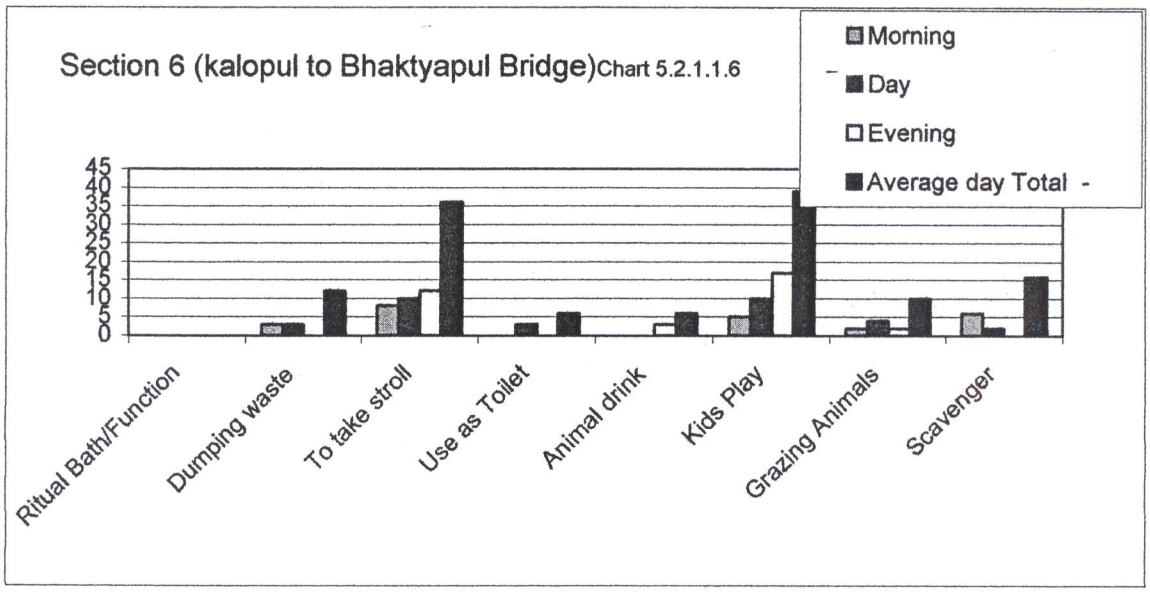
Section 5 is from *Ratopul* to *Kalopul* Bridge. Around 750 commuters have been found to be using this short section. Highest number of solid waste disposers per day i.e



around 50 per day has been found in this section. Higher number of solid waste disposal by carts, which is the collection from households, have been found below the *Kalopul* Bridge making the site very polluted. The river depth is also low and hence 20 scavengers per day have been found. Kids play, grazing animals, use for urinary purpose and strolling has been found normal and similar as other sections. Chart 5.2.1.1.5



Section 6 has a fairly good environment because of vacant land at both sides of the river. The section between *Kalopul* and *Bhatkyapul* (*Handigaon Naya Bridge*) has recorded highest number of people i.e. 36 person per day taking stroll. Since river is of low depth, easily accessible and availability of space to dry their collection, scavengers' number has been found in conformity with the solid waste disposers. Large vacant



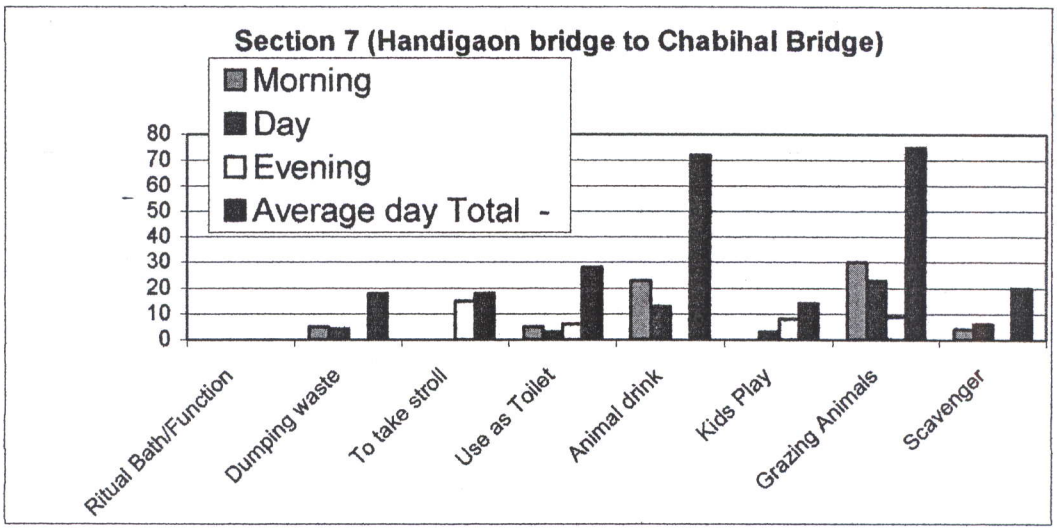
plots and a suspension bridge with less polluted environment have also found to attract highest number of kids to play. Nearly 40 kids per day and little more than 400 commuters per day have been recorded. Less number in 'use as toilet', grazing animals etc. have been recorded.

Urban expansion indicators like motor workshops, furniture workshops, metal workshops, concrete blocks and manual production of Nepali papers (Lokta) activities, which needs more open spaces, have been found at that section.

Section 7 is less developed and having more vacant plot area which includes huge plot of *Chabahil Dhumbarahi* at the west of Dhobi Khola proposed to be developed as a new residential area. Though the cremation site is there which is more than 100 m. apart from the river, the significant cultural relationship of people with the river haven't been found during river use survey and questionnaire survey. Scavengers and solid waste disposers have been found equal in number around 20 per day. Commuters have been found lowest, around 60 people per day at the riverside road. The earthen road has existed at the east bank and large chunk of agricultural land at the west. Hence the grazing animals, including, goats, ducks, hens have highest record of 75 number per day. Kids play, dumping waste, strolling people and scavengers are

normal around 20 per day as in other sections. The area has been used as toilet by 28 numbers of people per day as the highest in the corridor.

Chart 5.2.1.1.7



Section 8 is the municipality area beyond ring road including some wards of *Kapan*V.D.C., Which has been dealt in a different heading at chapter 5.3 later.

5.2.1.2 Questionnaire Survey

Household questionnaire survey of around 15% sampling has been carried out through the corridor from section 1 to section 7 (see questionnaire format at annexure-AX5.1). Around half of the respondents have intentionally been chosen of more than 45 years of age and the people less than 30 have been avoided.

Survey has shown that, 20 years back, there were only around 25% people of today living. Between last 10 to 20 years 40% were added up. Rest of about 35% was below 10 years duration.

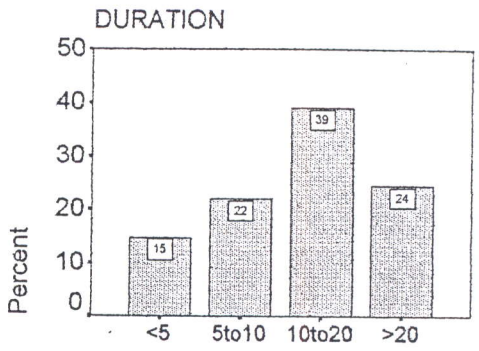
Majority of the people have been found to have adopted business as their prime occupation. Then private service and farming both came around 20%. Survey has revealed that less than 20% people were associated with the public service. Less than 10% respondents were retired personnel.

Nearly 35% of the households have their monthly family income of ten to twenty thousand. Similar percentages of households have their family income less than ten thousand. 15% each have been found for the households, which earns twenty thousand to thirty thousand and more than thirty thousand. Hence it has been revealed that the study area has mixed type-earning people but they are above the average.

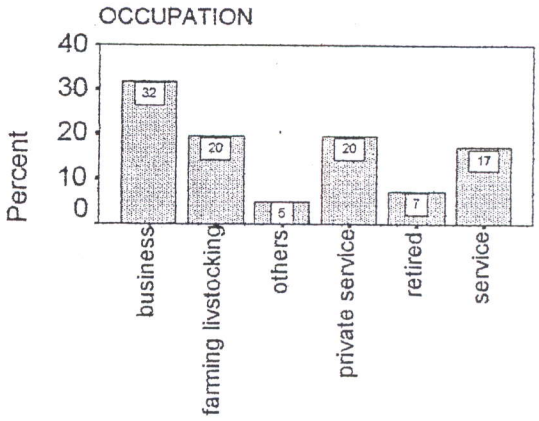
80% respondents have their own house whereas remaining 10% belongs to 'rented' people and ' having land only' category each.

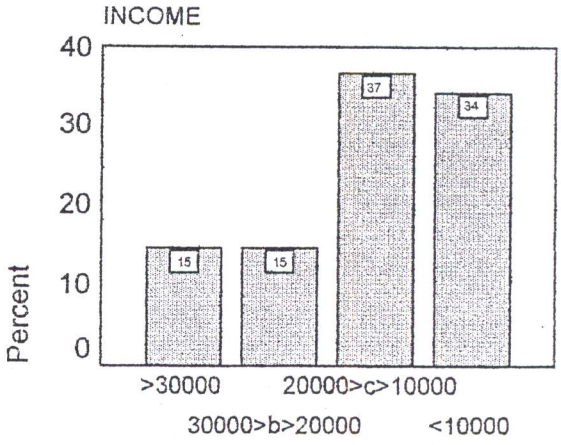
AGE

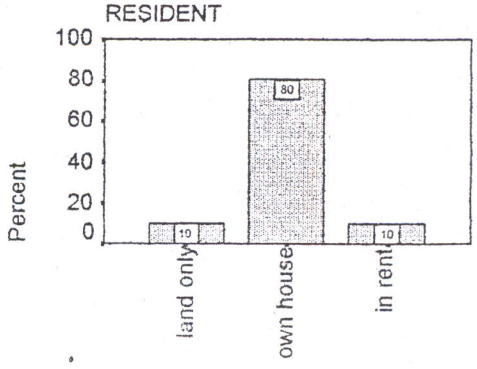
	Percent
25to35	22.0
35to45	34.1
>45	43.9
Total	100.0



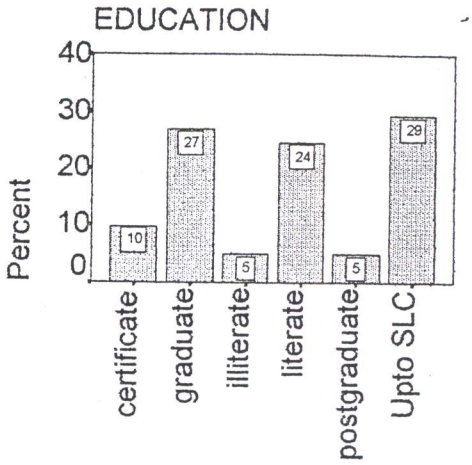
DURATION

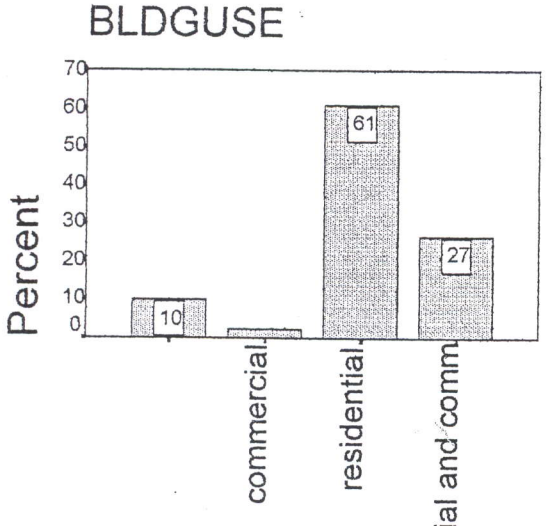






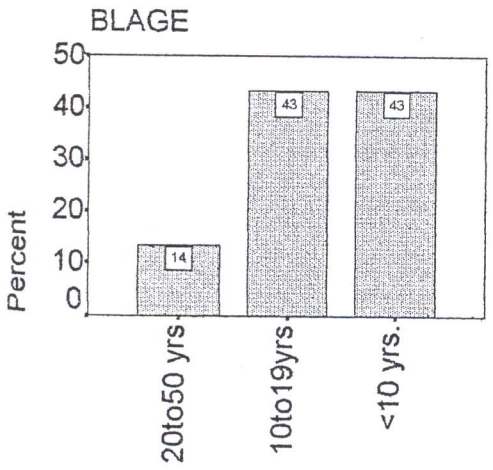
Majority of the people, 25% to 30% respondents each have been found to be graduated, SLC and literate. 10% people have been found to have studied up to certificate level and 5% people only illiterate. 5% respondents have been found to be highly educated with postgraduate and beyond.





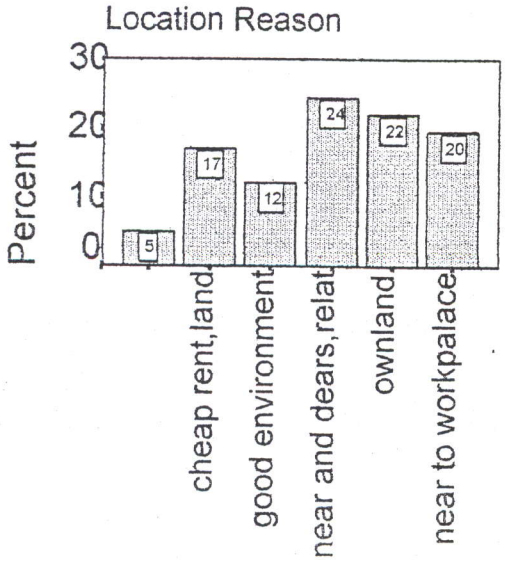
Prominent use of building at the river corridor is residential. Commercial use has been found to be below 5%. Residential cum commercial figure is around 25%.

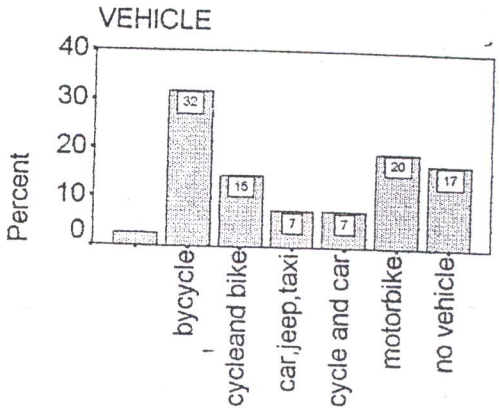
There have found only around 10% buildings of today were existed 20 years back. Nearly 40% buildings have been constructed between last 10 to 20 years, whereas around 40% buildings have been constructed during last 10 years. The figure is quite compatible with the survey result of age of the people residing there.



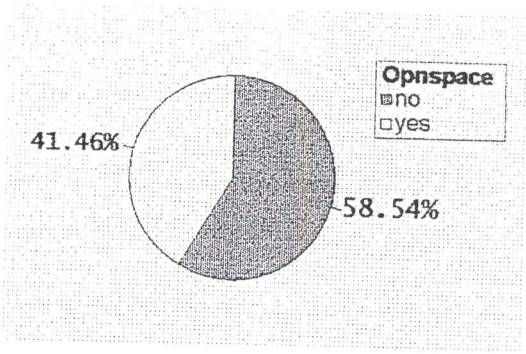
Very few portion of the rent have used in institutional and commercial purposes. Majority is residential.

Around one fourth of the total people residing in the corridor have found to have chosen the river corridor to stay because of their nearer and darers residing there. Similar percentage of people has chosen the place because of their own land. One-fifth of the people have responded that it was near to their workplace. Similar number of people has found to have chosen that location because of cheap rent and land. Only around 10% people stayed there making houses permanently because of a good environment.

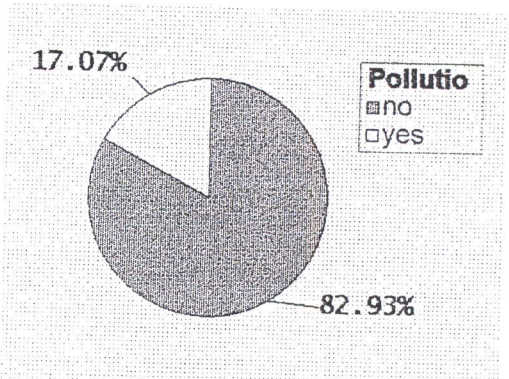




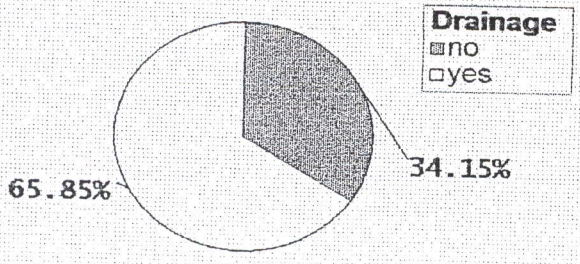
Bicycles have been found to be dominant vehicle of the area. About 40% of the households have bicycles in their houses. One fourth has owned motorbikes and around 10% households owned four wheelers. One-fourth of the houses are found to be vehicle less. The households having both bicycle and bike have been found to be around 15%.

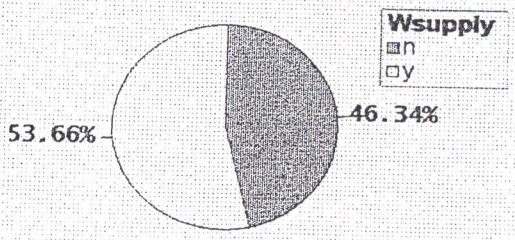


Exploring on the infrastructure sector, 70% of the respondents have been found to be not satisfied with the existing road. Around 60% people have responded that the open spaces are lacking and streetlights are not satisfactory in the river corridor area.

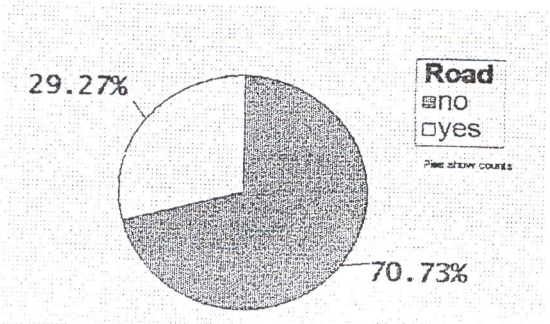


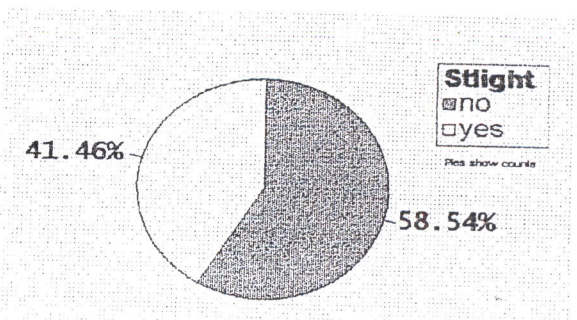
More than 80% respondents are dissatisfied and have expressed deep concern about the high river pollution. One-third people have been found to be dissatisfied with the



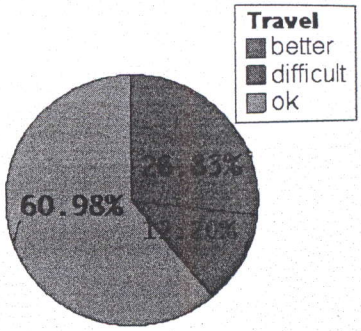


drainage system. Almost all households have found to be discharging their solid waste through pipes to the river. Around two third have been found to be satisfied with their

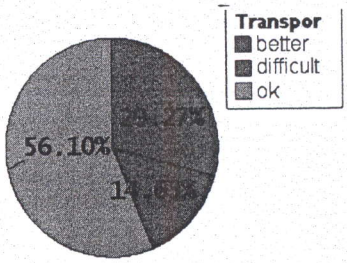




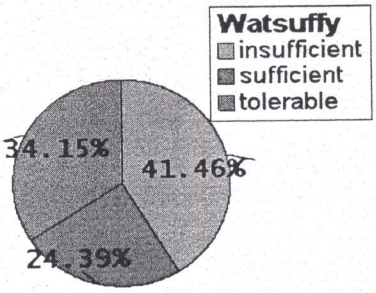
sewerage and drainage system. Responses over plotsize of the area have been found to be fifty-fifty as ok or not good plot size and similar ratio have been found for the satisfaction over water supply facility.



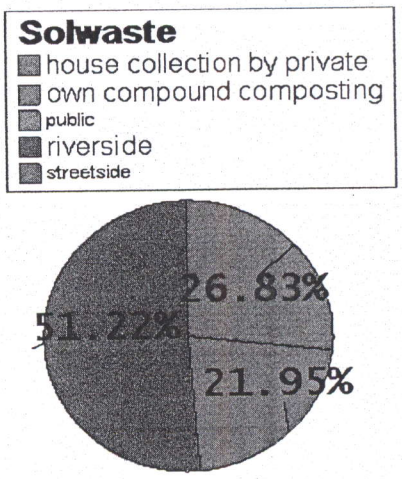
In response to the question, how do you find daily to and fro from the area, around 60% have said that it's ok, only around 12% have considered it difficult. Nearly 25% have taken it as better.



Almost a similar figure has been seen in the "accessibility to public transportation". Majority of the people have been found to be using local shops as their major market place. Around one-fifth have said that they have been using both city center and local shops equally. Around 20% have found to be going city center for their daily needs. Use of supermarket has been found to be very low, less than 10%.

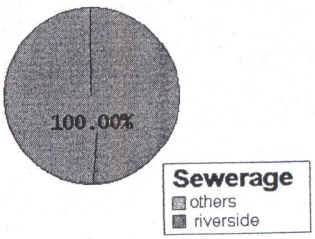


One fourth of the respondents have said that drinking water is sufficient for them, while one-third have taken it as tolerable and majority of the people have been found to be surviving in water deficiency.

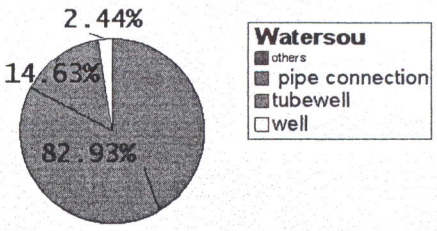


An alarming state has been found with half of the population disposing their solid waste directly at the riverside. One fourth has the house collection system by private collectors, which ultimately goes to the riverside in a bulk amount. Nearly one-forth have practicing own compound composting as a household solid waste management technique.

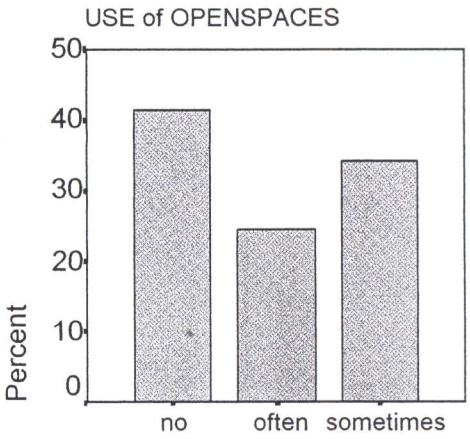
Almost all households have connected their household sewerage outlet through pipe to the river. No single houses within the corridor have been found to be constructing septic tank and soak pit.



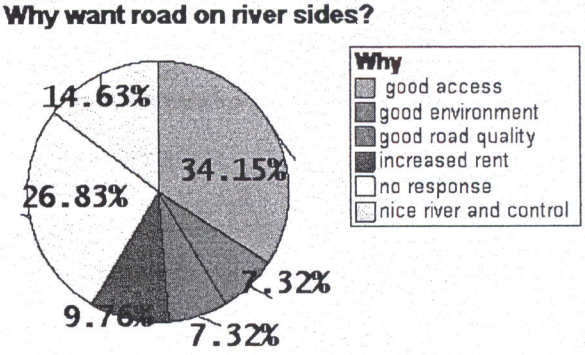
More than 80% households have been found to have connected with municipal water lines. At second rank tube wells are there with 15%. Very less people, almost negligible have been found to be using water wells i.e. near Ghattekulo area.

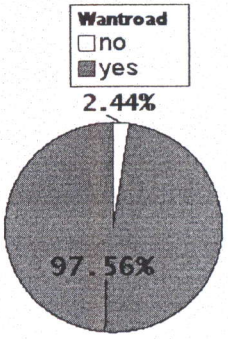


Survey has found that only one forth of the households is using the nearby open spaces. Around 40% have never used open spaces. Little less than 40% people have responded that they use the open spaces sometimes for strolling and playing.

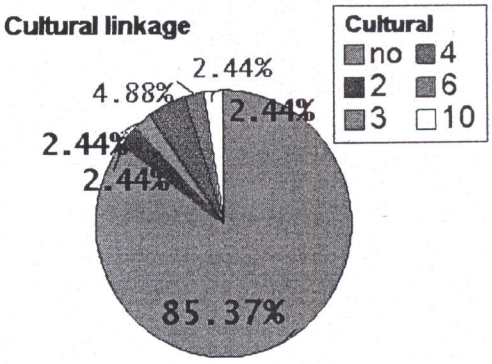


The questionnaire survey has revealed that almost all people want road to be developed on both the banks of the river. Few percent want greeneries and recreational garden instead. The major reasons given by the respondents are they want good access to their households. Around one-fifth has stated that nice river and river control would be obtained through road construction. Some 10% have responded that they want road because the land value and rent will increase.



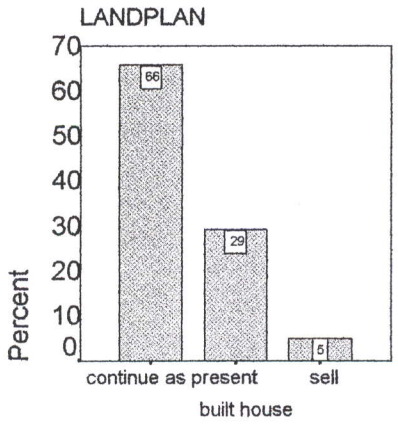


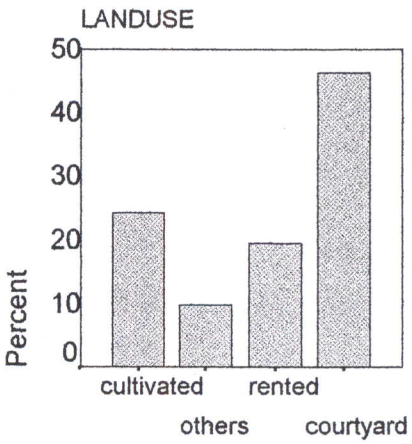
Around 85% of the respondents have no cultural and religious linkage with the river itself. However, some people who reside bit far come to the river occasionally just to throw their ritual wastages and small offering stuffs like "*Pindaa*", "*Bau*". These things also have found to be occurring Three to four times a year. Very few, around 2% have been found to come to riverside for



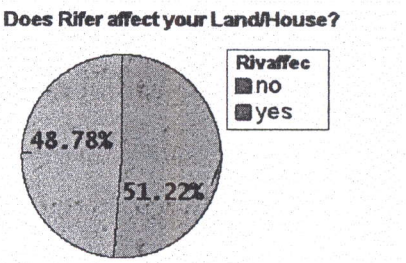
such disposal twice a year and similar percentages are found to come four to six and more than six times a year.

Talking to the land use, around half of the households have found to be using the land remaining from house as a family courtyard for family use or to park bicycle and motorbikes. Around 25% have been found to be cultivating their land at the river corridor mostly as vegetable garden and farms. Around 20% have even rented their land for various purposes like for furniture workshop, metal works, concrete block manufacturing, Nepali paper making (*Lokta*), poultry farming etc.





Most of the people have found no future plan about intervention on their land and just of the view that they would continue to use as present. But around 30% have planned to build house on their vacant lands, whereas nearly 5% respondents wants to sell the land.



According to questionnaire survey, the number of households affected by the riverflood and not affected has found to be fifty-fifty. Section 1 (Buddhanagar area), section 2 (Bijuli bazaar area), section 3 (Anamnagar-Ghattekulo area) and section 7 (Chabahil area) have found to be the most affected areas.

Section 1 (*Buddhanagar*) and *Section 3* (*Anamnagar – Ghattekulo area*) have been found the place where people have more mental torture due to the flood water. There have found even many such places where flood have likely to enter 8 times in last 10 years. Majority is 2 to 3 times flood likely to enter within last 10 years in the whole stretch.

LOCATION * RIVAFFEC Crosstabulation *Table 5.2.1.2.1*

LOCATION		RIVAFFEC	
		No	Yes
Buddha Nagar	% within Location	14.3%	85.7%

	% within Rivaffec	4.8%	30.0%
	% of Total	2.4%	14.6%
Bijuli Bazar	% within Location		100.0%
	% within Rivaffec		25.0%
	% of Total		12.2%
Anamnagar Ghattekulo	% within Location	81.8%	18.2%
	% within Rivaffec	42.9%	10.0%
	% of Total	22.0%	4.9%
Maitidevi to Ratopul	% within Location	100.0%	
	% within Rivaffec	19.0%	
	% of Total	9.8%	
Ratopul to Kalopul	% within Location	60.0%	40.0%
	% within Rivaffec	14.3%	10.0%
	% of Total	7.3%	4.9%
Kalopul to Bhatkyapul	% within Location	50.0%	50.0%
	% within Rivaffec	4.8%	5.0%
	% of Total	2.4%	2.4%
Chabahil	% within Location	42.9%	57.1%
	% within Rivaffec	14.3%	20.0%
	% of Total	4.3%	9.8%
Total		51.2%	48.8%
		100.0%	100.0%
		51.2%	48.8%

It is section 7 where flood have been entered maximum of 10 times during last 10 years. Where around 15% said that flood enters their compound each year. Then, Section 1 has been found with flood entered figure of 5 times within last 10 years. At section 2, it has been found that flood enters to around 12% respondents compound 3 times within last 10 years.

LOCATION * FLOODLIK Cross tabulation *Table5.2.1.2.2*

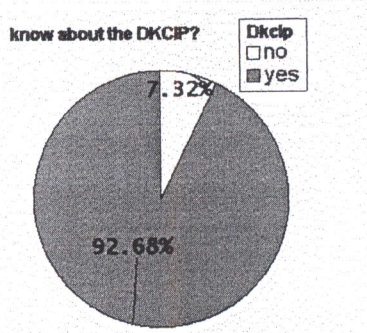
Location		FLOODLIK								Total
		0	1	2	3	4	6	8	10	
Buddha Nagar	% within Location	28.6%	14.3%	14.3%	28.6%			14.3%		100.0%
	%within Floodlik	8.7%	100.0%	16.7%	50.0%			50.0%		17.1%
	% of Total	4.9%	2.4%	2.4%	4.9%			2.4%		17.1%
Bijuli Bazar	% within Location			20.0%		40.0%	40.0%			100.0%
	%within Floodlik			16.7%		100.0%	100.0%			12.2%
	% of Total			2.4%		4.9%	4.9%			12.2%
Anamnagar Ghattekulo	% within Location	81.8%			9.1%			9.1%		100.0%
	%within Floodlik	39.1%			25.0%			50.0%		26.8%
	% of Total	22.0%			2.4%			2.4%		26.8%
Maitidevi to Ratopul	% within Location	100.0%								100.0%
	%within Floodlik	17.4%								9.8%
	% of Total	9.8%								9.8%
Ratopul to Kalopul	% within Location	80.0%			20.0%					100.0%
	%within Floodlik	17.4%			25.0%					12.2%
	% of Total	9.8%			2.4%					12.2%
Kalopul to Bhatkyapul	% within Location	50.0%		50.0%						100.0%
	%within Floodlik	4.3%		16.7%						4.9%
	% of Total	2.4%		2.4%						4.9%
Chabahil	% within Location	42.9%		42.9%					14.3%	100.0%
	%within Floodlik	13.0%		50.0%					100.0%	17.1%
	% of Total	7.3%		7.3%					2.4%	17.1%
Total	% within Location	56.1%	14.3%	14.6%	9.8%	40.0%	40.0%	4.9%	2.4%	100.0%
	%within Floodlik	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	% of Total	56.1%	2.4%	14.6%	9.8%	4.9%	4.9%	4.9%	2.4%	100.0%

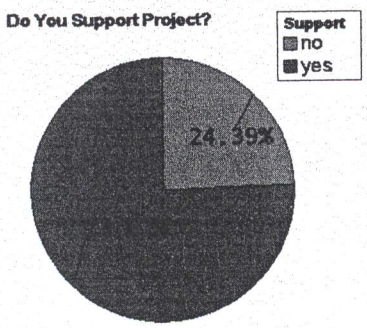
LOCATION * FLDENTER Crosstabulation

Table 5.2.1.2.3

LOCATION		FLDCENTER							TOTAL
		0	1	2	3	4	5	10	
Buddha Nagar	% within Location	85.7%					14.3%		100.0%
	% within FLDCenter	18.2%					100.0%		17.1%
	% of Total	14.6%					2.4%		17.1%
Bijuli Bazar	% within Location	40.0%	20.0%	20.0%	20.0%			-	100.0%
	% within FLDCenter	6.1%	50.0%	100.0%	100.0%				12.2%
	% of Total	4.9%	2.4%	2.4%	2.4%				12.2%
Anamnagar Ghattekulo	% within Location	81.8%				18.2%			100.0%
	% within FLDCenter	27.3%				100.0%			26.8%
	% of Total	22.0%				4.9%			26.8%
Maitidevi to Ratopul	% within Location	100.0%							100.0%
	% within FLDCenter	12.1%							9.8%
	% of Total	9.8%							9.8%
Ratopul to Kalopul	% within Location	80.0%	20.0%						100.0%
	% within FLDCenter	12.1%	100.0%						12.2%
	% of Total	9.8%	2.4%						12.2%
Kalopul to Bhatkyapul	% within Location	100.0%							100.0%
	% within FLDCenter	6.1%							4.9%
	% of Total	4.9%							4.9%
Chabahil	% within Location	85.7%						14.3%	100.0%
	% within FLDCenter	18.2%						100.0%	17.1%
	% of Total	14.6%						2.4%	17.1%
Total	% within Location	80.5%	4.9%	2.4%	2.4%	4.9%	2.4%	2.4%	100.0%
	% within FLDCenter	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	% of Total	80.5%	4.9%	2.4%	2.4%	4.9%	2.4%	2.4%	100.0%

In response to the question whether or not they have heard about the Dhobi Khola corridor improvement project (DKCIP), 90% respondents have answered positively. Only three fourth of the house owners have found to be in favor of the project and one-forth against.

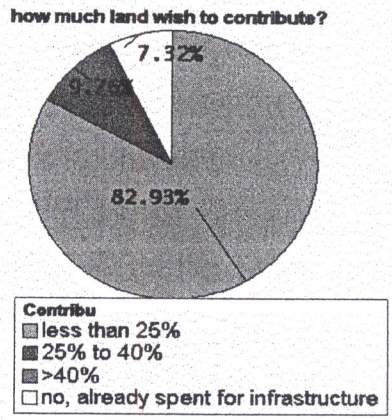




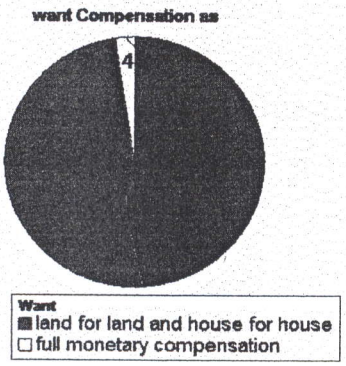
Majority of the respondents have said that improved river condition will be the first benefit of the project. Good roads and accessibility to the plots came on second place. Some 10% have only responded that planned plots will be the main benefit of the project.

Regarding willingness to contribute to the project, 80% respondents have been found ready to contribute only below 25%, either by giving their land or monetary contribution to the project. Around 10% have been found

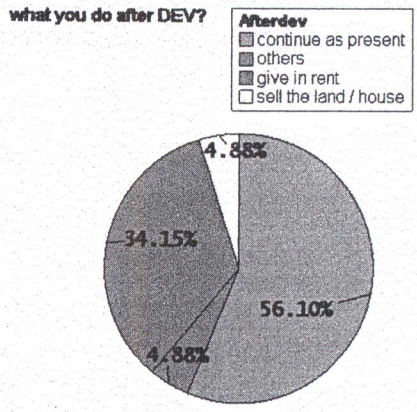
to be ready to contribute up to 40%. Remaining respondents haven't wanted to contribute at all because in their version, they have already spent lots of money for bringing roads, gabion walls, sewer lines, telephone lines and other infrastructures.



Almost all of the respondents have found to prefer land for land, house for house in case of DKCIP implementation. Below 5% have been seen to prefer full monetary compensation for their land and houses.



Little more than half of the respondents have said that they would continue to use their land and building as present even after implementation of DKCIP for various reasons, whereas nearly one-third of the respondents would prefer to give it in rent for higher charges. Nearly 5% respondents have seen to be planning to sale their immovable properties and 5% have plan to use for other purposes.



5.3 Section 8 (Dhobi Khola Beyond ring-road)

5.3.1 General

Photo 5.3.1

Section 8 is the portion of Dhobi Khola existing beyond ring road including some portion of KMC and *Kapan* VDC, touching the *Mandikhatar* at the right bank. Little more area has been tried to study because it's still a VDC. It has huge development potential. It is the interface of KMC Ward No. 4 and 6 touching at its north-east corner with *Mahankal* VDC and *Kapan* VDC. Though the major focus has been tried to be given at a ward number 1 and 3 areas of

Kapan V.D.C. It was large plain farm land previously and now converting into a dense concrete jungle. The study area starts from the stretch of the ring road between *Gopi-Krishna Cinema Hall* and *Dhumbarahi*. It extends towards east slightly tilting to north including *Saraswati Nagar* land pooled area undertaken by TDC, New colony, crossing 'Dhobi Khola' and '*Khahare Khola'*, which are the boundaries of KMC, to the *Kapan* VDC Ward No. 1 and 3.

Whole study area is a huge flat land with small hills both at North/North east and South/South East. Ring road lies at the west. The Dhobi Khola is flowing north to South in the middle of the study area. Roughly, the study area could be divided into municipal area and VDC area separated by waterlines.

5.3.2 Evolution:

Though, the development along the sides of the Ring Road had occurred already in 80's, after construction of *Gopi-Krishna Cinema,* the new development had gained momentum in the last decade. Since 1994 (2051 B. S.) buildings had started to come rapidly across the Dhobi Khola River, which are the territories beyond the municipal boundary.

In the past, beyond Dhobi Khola River, Ward No. 1 and 3 of *Kapan* VDC, it was a huge agricultural flat land named '*Phaika Phant'* and *'Bekh Phant'* respectively. *Saraswoti Nagar* area, where the TDC had done land pooling, was also an agricultural flat land.

Now after a decade, the immediate belt after Ring Road has been developed as a moderate density residential cum commercial area with private gardens, open spaces, whereas area beyond that up to Dhobi Khola River has been developed as low-density area except the new colony.

The development has spilled over from the hilltop of Chabahil - Bouddha route to the backside toe of *Kapan* VDC Ward No. 1 and 3. Now this area is in a trend of being a dense housing area.

5.3.3 Development:

The various reasons that triggered the development of Dhobi Khola corridor beyond Ring Road could be

i) **Factories:**

A huge garment factory at the bank of Dhobi Khola River at ward no. 1, *Kapan* VDC along with number of carpet industries, Dying industries, Pashmina Factories and some "feed industries" has pulled people to build houses there since the last five years.

ii) **Number of watersheds:**

Apart from the Dhobi Khola River, the area has number of small water courses passing through it, namely *Tupek (Chakhuncha) Khola*, *Khare Khola, Chapane Khola. Chhinda Khola* and *Yaghamati Khola* which have the origin on the same VDC at it's northern part and there was no problem of water till the last decade.

iii) **Infrastructure:**

Electricity, Telephone services are easily available and water supply now emerging as a major scared infrastructure though roar pump and tube well has good yield here. The people had not yet realized the sanitary as a major problem there. Transportation network is good except for rainy season.

iv) **Road Systems:**

Though the earthen and graveled roads are only there, one can see the good road network all around the study area. Minibus facility is there since 2055 B.S. form *Ratna Park* to *Kapan Krishna Temple*. Similarly, 3 Tempo routes are there, covering whole of the study area. These are first from *Ratnapark* via New colony, *Bekh* to hill toe, second, *Ratna Park* via *Bouddha*, *Mahankal* to *Bekh* and third via *Phaika*.

v) **Development Spillover:**

The huge urban development at 3 sides of the study area i. e. from west via south to east, which is area of Kathmandu Metropolitan city, could be another reason of this fringe development. There are already dense areas around. Ring Road and *Dhumbarahi* at west, *Chabahil* at South and *Bouddha* at East already became the major parts of metropolitan area.

vi) **Community type development:**

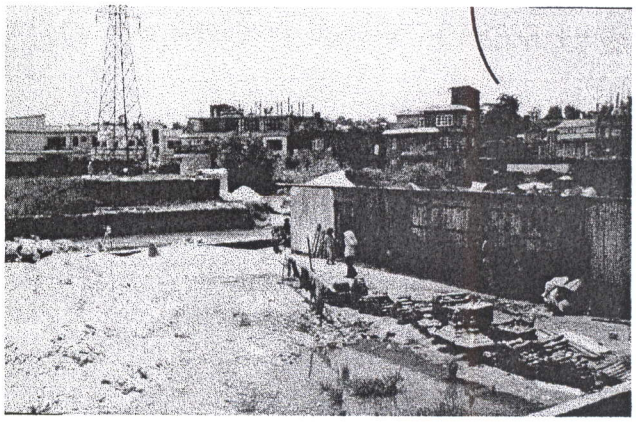
Ward No. 1 and 3 of *Kapan* has 32% household from *Sindupalchok* District only and 10% each are from *Okhaldhunga* and *Kavre* District. 30% form the nearby people and villages. So it could be the community feeling of attachment, which triggered the rapid haphazard growth of concrete jungle.

vii) Land price and Environment:

Cheaper land price with no lower limit of defragmentation had also pulled the poor people along with the few among 2000 informal sector people living near ward no. 7 of KMC at Dhobi Khola bank and 100 people at ward no. 1 *Phaika, Dhungen* area.

On other hand some elites in search of good environment have come and made modern houses with compounds.

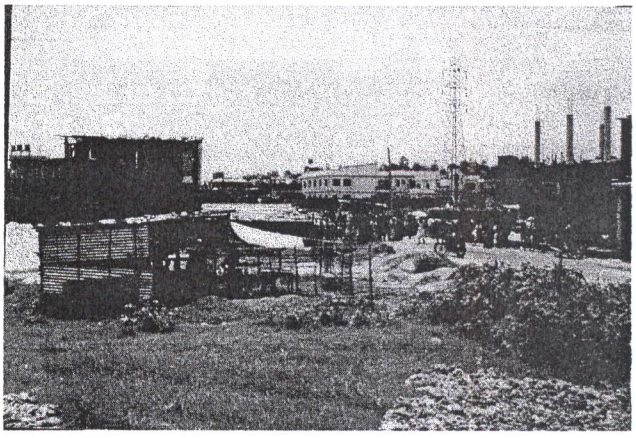
Photo 5.3.4.1/2



5.3.4 Economy:

Mixed type of economy could be seen in the area. Commercial activities are vibrant at the ring road side from *'Gopikrishna'* to *'Dhumbarahi'* and around the 'New Colony'.

People of low-density areas and planned zone (see map) are more involved in service sector. Beyond Dhobi Khola at ward no. 1 and 3 of *Kapan V.D.C.* which has a population around 10,000, around 35% are involved in service, 30% on business and 3% on industry. (All Data: *Kapan Darpan*)



Agriculture has totally been abandoned from this area and grocery shops and taverns are the major shops seen. 40% among the shopkeepers are tavern owners with investment of up to Rs. 20,000.00, only 20% of shops of all total have invested more than Rs.1, 00,000.00 and 50% have invested less than Rs. 80,000.00. Hardware shops are also frequent at main roads. Almost all shopkeepers are local people.

But the figure is different at municipality area roughly all municipal facilities are available at ring road and around *New colony*.

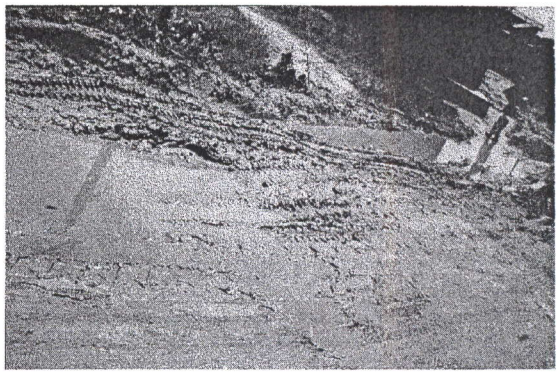
Some activities at the V.D.C. area are

- Carpentry Workshops
- Metal workshops
- Wool washing and drying for carpet industry.
- Large people involved in sand extraction from river
- Temporary sheds for barber's shop and tailoring work.
- Carpet / dying / Pashmina factories.

Low-income groups are dominant V.D.C. area where as number of higher income people is more at municipal area.

5.3.5 Infrastructure:

Photo 5.3.5.1/2



Electricity and telephone lines are available currently and water supply is also not a severe problem because of roar pumps, wells and tube wells. People of V.D.C. area are discharging their sewers openly at the rivers and *Khola's* nearby, though many have constructed septic tanks. Municipal area has a piped water supply and sewerage.

Whole area is deprived of road quality except the planned area. Even inside the land developed area many roads are left unmetalled and no side drains are there, though most of the plots are vacant, the few scattered plots having houses constructed are facing problems mainly in these rainy days.

Road width seems sufficient for only today's growth and many places where development was early, roads are narrow. Normal width is 16'0" and 22'0" whereas inner roads are 12' and 10'. Public vehicles are available in these routes.

5.3.6 Social Structure:

Around 15000 to 20000 people are living at Dhobi Khola urban fringe area with 10,000 only in V.D.C. area. Municipal area is composed of mixed people from different parts but it is dominated by people of Kathmandu Valley. The scenarios are different for planned area and V.D.C. area. V.D.C data shows that 70% people are migrated and 30% are the villagers of other wards. Among the total houses, around 32% are from *Sindhupalchowk* District only and 10% each from *Okhaldhung*a and *Kavrepalanchowk district.*

5.3.7 Education:

The study area has remarkable number of schools. Around 12 primary schools, 15 secondary schools and 3 "Ten + two" schools are there. V.D.C. area has 80% literate people. Municipal area also has the same pattern of development, schools and literates.

5.3.8 Housing:

It is an entirely new development with no single old houses. CGI roofs can be seen in few houses of cement mortar. Apart from frame structure one and two storied incomplete buildings, the slope roofed British style houses are increasing with small compound in front of house. 2-5 *anna* plots are dominant. Along the new colony roadside and V.D.C. area has compact housing.

5.3.9 Issues / Problems:

i) Lack of planning intervention and Haphazard building development at Dhobi Khola corridor and Kapan V.D.C. area. V.D.C. itself has defined it as haphazard growth of houses.

ii) Less attraction to DHUD planned area.

iii) River encroachment and pollution of rivers/ Kola's.

iv) Infrastructure improvement i.e. road surfacing, side drains, water supply and sewerage.

v) Making and enforcement of laws, land defragmentation problems.

vi) Severe lack of public open spaces.

vii) Social evils, druggists are increasing.

viii) Squatting of public/private land

ix) Autonomous Development with no planning at V.D.C. area.

x) Ribbon development along the main roads threatening future road improvement / expansion.

xi) Disappearing green areas and remaining greens are not at specific locations.

5.4 Existing Situation of Dhobi Khola Corridor

5.4.1 Terrain

In the Dhobi Khola River corridor, from Mandikhatar to Chabahil the terrain is flat along both the banks. River has fairly straight alignment due to prevailing river training works from Bulbule downstream and there are access road also for the existing houses along the bank. As it further goes down from the Maitidevi Bridges, left bank has a steep slope like a mountainous terrain up to Anamnagar while right bank is fairly flat and up to it's confluence at Bagmati river.

5.4.2 Waterway Width

The width of the river varies from 14 to 20 meter. At the confluence and at 'section 8' beyond ring road, it has width upto 20 meters. At *Babarmahal* (Section 2) it is 18 meters and at *Bijuli Bajar* (Section 3) it is 14 meters. At *Chabahil* width is around 16 meters. Normal water depth is around half meters and during flood highest water depths found at *Chabahil* is 3.0 meters and at *Babarmahal* it is 3.6 meters.

5.4.3 Aquatic Life

The river can be termed as aquatically dead because of high pollution level of river mainly resulting from the point discharges of sewers and solid waste at high frequency.

5.4.4 Sewerage and Drainage

The condition of existing sewer and drainage system is no better than water supply system. There is no planned drainage system within the project area supporting the drainage network suggested. Few localized sewer lines could be found collecting the

sewage of a group of households. Outfall of these untreated sewers is directly led to the Dhobi Khola river. Most of the isolated sewer lines are of equal size (mostly of 30cm diameter). So the existing sewer lines could not be integrated in the proposed drainage network.

'Section 2" i.e. *Bijulibazar* section, section 6" i.e. *Kalopul* to *Hadingaon Nayanpul* and section 5" i.e. *Ratopul* to *Kalopul* have found to be less number of sewer outfalls though Bijuli bazaar section is more polluted. Maitidevi, Anamnagar up to *Ratopul* has large number of sewer outfalls.

At the right bank of Dhobi Khola and right bank of Bagmati too, at the confluence a treatment plant of around 125 MLD per day has been proposed.

SN	Station Name	Odour	Colour	Ph	Temp (C°)	Conduct (µs)	Oxygen (% Sol)	Dissolve Oxygen O_2 (mgll)	COD (mgll)	BOD(mgll)	Hardness (mgcl/l)
1.	Chabahil Dhumbarahi	Low, earthy	Dark brown	7.50	28.3	104	81	5.9	68	39.0	0.6
2.	Sano Gaucharan	strong, musty	Yellow	6.86	28.3	202	62	4.4	94	42.0	0.5
3.	Maiti Devi	strong, musty	Brown	6.83	28.3	226	48	3.2	62	39.0	0.5
4.	Bijuli Bazar	strong, musty	Dark brown	6.93	28.0	262	22	1.6	68	24.0	0.8

Source: DHM Hydrology Division (1996) *Table 5.4.4.1*
Water quality data of Rivers of KTM valley (1992-95)

About 65 open and closed sewers discharge effluent into the Dhobi Khola River with no treatment facility available at all.

The *Chhapanne Khola* running at the *Sukumbasi tole* near Chabahil Gopikrishna hall has a significant impact on pollution of river. It discharges large amount of sewage with high velocity. The combined sewers discharging onto the river is frequent and can be seen throughout the length.

From *Chabahil Bridge* to the downstream, at the present intervals, many small diameter PVC pipes are there discharging wastes from the individual houses.

5.4.5 Solid Waste

Huge amount of solid waste deposition on the banks of river is a major environmental problem of the corridor. The solid waste generation of the Greater Kathmandu is 138 tons and the composition of these solid wastes are mainly organic,

around 58% to 66% with 5% plastics [EMAG-1992]. The use of plastic bags are being increased over the years and is a non- bio degradable.

More than 50 distinct solid waste deposits have been found throughout the river, where majority of the deposit spots lies at the section 1(Buddhanagar Area) and section 4, section 5 of *Maitidevi* to *Kalopul*. The distinct spots where the bulk amount of solid waste deposition is there have been found due to the small organizations that collects the wastes from households and disposes at the riversides through two wheeler and three wheeler carts. Section 3 (Anamnagar, Ghattekulo, Maitidevi) where sewerage outlets are heavy, found less polluted with solid waste.

5.4.6 Vegetation

Beyond ring road and nearby Chabahil, still there are lots of lands, which have been used for cultivation on both sides of river bank. Large chunk of land is still cultivating at Chabahil downstream of ring road at the right bank of river. These vacant plots and vegetation goes on decreasing downstream. Development of houses on the both banks have virtually left no space available for cultivation from *Bulbule* downward to the Bagmati Dhobi Khola confluence though some naturally from shrubs and grasses could be seen at the slopes of the banks. It is more near *Maitidevi* and downstream hence reducing the chance of erosion.

5.4.7 River Training

Gabion Walls of short and long length are there thought the length as river training works. Beyond the ring road also there is slope stabilization or river channel in the form of continuous stone pitching from *Sukumbasi tole* to *Gopi Krishna* hall on the left bank of approximately 600 meters. From there upto Bulbule bridge few sections of gabion walls are there and then series of such walls upto the confluence. These were constructed mainly to protect the roads at the riverside.

5.4.8 Land Ownership

Encroachment of the public land by private institutions and squatters were there.

It is there to some extent though it could be more in past. Major squatter settlement is at *Sukumbasi tole*, which is few hundred meters beyond the Ring Road. Similarly, *Ghattekulo* squatters have also encroached the public land. Dual ownership has not been found.

5.4.9 Religious/Archeological Sites

Religious and archeological sites having historical importance were there, though few have their own history. One of them is *Rudra Binayak* Temple at the left bank of the river near Maitidevi. The temple of various gods and goddesses at Bijuli bazaar and at its confluence is drawing more people at the corridor. The cremation places of *Chabahil* and *Maitidevi* are there though they are 300 meters apart from the current river. The Dhobi Khola at *Handigaon* has found to be used as a holy river once a year during the *'Dhanwantari Jatra'.*

5.4.10 Squatter Settlements

5.4.10.1 Section 3 (Anamnagar Settlement)

Along the Dhobi-Khola River, there are two prominent squatter settlements, one inside greater Kathmandu and the other just beyond that. A smaller one can also be seen in the left bank at Ghattekulo.

Anamnagar squatter settlement lies at the city center along the left bank of Dhobi Khola, some 500 meter downstream from the Maitidevi Bridge. It's is the section 3 of this study area and it is in danger during monsoon because of it's continuity of steep slope from Maitidevi bridge.

The settlement is nearly 12 years old and contains nearly 50 dwelling units with population of 200. *Tamang, Magar* and *Chhetris* have found to be dominant there. Wool spinning is indoor work while guys work in various market of city center.

Physical Characteristics

The squatter is situated at the east river bank. There is 3 feet foot trails between river and houses, and it is in a steep slope. The houses are in row. Between rows there is a narrow foot trail in which chances of landslide is very high. But people haven't found to be anxious about that. Almost all houses are single storied except three of 5ft. high another

storey with pitch roofs. Chimney bricks have been found to be used in most of the houses. Number of toilets, detached from the houses, shared by households have been found to be built which directly discharges on to the river through 4 inch P.V.C. pipes, C.G.I. sheets are the common roofing material. Mud plaster on walls and brick soling floor is common.

Infrastructure

Public water stands have been used for drinking water purpose in addition to natural water spring. These waterspouts are natural water spring. These waterspouts have found to be busy whole day from early morning till late evening. There is no wider road as in other area of riverbank but electricity is there in all the houses. People have found to be using nearby open space for playing and washing and drying clothes. Even some people have been found to be earning through washing clothes of people residing in other places. Another few squatter houses have found to be built at the Ghattekulo, near skew bridge where the river is meandered almost a half circle, few hundred meters upstream of previous settlement at the same east bank. Two houses have been found at the right bank too. Similar physical and infrastructure characteristics have been found but it is amidst a high pollution. Lots of solid wastes have been found scattered into the river and river water has also been found highly polluted with bad smell.

5.4.10.2 Section 8 (Chabahil) Squatter Settlement

This Chabahil squatter settlement lies just beyond the ring road along the left bank of river Dhobi-Khola. The settlement has a history of 8 years when around 50 dwelling units have been settled in 1994. Now 200 dwelling units are residing there with 550 numbers of people.

Physical Characteristics

All the houses have found to be single storied and found arranged in rows with nearly three feet road in between and more than ten *ropanies* of land have been occupied by the settlement. Bamboos, bamboo mattresses have widely been found to be used as wall materials with thatch on the roof with high gauge plastic sheets and also pieces of CGI sheets on roof.

Infrastructure

Infrastructure services have been found to be lagging in this settlement. All the households have to depend on the public rover pumps. Around 15 houses have been found to have toilets with jute bags and polythene sheets covering as wall. Others go to the fields and riverbanks. Level of physical infrastructure is very poor. There are no private water connections and no electricity at all. The quality of water from nearby rover pump is also poor.

5.4.11 Road Network and Traffic

The proposed Dhobi Khola Link Road (DKLR) when completed would from the eastern wing of a larger arterial road network, the 'Inner Ring Road'. The 'Inner Ring Road' concept have been visualized by various studies and government plans as a long-term plan for urban road-development to alleviate the traffic congestion, of Kathmandu valley especially in the present circumstances when there is only one north-south link allowing the traffic flow across Kathmandu city.

Presently, traffic volume along the *Chabahil-Gaushala* section of Ring Road is about 5,120 vehicles per hour (vph) during the peak hour period (9:00 – 10:00 AM) and 60,235 vehicles daily. Both these figures far exceed the Design Capacity (Design Service Volume) for this road as per Nepal Road Standards, 2045 B.S. The design capacity is the traffic volume that a roadway can accommodate for a level of service 'B' (level-of-service is a parameter to denote the qualitative measure of the traffic operation). Though the existing volumes along the *Chabahil – Gaushala* section of Ring Road are still within the capacity level of the roadway, this section is likely to be over saturated within 6-7 years if the current traffic growth prevails. There is also the added likelihood of traffic increase to the Kathmandu streets and to Ring Road once the *Banepa-Sindhuli* Road is complete in the near future. Against this backdrop, proposed DKLR forms part or long-term effort to streamline traffic flow of Kathmandu, especially the north-south traffic along this road. Development of DKLR is also in line with the urban expansion of the valley towards the east along the Kathmandu-Bhaktapur corridor.

The Dhobi Khola corridor and its largest land development area of *Dhumbarahi* have following main accesses;

1. Ring Raod (the main access to the project area from the East)
2. *Chabahil Ganesh thaan* to *Handi Gaun* Chowk via Bhatkeko Bridge along the south.
3. 4m- wide eastern road connecting Ring Road to *Bhatkeko*pul (now renamed as Naya Bridge) which runs along Dhobi-Khola's eastern side.
4. 4m- wide eastern (partly pitched) road (proposed 6m GLD road to connected Ring Road to Chabahil Ganesh than-Handi Gaun Road) which runs almost along the Northern and Western boundary of the Project Area but discontinued at *Khahare Khola.*

5.4.12 Traffic Growth Rate

The Consultant derived traffic growth-rate for the study area by analyzing data from different sources and studies. Table 2.1 summarizes the traffic growth-rates used by various studies.

As shown in the table above, almost all the traffic growth-rates generally agree except the 1944 database on vehicle registration in Bagmati Zone. Most of the growth-rates are also national average and would probably be lower than the actual growth-rate in Kathmandu valley and therefore, growth-rate based on vehicle registration would probably be a better assumption for this parameter. However, the Consultant perceived 16.6% annual traffic-growth as being unrealistic for this study and therefore, has assumed an annual growth of 9% (average of all data above) for this study for the period 2002-2012. Similarly, an annual growth rate of 5% was assumed for the period 2013-2020 based on the above data.

Table 2.1 : Traffic Growth Rate Analysis

S. No.	Period of Statistic	Traffic Growth Rate % annum	Data Source & Type
1.	1980-1991	7.4%	1993 JICA's KVUR*(based on vehicle registration in Bagmati zone)
2.	1986-1993	11.0%	Growth rate at some sections of the Strategic Road Network. Growth was found to range from 5~11% annually.***
3.		8.0%	PIP^. Average national growth rate. (Range 5~8% in Nepal).
4.		6.5%	1998 KOICA Study on Kanti Rajmarg.+Value is the average growth rate computed based on projection of 8.7% (1998-2007), 6.5% for 2005-2015 % 4.2% (2015-2025).
5.		6.9%	DOR automatic logger traffic count data. Value is the median of growth between 5.1~6.9%/annum.
6.	1988-1994	16.6%	Vehicle registration in Bagmati.
	Average Rate	**9.4%**	**Per annum**

(Source: Draft Report of DKCIP, KVMP)

Table 5.4.11.1

5.4.13 Water Supply

Existing Condition of water supply system is not appropriate within the project area. There is a lack of planned water supply network. Pipe lines laid for supplying water from main lines are on individual basis. Some of the households within the project area are dependent on ground water. Existing water supply system is not sufficient for the proposed land development area. It is required to build entirely new water supply network within the project area.

5.4.14 Electricity

Electricity supply line exists in each of the existing vehicular roads. Existing electricity network only covers the existing residential part within the project area. The electric poles used are of wooden, tubular steel and pre-cast RCC poles. Most of the wooden poles are not in good condition. Some of the electric poles are used for street lighting as well. Most of the electric poles are obstructing the existing road width and proposed road network as well. They should be shifted and relocated.

5.4.15 Social Infrastructure

Open spaces / playgrounds

The local children are using public spaces as play grounds. No formal open space or playground is defined within the project area.

School

Few primary and lower middle schools are being conducted privately within the project area. Section has larger no of schools including primary, pre-primary and plustwo schools.

Temples Dhumbarahi temple, Maitidevi Temple, Mahadev and other temples at confluence.

Hospital Om Nursing Home and Research Center.

Film hall Hira Ratna Chal Chitra Mandir, Gopi-Krishna Cinema.

5.4.16 Present Land Use Pattern and Land Value

The existing land use is predominantly agricultural. Residential cum commercial use of buildings is prevalent in the area.

Depending upon location use of land and other socio-economic factors the price of land is different in different locations. However in an average at present land price at Dhobi Khola can be roughly categorized as follows:

Land along the DhobiKhola river : 1 lakh per ana

Land along existing 6m GLD roads : 3 lakh per ana

The land value is expected to rise three to four times or even more once the Dhobi Khola link road is constructed land development is carried out in the entire northern sector along the entire river corridor.

5.5 Map Interpretation

5.5.1 Aerial Photo Interpretation

Aerial photographs of year 1982 and 1998 have been collected from HMG, survey department of scale of 1:8000 in a separate request and photographs of year 1954 and 1964 have been collected from HMG. Department of Forestry. Due to unavailability of film 1964 photograph could not be enlarged to 1:8000 so it was of 1:12000 while 1954 is of

same 1:8000 scale as others. The river with its 100 meter each side from the center have been tresses out for the study purpose. A digital satellite image (IKONOS 2, Ht. 681 km, Resolution (PAN) 1m. viewed at March 2 and 27, 2001) of the study area have been collected from the KVMP and interpreted.

River and Buildings seen on the aerial photographs have been tresses out and section-wise tentative built up covered area have been calculated assuming 150m^2 per house area instead of finding area of clusters. Weighted average of the built up areas thus found have been calculated to deduce the built up area of whole river corridor.

Following table shows the result of these calculations of built up area within 200 meter Band of Dhobi Khola

S.N.	Study Area Section	Year					Remark
		1954	1964	1981	1998	2001	
1.	Section 1	2.8%	2.8%	4.6%	18.0%	31.0%	
2.	Section 2	3.5%	3.5%	7.2%	31.3%	38.5%	
3.	Section 3	5.6%	6.1%	7.3%	34.1%	48.5%	
4.	Section 4	1.43%	2.5%	10.4%	24.7%	38.9%	
5.	Section 5	4.9%	7.0%	13.8%	29.2%	34.7%	
6.	Section 6	0%	1.8%	3.2%	18.7%	23.3%	
7.	Section 7	0%	0.5%	1.8%	8.6%	10.1%	
8.	Weighted Mean Total Built up Area	4%	4%	7%	25%	31%	
9.	River Area	18%	18%	15%	12%	8.5%	
10.	Free space	78%	78%	78%	63%	59.5%	
11.	Total	100%	100%	100%	100%	100%	

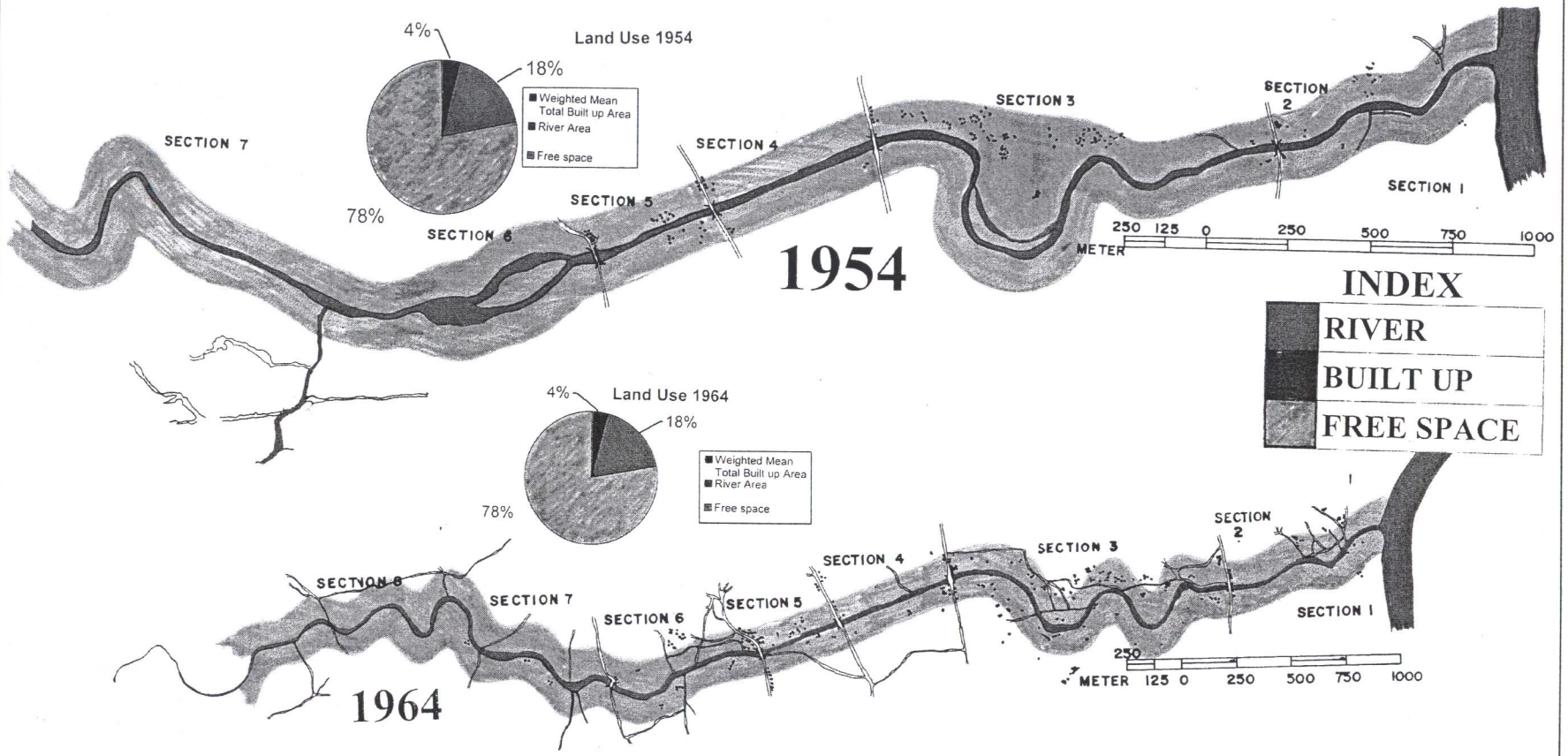
AERIAL PHOTO INTERPRETATION *Table 5.5.1.1*

In Fifties and Sixties

There were no houses in Dhobi Khola in fifties and sixties beyond *Kalopul* and between *Maitidevi-pul* to *Kalopul* also, there have found very less no. of houses. Aerial photo haS shown that few small houses and field sheds were there. 'Section 3' i.e. from Anamnagar to the Maitidevi Bridge have few scattered houses as to say settlements and houses were there between *Baneshwor* to *Anamnagar* i.e. 'Section 2'. 'Section 1' has almost negligible houses.

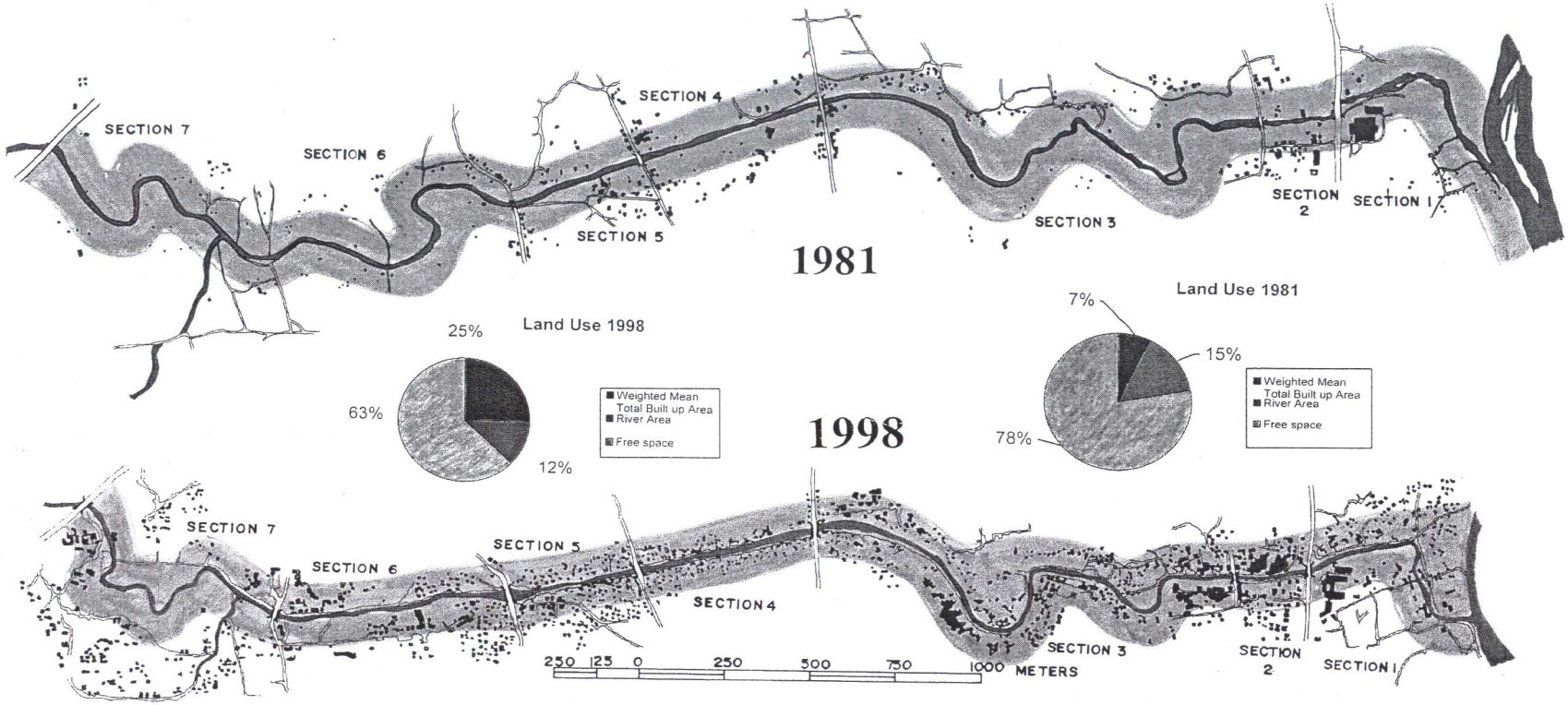
CHRONOLOGICAL DHOBI KHOLA

AERIAL PHOTO INTERPRETATION



THESIS REPORT: IMPACT OF PLANNING INTERVENTION ON CITY RIVER CORRIDORS (A CASE STUDY OF DHOBI KHOLA RIVER, KATHMANDU) SHEET TITLE: AERIAL PHOTO INTERPRETATION	BY: KICHAH CHITRAKAR M.Sc. URBAN PLANNING-2002 TRIBHUVAN UNIVERSITY, IOE, PULCHOWK CAMPUS	DATE : DEC 2002 THESIS SUPERVISOR Mr. P. S. JOSHI N

AERIAL PHOTO INTERPRETATION



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Till sixties it has been found that there was only 4% of built up area throughout the corridor and around 18% of 200m. Width corridor has been occupied by the river and remaining 78% is free which includes slopes, trees and greeneries etc.

In Eighties

Houses in clusters have emerged in eighties especially in 'section 2', Northern part of 'section 3', 'section 4' and 'section 5'. So, built up area seemed to be decreased. Some institutional buildings have come at section 1 i.e. at *Baneswor* area.

In Nineties

It is after the popular movement of 1990, the encroachment and construction of building at the Dhobi Khola river corridor have gained the momentum. Drastic change in the land use has occurred during the last 12 years. Aerial photograph of year 1998 have shown that the built up area increased to 25% from 7% of 1981 and to 4% in fifties and sixties. River width also decreased to total of only 12% from 15% in 1981 and 18% of fifties and sixties and the free space remains to only 63%.

The New Millennium

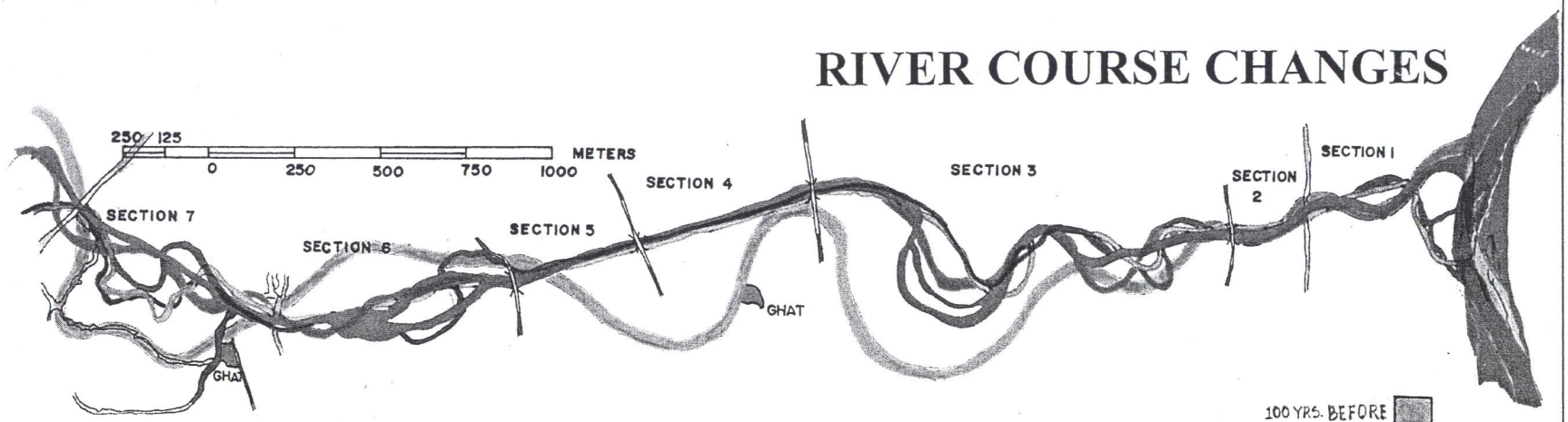
The river alignment hasn't been found to be much changed in the year 2001 than in 1998. Only the 'section 8' (*Chabahil section)* of river where there is a large open space still exist to flow freely have found some alteration in alignment and others remains the same. (See 6 layers of Dhobi Khola aerial photo interpretation map).

Building construction further extends and till now around 31% space of the 200 meter river corridor have already been occupied as built up including residential commercial all land uses and only around little more than 50 percent land is free. The satellite image of scale 1:4000 have been used to calculate the above data and river area have been found to be only 8.5% and around 60% space has been found to be free.

5.5.2 Dhobi Khola 100 years back

Studying the nature of development of nearby areas on the map and with some implications on the field also, it has been tried to draw a Dhobi Khola river 100 years

RIVER COURSE CHANGES



100 YRS. BEFORE
* 1954
* 1964
* 1981
* 1998
* 2001

AERIAL PHOTO INTERPRETATION

(6 LAYERS RIVER COURSES)

THESIS REPORT: IMPACT OF PLANNING INTERVENTION ON CITY RIVER CORRIDORS (A CASE STUDY OF DHOBI KHOLA RIVER, KATHMANDU) SHEET TITLE: AERIAL PHOTO INTERPRETATION	BY: KICHAH CHITRAKAR M.Sc. URBAN PLANNING-2002 TRIBHUVAN UNIVERSITY, IOE, PULCHOWK CAMPUS	DATE : DEC 2002 THESIS SUPERVISOR **Mr. P. S. JOSHI** N

back. It has been found that the River has ever been shifting towards east from west especially in Ghattekulo and Maitidevi areas (see 6 layers of river alignment map). The circular pattern of development at both the areas (see 2001 satellite Image Map) and the location of cremation place of Maitidevi and Chabahil, which are far from present day river have helped in drawing Dhobi Khola river alignment of past. The story was told by a 86 years old farmer during the questionnaire survey that there had been a competition between Bagmati and Dhobi Khola which runs parallel, in the past to flow quicker. The Dhobi Khola always used to loose and it became angry. Therefore it had started to flow straight. It reveals that the river alignment was highly meandering one in the past. Mean time the old brick walls have been seen at the bank of present river at *Maitidevi*, which was constructed to straighten the river few decades ago with the help of Russian Government. The fact that there was a drain some 100 meter west of present Maitidevi Bridge, parallel to the current river have also helped to draw the river course of 100 years back.

The shifting of river might be one of the reasons for people's reduced cultural and religious relation with the river Dhobi Khola today. In the past people might has used the river for cremation and other purpose, as they do with *Bagmati* and *Bishnumati* now. But the river has shifted as much as 500 meter and both the cremation places are nearly 400 meter far from the today's river. People of *Handigaon* and other nearby area now; prefer to go to the Bagmati for their cremation and religious / cultural purposes.

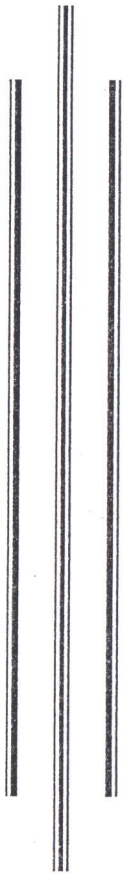
The river has been found to be highly meandering than in the past. Now also beyond the ring road, *Chabahil* and *Ghattekulo* it is meandered. The portion between *Handigaon Bhatkyapul* to Maitidevi (section 4, 5 and 6) has found to be flowing straight from 1950's to till now. At section 1 where Dhobi Khola meets the Bagmati River, it has changed it's direction, from some 300 meter upstream, sharply bending towards west to meet Bagmati, from 1970's. The previous river alignment has been found to be converted into a road now. River at both the section 1 and 2 has found to be straightened in due course of time.

The section 3 i.e. the Anamnagar, Ghattekulo, Maitidevi area, where the east bank has a steep slope and *Chabahil* area, downstream of ring road have found to be highly turbulent. It is interesting to note that, since the centuries and last five decade the river at this section have found to be shifting towards the east where there is a constraint i.e. steep

slope land. Hence the planning intervention in these areas might need attention towards this nature of the river. The Chabahil area (section 7), has opposite characteristics, where both the banks are flat and river was fairly straight in 1954 but it has been found to be meandering and shifting towards west from east in successive decades.

CHAPTER- VI

SYNTHESIS



CHAPTER VI

6.0 Synthesis

6.1 Why River Corridors?

The prime reason behind the selection of river corridors for the development work has been seen as availability of urban land. Since the vacant privates lands as well as government lands are there, intervention become much easier. The economic value of these urban lands have supported the self-financing and self-sustainable modality of the development i.e. Dhobi Khola Corridor Improvement Project. There are various small and large pockets of vacant land along the riverside for the development.

The easy and straight layouts of road alignment with less destruction of physical structures are another reason for selection of river corridors to intervene. Various studies in the past have shown that only possible routes for laying major transport corridors are along the rivers of Kathmandu Valley. So, it could be a major road corridor of the valley.

Due to the social and cultural linkage of people in the past with the river, roads are there from every small settlement to the river. These roads now could act as collector roads for the metropolitan transportation network. Like *Ason* and *Indrachowk* were the center for old settlements of Kathmandu, these river corridors could be the centres for urban areas of Kathmandu valley.

Viability of self-financing modality of development has also played a significant role on choosing river corridors as development sites along with the other reasons.

Yet another aspect is that the river corridors of Kathmandu Valley are environmentally degraded. Hence to upgrade its environment also, the planning interventions have been proposed. Like for roads, river corridors are the best alignment to layout the collector sewers.

If the present trend of encroachment and development is continued and no intervention is made, it will lead to a situation that betterment of the river environment will not be possible for several decades.

6.2 Declining Cultural Values

Since the settlement history of *Handigaon* and *Dillibazar* area goes back to Lichhavis era and beyond there might be more religious and cultural linkages with river Dhobi Khola than today. This could be a research topic by itself.

It has been found that there is a *jatra* of god named "Dhanwantari" in *Handingaon.* Once a year, the idol of the god has to bring in the Dhobi Khola River for its bath during the *jatra*, which takes around half an hour in the river.

Present river has shifted as much as 400 to 600 meter and both the cremation places are nearly 400 meter far from the river, (*see chapter V, Dhobi Khola 100 years back*).Due to lack of facilities, people of *Handigaon* and other areas now prefer to go to the *Bagmati* for their cremation works. The nature of development of nearby areas on the map and with some implications on the field, when tried to draw a Dhobi Khola river 100 years back, it came just near to the present cremation places of *Maitidevi* and *Chabahil.* It has been found that the river has ever been shifting towards east from west especially in *Ghattekulo* and *Maitidevi* areas (see 6 layers of river alignment map). The story was told by a 86 years old farmer during the questionnaire survey that there used to be a running competition between *Bagmat*i and Dhobi Khola which runs parallel in the past and in which Dhobi Khola always used to loose. So, Dhobi Khola became angry and started to flow straight. It implies that Dhobi Khola was also a meandering river in the past The circular pattern of development at *Ghattekulo* and *Maitidev*i (see 2001 satellite Image Map); the location of cremation place of M*aitidevi* and *Chabahil,* which are far from present day river; the old brick walls seen at the bank of present river at *Maitidevi* and the fact that there was a drain some 100 meter west of present *Maitidev*i Bridge, parallel to the current river are few bases to draw the alignment of Dhobi Khola some 100 years back.

The primary survey of "river use" and "household questionnaire" also implies that there is no strong religious and cultural linkage of people with today's river Dhobi Khola as it does with *Bagmat*i and B*ishnumat*i. Hence the impact of Implementation of proposed DKCIP on cultural and religious side could be considered as minimum against the backdrop of other sides of the development and positive impacts.

6.3 Solid waste generation at Dhobi Khola

Total Solid waste disposal at Riverside (Section 1 – Section 7)

S. No.	Section	Person No.	Vol. (m^3)	Qty. (m^3)	Carts			Total Qty. (m^3)
					No.	Vol. (m^3)	Quantity (m^3)	
1.	1	4	0.025	0.06	-	-	-	0.06
2.	2	20	0.025	0.3	2	0.30	0.60	0.9
3.	3	7	0.015	0.105	1	0.30	0.30	0.41
4.	4	22	0.15	0.33	2	0.30	0.60	0.93
5.	5	43	0.015	0.65	3	0.30	0.60	1.25
6.	6	32	0.015	.48	4	0.30	0.60	1.08
7.	7	15	0.015	0.23	3	0.30	0.60	0.83
	Total	-	-	**2.160**	-	-	**3.30**	**5.46**

Table 6.3.1

Based on the river use survey, tentative quantity of solid waste disposal at the Dhobi Khola River from *Bagmati* confluence to *Chabahi*l has been found to be around five cubic meters per day. The waste disposal by individuals residing at the corridor have found to be only around two cubic meter per day whereas significant amount i.e. around three cubic meter have found to be due to the disposal by carts.

This volume of nearly five and half cubic meter should be added to the 350 – 400 cubic meter per day being managed by KMC and the proper care should be taken if planning intervention has to be made in the corridor.

6.4 Transportation

The flood plain of the Dhobi Khola, which until 1990 was restricted for construction activity, has now been developing into a low-density residential area. The riverbanks provide an opportunity to be developed as a major transport corridor, facilitating the north south movement along the eastern fringe of the city center. This corridor can help to improve the traffic management in the city center. In order to achieve desirable residential density in newly developed areas, such as *Ghattekulo* and Anamnagar, this road corridor will help to accelerate the densification process.

Though the concept of ring road envisaged by "*Halcro Fox*" and "*Jaica*" Report doesn't seem to be executable because of the dense built up area at it's north alignment, both at *Naya Bazar - Indian Embassy – Pani Pokhari – Bishalnagar – Chabahil* and *Dhobichaur – Lekhnath marg – Royal Palace – Tangal – Sanogaucharan alignment.* The Dhobi-Khola link Road could still work effectively making northern part of

existing ring road and *Teku - Tripureswor* road as its north and south wings respectively.

Since the KVTDC has initiated hiring the consulting firm to study the proposed *Bagamati link road* few days back which runs from *Chobhar* to the *Manahara* River, the DKLR has widened its scope too.

Since the northern part of KMC has relatively less-traffic and less number of commuters, improvement of existing road from *Dhobichaur* to *Sano-Gaucharan* up to proposed DKLR via *Lekhanath Marg*, Palace and *Tangal* will be able to fulfill a role of northern wing of envisaged inner ring road. This northern road is more justifiable also because it is closer to the city core construction of outer ring road after 20 years. It would then formulate a series of *four concentric ring roads* within the Kathmandu valley to become a transportation network base including present *Ramshaha Path*, *Jamal-Tripureswor* Road as innermost one.

Ring road 1- Innermost ring road of Tripureswor - Thapathali - Ramshah Path Jamal - Shahid Gate.

Ring Road 2- Dhobi Khola ring road consisting of Bishnumati corridor, Bagmati Corridor and Dhobichaur - Sanogaucharan road.

Ring Road 3- Existing ring road

Ring road 4- Proposed outer ring road.

DKLR end at north lies the rapidly growing urban fringe i.e. Kapan V.D.C. including some part of KMC, where the development spillover from East, West and South i.e. *Bouddha, Chabahil* and Ring road to D*humbarahi* respectively, has demanded good transportation system. Number of factories and industries are growing there. There are already three tempo routes running from Kathmandu. A small Tempo park has already been built at the left bank of Dhobi Khola within few hundred meters distance. At south lies P*atan* core area, which is the major destination for the future users of DKLR after construction of *Bagmati link Road* and new bridge at confluence. Along with the trip generation from Kathmandu core area. Prospect of this road to be connected with *Bouddha* and then to the *Bhaktapur* should not be neglected.

The DKLR must have a grade separation with the existing road crossings because of short distance between the intersections. All the intersections lie within half kilometer to one Kilometer range except at the 'section 3' (Ghattekulo area). A short

route (N1-N2) has also been proposed from *Ghattekulo* by *GAIAUPP*. Concept of arterial would not be possible otherwise. Few of the existing bridges should be reconstructed rather than going to the land acquisition and building dismantling at intersections to connect with the existing road in order to function by a Ring road.

Comparative table for using the DKLR and other routes

Dashrath Stadium to Kapan	**Others Routes**	**DKLR Route**
Route	Jamal-Lazimpat-Dhumbarahi-Kaoan	Thapathali-DKLR-Kapan
Distance	9.0 Km	6.5 Km.
Traffic Jam	High Chances	No
Speed	30 km/h (Max.	60 Km/h
Fuel	139%	100%
Time	18+15 mins.	7+5 mins.
Visibility	Rough	River and greens
Pollution	More polluted air	Riverine environment
No. Of accident prone points	Six	One

Table 6.4.1

After a football match, if people have to return from *Dashrath Sta*dium to newly developing area of *Kapan,* Possible routes are either via inner city roads or North-South *Jamal-Maharajgung* road or through *Arniko H/W*-Ring road. For vehicles inner city roads are not comparable also because of single lane roads. Hence the *Jamal-Lazimpat*-Ring road-Kapan has been considered for the comparison. The study has shown that the proposed DKLR is much efficient.

The case has found favorable for *Patan* to *Dhumbarahi* and Bjeswori (at Bishnumati Link road) to *Kapa*n also, which are the typical cases to represent Kathmandu Valley for the future use of DKLR.

A primary survey has shown that around 50% households have bicycles. Other studies also reveal that number of bicycle users at adjoining areas of DKLR like Patan, *Handigaon* and *Kapan* area is significant. Hence, the cycle track should also be considered as an important component of the DKLR.

6.5 Land Development and Management

For the growing needs of residence, land development projects are necessary indeed and the basic difference would be the household density and the infrastructures between new and old ones. The *Ghattekulo* area, where GAIAUPP is launching, have 500/ha population density, 36 hph with 14 person per house and 65% people are in rent against the proposed DKCIP having 550/ha population density and 96 hph household density. So the comparison between two areas clearly justifies the land development schemes. The prevention of turning those vacant plots into a haphazard, dense area like *Ghattekulo* would be a major advantage where projects like GAIAUPP would not be necessary.

Comparison Chart of the residential areas

S.N.		Ghattekulo Area	Proposed DKCIP land Dev.
1.	Population density	500/ha	550/ha
2.	Person per house	14	6
3.	House per hectare	36 hph	96hph
4.	Residence use	80%	60%
5.	Plot size	Varying	127.17 sq.m.
6.	No. of plots per hectare	-	48
7.	Level of infrastructures	Poor	High

Table 6.5.1

Proposed DKLR and nearby existing ring road would be the major roads to be used by these land development sites.

6.6 Effect on River

The hydrological study of the proposed Dhobi Khola Corridor Improvement Project have calculated the theoretical water way of the river as around 50 meter and actual waterway measured is around 18 meter. It has recommended a 14-meter width of waterway considering for future considering local constraints. The highest depth of river during flood measured is 3.6 meter. Reduction in the flow width then increases its velocity, thus leading to the high scouring of the riverbed. Rapid destruction of sidewalls may occur. Vegetation and aquatic life may not be present in the river.

The flora and fauna, which is supposed to exist in and around the rivers, may not be there in the case of Dhobi Khola River, once it is converted into the huge institutional area or the CBD as envisaged by the project.

The discharge in the river could possibly be reduced after construction of collector sewer at both the banks in dry seasons. Disposal of treated water within the catchments of the river, from various government institutions like army, police, large

complexes and factories should be better way to increase the discharge. Scenario will definitely be increased after 'Melamchi' project starts to supply water in Kathmandu. So, the surface water could contribute more to flow Dhobi Khola with sufficient discharge.

Construction of few check dams at the river may solve the problem of scouring. Fisheries can be done in a river to improve the river environment with the help of these check dams. Gabion walls should be avoided because of their shorter life period of around five years. Permanent lining of the river bed and its side walls should be carried out.

These development activities lead to the huge reduction of sand extraction from the river. Solid waste disposal on the river vanishes once the area converted into huge institutional and commercial area. Consequently, scavengers will also be displaced from the area.

6.7 Cost and Financing

The proposed DKCIP land development scheme has shown that land development projects are financially viable. For largest land development scheme of around 700 Ropani at Chabahil, the land price of developed plots have been assumed to be increased by two fold. The land price is 2 lakhs per anna at present and will be 4 lakhs per anna after development. The calculation also showed the surplus amount of 1.5 crores for that area. (see chart 4.1.8.1)

Taking reference to the price like of Bishnumati corridor, where the price of developed plots have gone up to as high as 10 times, the land development scheme along the DKLR and other smaller pockets would be self financing.

For the construction of DKLR only, the draft report has calculated following land for acquisition @ Rs.3200000 per Ropani

At left bank	57.55 Ropani
At right bank	58.36 Ropani
Total	*115.91 Ropani*

Analyzing the above data, it comes around 6.25 meter strip of land at the each bank required to be acquire for the said design of 3 meter cycle track, 7 meter Road and 2 meter footpath at each side.

If we choose the plots at the developed roadsides to be 6 anna (190 square meters) and depth as 18.75 meter, so that the total width of the land to be acquired including for DKLR becomes 25 meter from the property line, the width of plot becomes 10 meter.

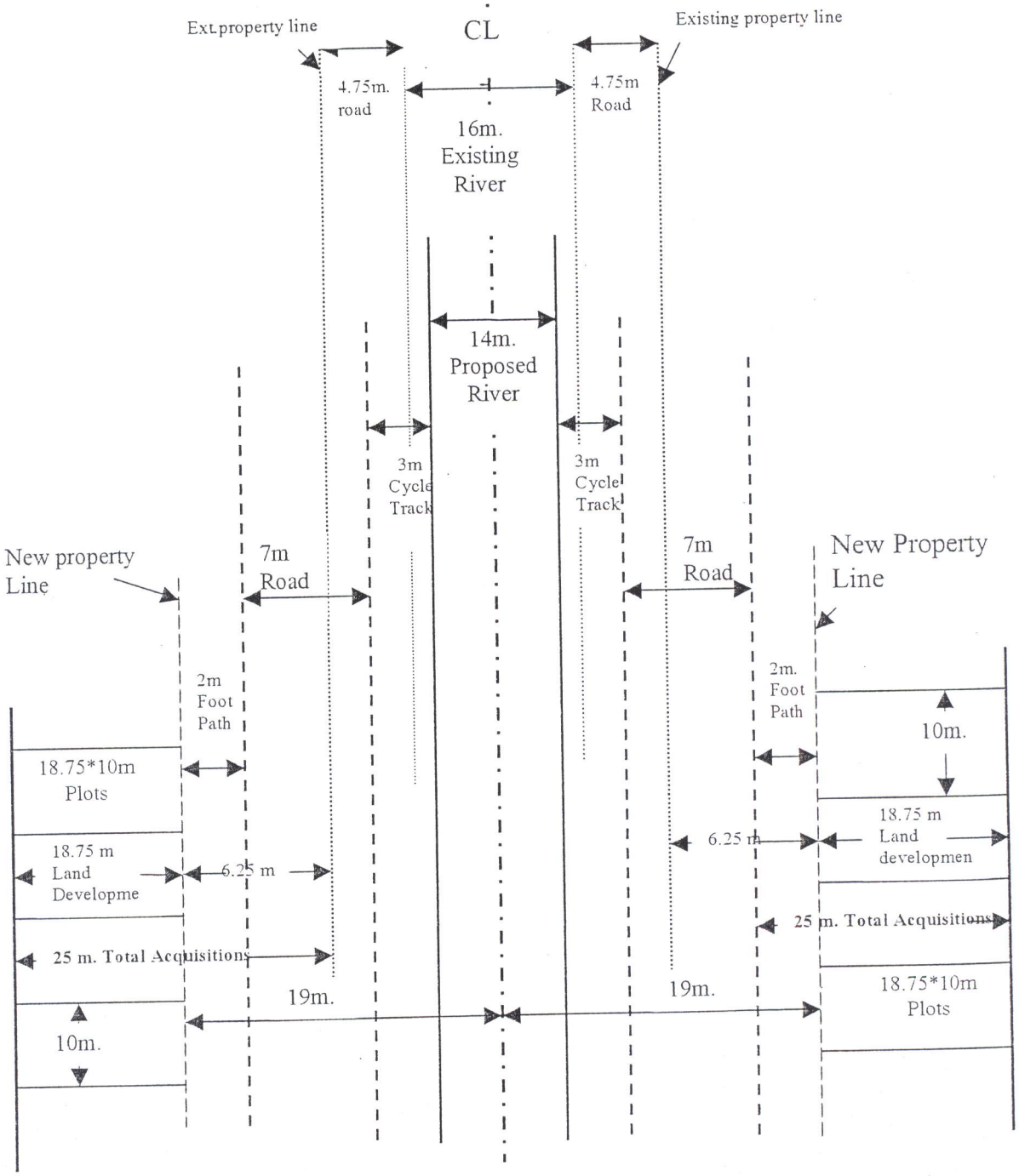
Hence, for the length of 4.5 kilometer

Number of plots at each side = 450

Total number of plots = 2*450=900 plots.

Less 10% for roads and to resolve
land readjustment difficulties and others,

Total number of salable plots = ***810 plots***.



ANALYTICAL LINE DIAGRAM

Fig.6.7.1

If the price of land after development is 5 lakhs per anna, price per plot becomes Rs. 3000000.

Total sales revenue from developed plots = 810*3000000 = **Rs.2. 430,000,000**

Now, total land to be acquired for land development only along the DKLR at both the banks is 2*18.75*4500 = 168750 sq. m. (Around 332 Ropani)

Adopting the price of land as 2 lakh per anna,

Cost of Land acquision 332*3200000 =Rs.1,-062,400,000.00

Adding calculated development cost =Rs.1, 097,700,000.00

Total Cost =**Rs.2, 160,100,000.00**

Hence, the surplus amount is Rs.269, 900,000.00

The surplus amount of around *27 crores* could be used for payment of interest over initial investment loans, development of acquired plots and others.

So, the development of Dhobi Khola Corridor, demands minimum of 25 meter land at the each side, or even more to be acquired for its self financing modality to work.

Since majority of the people are found to be involved in business, private service and higher level of government services with higher monthly income, which have shown by the primary questionnaire survey, there may not arise much complexities of non-affordability and relocation of people for land development.

CHAPTER VII

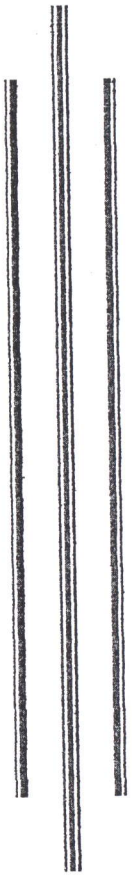
7.0 Impact Statements

S.N.		Impacts
1.	Cultural/Religious	• Insignificant impact because of less cultural/religious linkages and People can continue to use as present. Moreover due to easy accessibility, value of nearby cultural and religious places will increase.
2.	General	• The ultimate benefit of the planning intervention will be the people residing in the corridor. • Road will act as a Buffer zone between river and settlement. • River ROW will be fixed and stops further river encroachment. • Scavengers will not seen in the area as a result of solid waste reduction and management. Sand extractors, scavengers and slum dwellers may loose their current occupation. • Public participation in the development activity could be observed. • Heavy inflow of migrants. Currently it's not densely populated. • A combination of river corridor and road corridor characteristics may lead the area into the major institutional, trade and economic center of the city. Since 32% people of the corridor are involved in business, potentiality of becoming commercial centre is also high after development. • Disparity in development between proposed DKLR area and Kapan area (Section 8) further increases.
3.	Environmental	• Solid waste disposal at riverside will be controlled. • Flora and fauna may not exist along the river. • The natural regime of river flow will be disturbed. • The riverbed-scouring problem occurs and frequent destruction of sidewalls may deteriorate the visual environment of the area. • No disturbance to existing drainage pattern. • 3 squatters will be evacuated and likely to be resettled. • Flood damages will be controlled. • High reduction in sand extraction from the river. • River water will be cleaned as collector drains carry sewages. Nuisances will be reduced highly. • Less water than now may flow initially in dry weather for few years as collector drains carry all sewages. • Environment of Kapan area (Section 8) may further degrade due to increased industries and factories.
4.	Transportation	• No disturbance to existing road alignments. Few intersections need signalization. • Cycle track will be established as a good example in the Kathmandu valley. Risk free travel for cyclists along DKLR will be established.

		• Reduce congestion at city core roads. • Major traffic decongestion at Gaushala & Chabahil Chowk. • Cross-city transportation becomes easier. • Decongestion at Thapathali Bridge after connection of DKLR with Patan via proposed Bagmati Link Road of Bagmati River Corridor depelopment project. • Increased traffic at Dhobichaur, Lekhnath Marga, palace, Tangal, Sanogaucharan road. • River system will get priority if road is improved. • Traffic attraction from Patan and Kapan along with Kathmandu city core to DKLR. • A major transport corridor will be established. • Air and noise pollution due to increased traffic volume in the corridor. • It will further encourage going for other corridors.
5.	Land Development	• Controlled land use and number of house hold per hectare, hence, household density controlled. • Stops the river encroachment. • Densifies the partially developed areas like Ghattekulo and other nearby settlements. • Efficiency in land utilization and land management will be observed. • Availability of open spaces for the corridor at the land development sites. • High increase of land value in corridor. • Increase in rent. • Growth of Kapan area (section 8) further accelerates. • Land price of the Kapan area goes up. It will be induced by the DKCIP.
6.	Land Use	• Huge change in land use pattern occurs. • Lost of agricultural land with some trees and greens. • Fast commercial and institutional growth. • Development of areas into residential area with improved accessibility and infrastructure. • Insignificant impact due to loss of some productive agricultural land.

CHAPTER - VIII

CONCLUSION AND RECOMMENDATIONS



CHAPTER VIII

8.0 CONCLUSION AND RECOMMENDATIONS

8.1 Conclusion

It has been concluded that the planning intervention on the corridor must be carried out as soon as possible due to the strategic location of the area from the development point of view. Deteriorating environment, urban land availability, existing infrastructure facilities, financial viability, less religious and cultural impacts, necessity of flood mitigation measures are the positive arguments for the intervention.

Land use of the corridor has gained significant difference in last 50 years. Built up area has been increased to 31% from 5% and net river area has been decreased to 9% from 18%. River has changed its course sharply at the northern and southern portion and middle one third remained straight.

People of the corridor are found to be in favor of planning works proposed by DKCIP but the minimum contribution of less than 25 percent should be assured to them. Minimum of 25-meter land or even more, if possible has been calculated as necessary, to be acquired and develop for the said road development of DKCIP. according to the proposed development modality.

Measures to straighten the river and attempts of reclamation of riverbanks have been found in the past. The private encroachment has been found increasing and unplanned built up area are high consequently.

Number of studies has been made on different river corridors of the Kathmandu valley, but less has been found about the Dhobi Khola, particularly on the cultural. religious, spiritual, social and economical aspects.

Solid waste deposits and discharge of untreated sewage are the major actions deteriorating the river corridor. Squatter settlements, bank erosions are also responsible for visually worsening river environment. There have been found to be depositing five to six cubic meter of solid waste per day on the river only, which turn out to be more than 1% of the total waste being managed by KMC now.

People of the area are found aware about the development works being carried out at their vicinity. They also know that the ultimate beneficiaries are the people themselves.

Dhobi Khola River has her own characteristics unlike Bagmati and Bishnumati. Archaeologically important. cultural and historical sites of today haven't been finding.

It is centrally located and has medium discharge among the rivers of Kathmandu valley. The study will help to find out the development modalities for the other similar rivers of the valley like Manohara and Nakhkhu.

8.2 Recommendations

8.2.1 General

- Planning intervention is inevitable.
- Develop river corridors strategy, synchronize it's potential with the potentialities for development of the surrounding areas of the river.
- An authority for all the water bodies of the valley to co-ordinate all components of intervention.

8.2.2 Environmental

- Provide separate sewage treatment for major institutions within the catchments like army, police and factories to clean the river and also to have some water to flow in dry season.
- Provision of public toilets on section 2, 3, 4 and 7 of corridors should be made immediately.
- Solid waste management plan for the corridor should be identified with strict control on riverside dumping activities.
- Lining of the riverbed and sidewalls should be carried out wherever necessary.
- Few check dams should be constructed across the river to reduce the flow velocity and to have some fishes and other water based animals. Side plantation should be carried out wherever possible.
- All the squatters along the riversides should be resettled

8.2.3 Transportation

- Use northern part of existing ring road as its northern wing, for immediate functioning of DKLR ring road.
- Improve and widen wherever possible, Dhobichour – Lekhnath Marga – Palace – Tangal – Sanogaucharan Road as it's near to city core.
- Transportation Plan of Valley should consider 4 concentric ring roads in next decades.(see ch.6.4)

- Concept of arterial road is not feasible at DKLR without grade separation because of short distance between intersections. If less land and building should be acquired /dismantled, it is even more necessary to separate grade.
- Extend DKLR upto Kapan, a rapidly urbanizing area. It will establish link among the Bouddha, future connector roads of outer ring road, Patan and Kathmandu .
- Provision of cycle track and sufficient footpath at each side for commuters along the river is most essential.
- Traffic technology should be integrated with the land use planning and urban form. Grade separation at the DKLR seems necessary. Signalizations of necessary intersections are recommended.
- The river corridor should also be considered as a major road corridor of the valley.

8.2.4 Land Development

- Land Development schemes along the corridor and the vacant plots of Chabahil, (section 7), Ghattekulo(section 3) and section 6, which has also been pointed out by DKCIP should be implemented.
- At least 25 meters of land, if possible more land from the existing property line at both sides of the river should be acquired and develop to make the project self financing.
- Kapan area (Section 8) of Dhobi Khola riverbanks should be developed as a park and recreation centers. Right bank of the river is still all vacant. Byelaw making and enforcement is immediate necessity of Kapan area. Public agency should activate as doer, provider and monitor of the legal and physical development activities. Riverside lands should be reserved and planned for said activities from right now. The emphasis should also be given to further grow and develop the area as a good educational area. It will refrain the area from industrial encroachment and keeps environment better.
- River ROW at the section ? should be fixed.

8.2.5 Others

- River training works should be carried out.
- Kapan area (Section 8) can be developed as a good educational area.

- Land use map of whole Kapan area should be prepared which even helps to bring growing factories and industries into the tax net.

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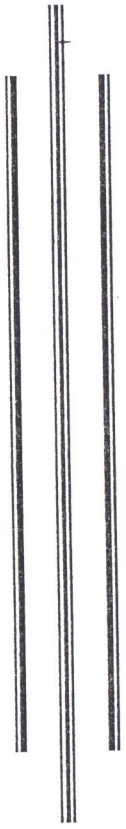

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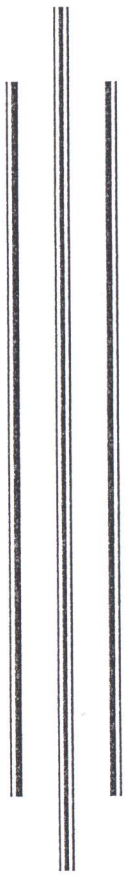
ANNEXURE



AX - 1

1. (GAIAUPP) GATTEKULO / ANAMNAGAR INTERGRATED AREA UPGRADING PILOT PROJECT REVIEW

1.1 General

During the planning and development of five sectors of KMC and while preparing Central Sector Development Plan, it has been identified that the areas along the bank of Dhobi Khola River have been developing slowly but haphazardly for residential and small offices. These areas are partially developed having residential density as low as 100 inh/ha. Due to inadequate provision of access and infrastructure, large tracts of land have found to be underdeveloped and underused. Despite its central location in the city, market prices of land in this area have found considerably lower than other parts of the Central Sector. In order to accelerate the urban development process in the area, need of intervention have been realized to improve the provision of access and infrastructure. As "Area Upgrading" is one of the main objectives of urban planning of KVMP, it has proposed to initiate a pilot project for infrastructure improvement and accelerated development in the Dhobi Khola area. The Dhobi Khola Link Road, which has been listed in the program of KVMP have believed to provide the impetus to the accelerated development of this area. Ghattekulo in Ward No. 32 is one of the areas in the Central Sector identified by the Planning unit, KVMP for area upgrading pilot project.

1.2 Project objectives

The principal objective stated for the Ghattekulo Area Upgrading Pilot Project was to develop mechanisms and procedures for the physical upgrading of partially developed urban areas in Kathmandu, to be progressively undertaken by KMC in close partnership with the resident community. The expected results and benefits accruing from this pilot project would be

1. Improvement in living/working conditions of the area
2. Development of residential areas at optimum density levels thereby lowering per capita infrastructure cost
3. Slowing down of horizontal city growth and urban sprawl
4. Strong communities through enhanced self-reliance and neighbourhood integrity.

5. Cost of upgrading infrastructure to be covered by beneficiaries through contribution in cash/kind
6. The pilot project have also plan to
    a. Undertake land pooling in the vacant areas
    b. Review and implement to the greatest extent possible the proposed GLD roads in the area to enhance traffic flow and accessibility

1.3 Scope of GAIAUPP

The project has following specific components:

1. Demarcation of project area based on the feasibility of implementation
2. Prepare database for land and houses based on cadastral information and field survey
3. Prepare database for existing infrastructure (road, drainage, water supply, electricity, telecommunication etc.) with their condition status
4. Prepare infrastructure upgrading plans (drainage, water supply, road network)
5. Prepare cost estimates for upgrading infrastructure and investment plan with prioritisation of the works.
6. Prepare contribution criteria and contribution database of individual landowners
7. Collect development charges from landowners
8. Phase wise construction of infrastructure

1.4 Project Area

1.4.1 Location

The area selected and recommended for this pilot project is located at Gattekulo wards no 32. It measures about 30 hectares of land and estimated to house about 4500 residents at present. The number of households (i.e. housing units) is estimated at 1100. The location is shown in Map.

Few decades back there was no settlement. The area was agriculture land with a small local canal called 'Ghattekulo'. There was a water mill during those days and the name of the place has same meaning. 'Ghattekulo' means a water mill canal.

The project area is situated in central sector of Kathmandu Metropolitan City. The project area covers majority settlements of the ward no. 32. The area is located on the bank of Dhobi Khola River and behind Singha Durbar (complex of head of the

governments where parliament, secretariat of prime minister and other ministries are located). The area is valuable in terms of its prime location and strategic position. The nearby presence of Dillibazar Road (Maitidevi area) with high commercial activities, Maitidevi Temple and old settlement of Dillibazar has also given the project area more importance.

The project area encompasses the settlement within Dillibazar road from 'Seto Pool' (Maitidevi Bridge) to Birendra Marg in North, Tanka Prasad Ghumti Road (Hanuman Than – Dhobi Khola Pool) in South. Similarly, the boundary of study area lies on Ghattekulo-Birendra Marg and Singha Durbar in west and Dhobi Khola in East.

1.4.2 Housing

The study area encompasses total area of 32 ha. A sample (10%) household survey was conducted in the area and the result indicated that total inhabitants of the area are 15,995. Hence, the population density of the area is 500 persons per hectare. The density is too high for such settlements. A separate house and land use survey was also conducted for entire area. The survey shows that there is 1156 houses exist on whole area. These surveys also show that out of 15,995 inhabitants 10,397 (65 percent of total) are on rent.

As indicated above sample-housing survey was conducted. The main purpose of this survey was to find out number of inhabitants in a house. The survey also revealed us the number of people that are on rent. Information about the types of house and use of house/land is collected from the survey. On average 13.84 persons dwell in a house.

Following tables highlights the findings of survey

S. No.	Types of House	Number	Percentage
1	Temporary	57	5
2	Load Bearing	312	27
3	Framed	787	68

Table Ax-1

1.4.3 Land Use and Land Price

The land-use of the study area has found to be predominantly residential. A land-use survey was conducted and result of the survey was presented as Land Use Map. The general trend of the area was that *these agriculture lands are converting into housing plots very rapidly*. Other type of land use that could be seen in the area is vacant land. These barren-lands are private plots where any thing could be emerged.

There are very *few institutional lands*. A public open space has been found where a temple and playground exist. Squatter settlements are thought to be sent in open spaces near the temple. These one-storied temporary dwellings have mentioned to be separately dealt with care, as these are very sensitive-politically.

1.5 GAIAUPP Planning Proposals

The result of community mobilization have briefly been presented as below:

- Community has found to be ready to participate in development efforts of ward office/government line agencies.
- Community is ready to contribute land without any compensation for road widening and drainage.
- Community is more concerned about dismantle of their existing home.
- Community is ready to widen existing road to 3.0m/4.0 m. as per existing condition of the site.
- They are ready to coordinate and cooperate with project / KMC officials for developmental works.
- They are ready to contribute 60% of the project cost for road and drainage works.
- They expect transparency and accountability from KMC personnel and ward representatives.

1.6 Roads

Rapid through flow of vehicle is possible only along north-south Rudramati Marg, Tanka Prasad Ghumti Road and Ghattekulo Marg. Similarly, rapid through

traffic flow is possible in Dillibazar Road and Tanka Prasad Ghumti Road along east west direction. The main roads/streets selected for major upgrading, i.e., widening and pavement improvement is based on its link with major roads (so that inner traffic could have easy access with high speed traffic road) just mentioned above. Another criteria for improvement are condition of road and availability of land for widening. Besides these criteria, the willingness of the concerned community for upgrading and participation in the project is considered. The roads considered for widening and pavement improvement is listed as below:

Sahayog Marg

Shree Siddhartha Marg

Chandan Marg

Himal Marg

Kalinchowk Marg

Gujeshwori Marg

Siddhikali Marg

Ghattekulo Marg

Laligurans Marg

Pathivara Marg

These proposed roads passed through central part of Anamnagar as well as central part of Ghattekulo and Shantinagar. Hence, this road has expected to attract traffic into core area of the settlement and similarly, it will divert/discharge traffic from core area of settlement towards major roads of the area. Due to constraint of land availability and following GLD road policy, widening of road is limited to 6m in Ghattekulo Marg and it is limited to 3-4m in other parts of the area.

All other gravel and earthen roads are proposed to have interlocking concrete block pavement. Proposed alternate to interlocking concrete block pavement is premix carpeting, which is less expensive than block pavement. As local community is not familiar and used to with interlocking concrete block pavement, they seems to be more reluctant to accept such pavement.

A new road has been proposed in the project area at Anamnagar, near Hanuman Than (Hanuman temple) in the light of new project, Dhobi Khola Corridor Improvement Project. A collector road has been felt necessary to feed traffic of Ghattekulo, Putali Sadak and Dilli Bazar into proposed Dhobi Khola arterial Road. It would be identified as best to provide it along the north boundary of Singha Durbar towards east meeting Dhobi Khola. Unfortunately, due to compact settlement development in that area, it is not viable. Hence, only open space available in that stretch of road is at proposed area. Again, stretch N1-N2 (refer map) is the shortest route to the Dhobi Khola. The tentative cost estimate of the stretch has also been calculated. But, the proposed entry point of the collector road is very near to the Dhobi Khola Bridge (about 100m), it has not recommended to invest extra fund for this collector road.

1.7 Review of GLD Roads

GLD roads have found to be more or less falls into the category of statutory planning in a sense that certain roads are classified according to width (ROW) and new building construction should follow the ROW rule. Three types of GLD roads have been found to exist in the area as mentioned above.

Road Upgrading planning has tried to follow GLD Road ROW as far as possible. In few cases, existing road have been proposed instead of GLD roads as buildings are already there in GLD Road stretch. Other GLD road stretch has been kept as it is and road-upgrading planning has been done as mentioned above.

There are many residential roads in the area. These roads have been proposed as residential roads (2.5m-3.0m wide) in GLD road network and some other residential roads are proposed as well. Besides this, the roads proposed for widening and improvement that was not included in GLD roads are also proposed as GLD roads. Similarly, small gullies have also been included in road network as these are also part of road network even though they are not vehicular roads.

1.8 Drainage

Planning of drainage upgrading has been done in such a way that existing drainage network could be utilized optimally. Three types of problems have stated to be

emerged during field survey regarding drainage system in the area. They are listed as below:

Manhole blockage

Re-sizing of drainage pipe

New drains

Manhole blockage is more or less social problem. During heavy rainfall, affected people blocked manholes to divert the of flow water to other direction. As manholes are not properly constructed and covers are easy to lift such event occurs. Hence, it has been proposed to have maintenance of existing manholes with replacement of cover drainage.

Best solution has been proposed as discharge storm water from Pathibhara Marg to Dhobi Khola. The existing drain size is only 600 mm diameter concrete pipe which will be replace with 900 mm diameter concrete pipe to cater more discharge. All manholes along this road have proposed to be maintained to house replace diameter of the pipe.

1.9 Legal Provision

This was the first attempt of KMC to implement an "Area Upgrading Project". The prevailing legal provisions do not provide specific mechanisms for the projects of this kind. However, the project can be implemented based on a general provision made in the Town Development Committee Act. In order to prevent the new constructions and change in cadastral status of the plot parcels, a moratorium shall be imposed on the lands within the project area. The acquisition of land/buildings may be required in the areas especially for road widening or opening up the bottlenecks.

1.10 Project Partners

1.10.1 Stakeholders

Steering Committee constituting officials from KMC, line agencies and representatives from Users' Committees have been formed. This committee have proposed to be responsible for formulation of plans and policies. In order to have participation of the landowners in planning and implementation, implementing body

will work in close coordination with local committees constituting representatives of landowners.

1.10.2 KMC as implementing body

The project has proposed to be undertaken by KMC/KVMP in close coordination with KVTDC. The study and design of the project be out sourced to a qualified local consulting firm.

1.11 Project Staging

Stage 1: Feasibility Study

The stage 1 of the project includes all the preparatory works pertaining to the technical and financial feasibility study. Based on recommendations of the study, level of physical intervention (infrastructure upgrading and land development) and financing mechanism for project implementation.

Stage 2: Work planning, staging and staffing

On the basis of the findings and recommendations of the Feasibility study, the detail project plans and policy would be developed. Which includes all the works related to land development, infrastructure upgrading and financial mechanism to be accrued from the beneficiaries. The prioritisation of infrastructure development works and investment planning would be part of works to be carried out in this stage. It has been recommended that in the initial stage of the project a small pocket within the project area would be selected to carry out infrastructure upgrading works so that it can be replicated in the entire area.

Stage 3: Operation and Maintenance

Infrastructure and other services provided under this project would be handed over to a committee constituting ward and local representatives for future operation and maintenance.

1.12 Project cost and Financing mechanisms

GAUPP is a self-sustained scheme in which financial resources have proposed to be generated within the project itself through contribution from landowners based on the accrued land values. In other to overcome the problems of initial investment for infrastructure upgrading, KMC shall seek loan from the financial institutions.

The project has following steps and institutions for implementation;

Activity		2002										2003	Responsible agencies
		M	A	M	J	J	A	S	O	N	D		
1	Feasibility study												Outsource
2	Approval of the project			○									KMC/KVTDC
3	Formation of PSC			○									KMC/KVTDC
4	Moratorium on project area			○									KVTDC
5	Formation of Users' Committees			○									KMC/KVMP/UI
6	Detail project formulation												Outsource
7	Approval of the plans										○		UCs, PSC
8	Consultation with land owners												KMC/KVMP/UI
9	Construction of infrastructure (Pilot)												KVMP
11	Collection of contribution (Pilot)												KMC/UDD
12	Collection of contribution												KMC/UDD
13	Construction of infrastructure												KMC/UDD
14	Handover											○	UCs

1.13 Costs

Cost estimate have been prepared road wise separately so that CBOs / community could use it for their contribution calculation and other purposes. Alternate cost estimate have been prepared for all roads with interlocking concrete blocks pavement of all category so that local community and KVMP have choice for implementation. It is found that alternative pavement is 30% less expensive that interlocking concrete block pavement. Total estimated cost is Rs.3, 08,72,786. Similarly, total estimated cost with alternate price is Rs.2, 57,44,723.

1.14 Investment Plan and Contribution Criteria

It has been recommended to implement the proposed upgrading project in various phases.

It is stated to be clear during community mobilization process that community is ready to contribute in the project. It has also found to be clear that they are ready to

contribute 60% of the project cost. There are various options available regarding contribution criteria for the community. These are listed as below:

1. Household Based:

   This is simplest and most popular form of contribution criteria. All households will contribute equally regardless of their land size and road frontage. In Siddhartha Marg, Himal Chandan Marg and Gujeshwori Marg has adopted this criteria for collection of contribution. In this criterion, contribution will be collected also from households that benefit indirectly household situated just behind front row house. Normally, the contribution from them will be 30-40% of full contribution.

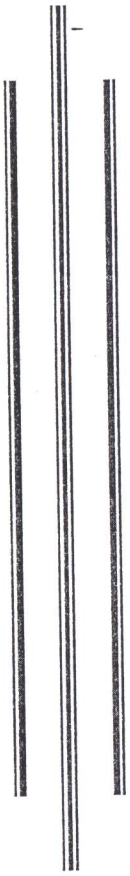
2. Frontage Based:

   In this criterion, only frontage of the land is considered. It does not matter whether depth is more or less. As commercial value of the building depends on its frontage. Rent from the shops will be more for building with long frontage; hence, it seems to be more realistic for commercial locations. The contribution will be more for household with long frontage.

1.15 Current Implementation

KMC have found to be undertaking an improvement programme at Siddhartha Marga, which is partially successful according to the engineer B.R. Shrestha, involved in the project. The project of one month took 4 and half month. There has been problem in getting 60% contribution from owners. The owners, whose houses have been demolished partly don't seem happy because they have been charged in 3 ways, through the household based contribution criteria. First with cash contribution, second the contribution of land to widen the road and lastly the cost of rebuilding the dismantled portion of their toilet blocks and houses. Hence in many places the project couldn't widen the road as designed and remains some portion narrow. 4meter wide Gujesswori, Kalinchowk marga and 3 meter wide Bhrikuti, Chandan, Himal Marga has been proposed for no financial contribution. Instead people are supposed to dismantle and rebuilt their walls, toilets, and rooms. But in case of other objectives and infrastructure up-gradation, most people and project staffs have expressed their satisfaction.

APPENDICES

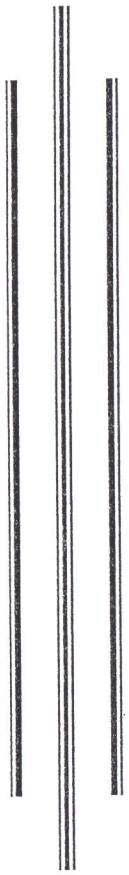


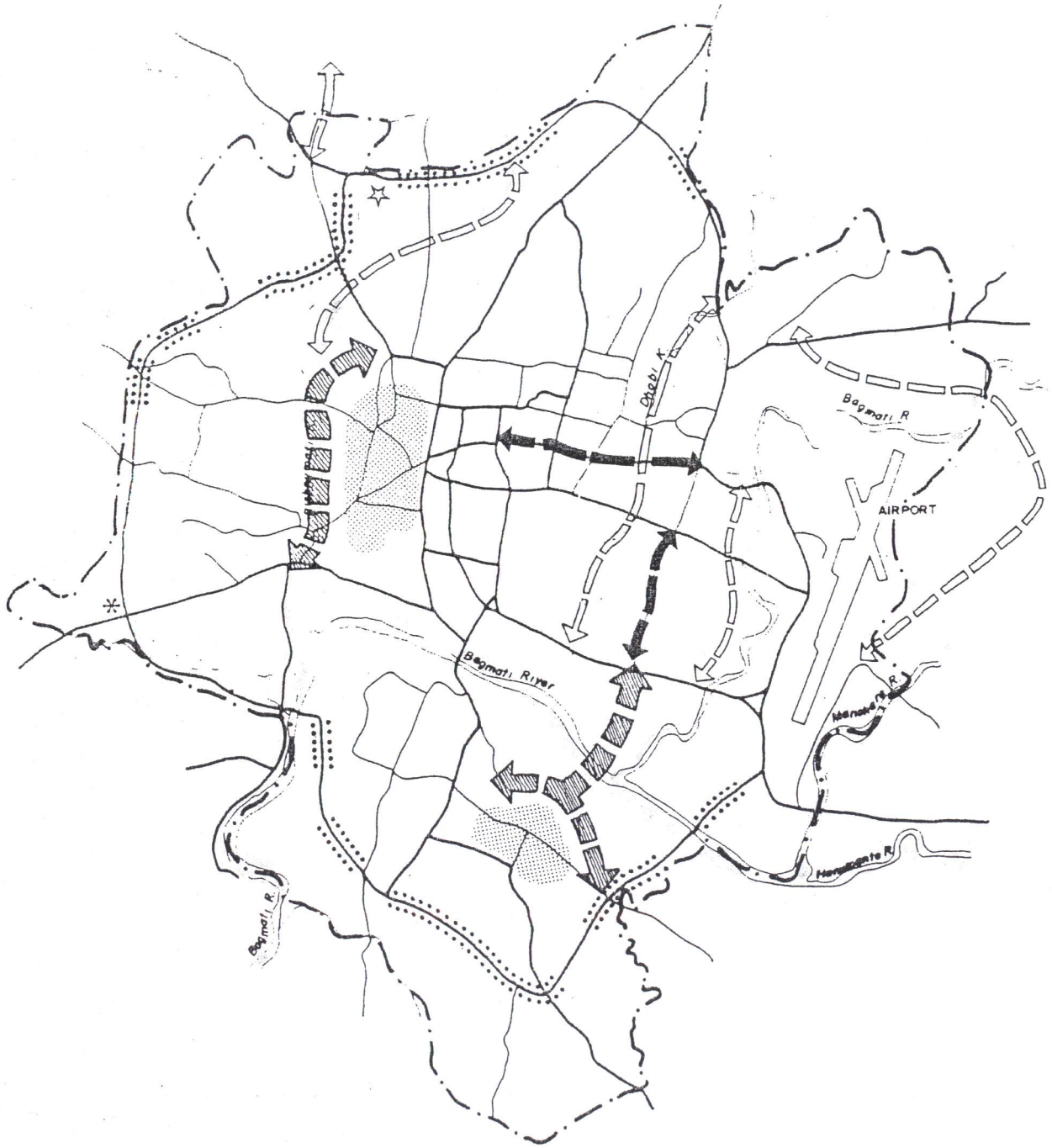
Persons Interacted

S. N.	Date	Persons	Remarks
1.	July 26, 002	Prof. Dr. J.R. Pokharel; IOE, Pulchowk Campus.	
2.	Aug. 05, 002	Prof. Dr. S.R. Tiwari; IOE, Pulchowk Campus.	
3.	Aug. 06, 002	Biresh Shah; Associate Professor, IOE, Pulchowk Campus.	
4.	Aug. 08, 002	Anup Mangal Joshi; Urban Planner (KVMP)	
5.	Aug. 12, 002	David Irvin; Senior Urban Planner, UDLE	Lectures
6.	Aug. 25 002	Sangeeta Singh; Co-ordinator, Astra Development Network (A Consultant of Phase II- DKCIP)	Attended
7.	Aug. 25, 002	Bipin Chitrakar, Astra Development Network.	
8.	Aug. 26, 002	Surya Bhakta Sangechhe; Member Secretary, Kathmandu Valley Town Development Committee.	
9.	Sept. 03, 002	Dr. Kavita B. Shrestha; Statistician (KVMP-Consultant)	
10.	Sept. 10, 002	Prof. Dr. Shovan Shah; HOD, Environmental Planning Dept., School of Planning and Architecture (SPA), New Delhi.	Special
11.	Sept. 11, 002	Prof. Kavas Kapadiya, Dept. of Urban Planning, SPA, New Delhi	Lectures Attended
12.	Sept. 11, 002	Prof. B. Moitraya, SPA, New Delhi.	
13.	Sept. 11, 002	Prof. Mrs. Nalina Thakur, SPA, New Delhi	
14.	Sept. 11, 002	Prof. B.Mishra, SPA, New Delhi	
15.	Sept. 11, 002	Prof. Neena Garella, SPA, New Delhi	
16.	Sept. 12, 002	Prof. Dr. Shovan Shah; HOD, Environmental Planning Dept., School of Planning and Architecture (SPA), New Delhi.	
17.	Sept. 15, 002	Gyanendra Singh Shekhawat, Lecturer, National Institute of Technology, NIT (Former Malayavi Regional Colledge, MRC), Jaipur, Rajasthan, Inida	
18.	Sept. 24, 002	Mukesh Shakya, Overseer, Astra Development Network.	
19.	Sept. 28. 002	Tara Pd. Lamsal, Engineer, Astra Development Network. Yogesh Shrestha, Planner, Astra Development Network.	
20.	Oct. 01, 002	Unam M. Pradhan; Urban Planner (DUDBC)/(KVMP); frequent meet throught the thesis period.	
21.	Oct. 05, 002	Mr. Ajaya Chandra Lal, Urban Planner & Lecturer, IOE, Pulchowk Campus.	

22.	Oct. 17, 002	Kishor Manandhar, Senior Urban Planner, KVMP.
		Dr. Frange Zigglar, Consultant, KVMP.
23.	Oct. 23, 002	Ms. Dhanita Sthapit, Urban Planner, KVMP.
24.	Nov. 19, 002	Sunil Poudel, Departmentof Road, HMG.
25.	Nov. 19, 002	Ramesh Jung Rayamajhi,UN Park Development Committee.

MAPS AND DRAWINGS





PLAN 5.11

KATHMANDU URBAN AREA
TRANSPORTATION STRATEGY

LEGEND

- Municipal Boundary
- Major Roads
- Minor Roads
- Rivers & Streams
- Strategic Primary Roads: Relief and access to city cores; additions to secondary road network.
- Strategic Secondary Roads: To service development sites.
- Pedestrianisation of Central Cores
- Other DOR Strategic Widening Schemes
- Provision / Completion of Service Roads on Ring Road
- Bus Stand Proposed By DOR / JICA
- Preferred Location For Bus Stand

HMG/ADB
KATHMANDU VALLEY
URBAN DEVELOPMENT
PLANS & PROGRAMMES

1·5 Km 1·0 0·5 0 0·5 1·0 1·5 Km

HALCROW FOX AND ASSOCIATES
PAK – POY & KNEEBONE PTY LTD.
CEMAT CONSULTANTS (PVT) LTD.

N

PLAN 5·11

PLAN 5·8

EXISTING HIGHWAY PLANNING PROPOSALS (DOR & MHPP)

3 RIVER BANKS TO FORM A INTERNAL RING ROAD.

LEGEND

- Municipal Boundary
- Major Roads
- Minor Roads
- Rivers & Streams
- DOR Schemes
- MHPP Schemes

HMG/ADB
KATHMANDU VALLEY
URBAN DEVELOPMENT
PLANS & PROGRAMMES

1·5Km 1·0 0·5 0 0·5 1·0 1·5Km

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PAK - POY & KNEEBONE PTY LTD.
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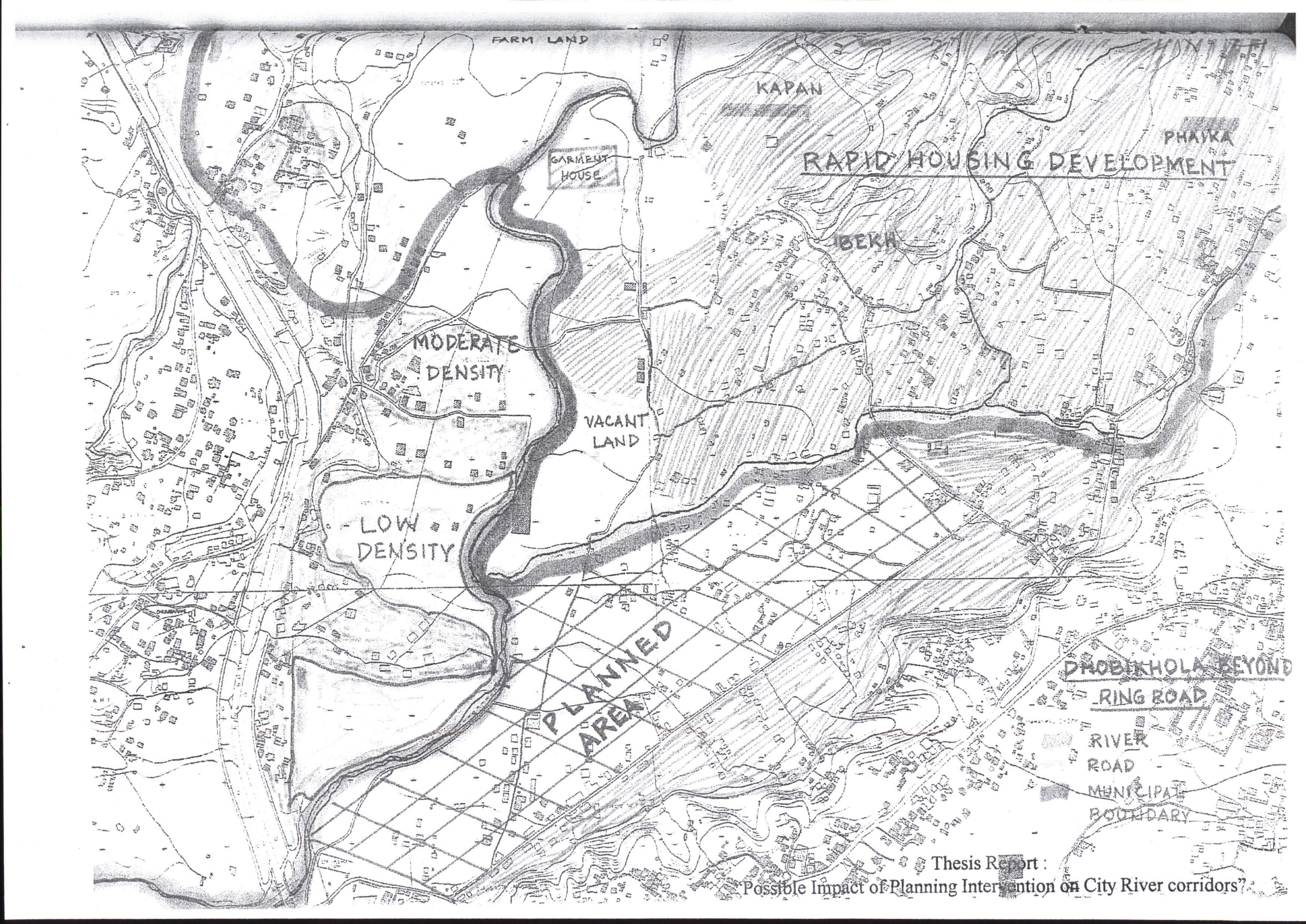
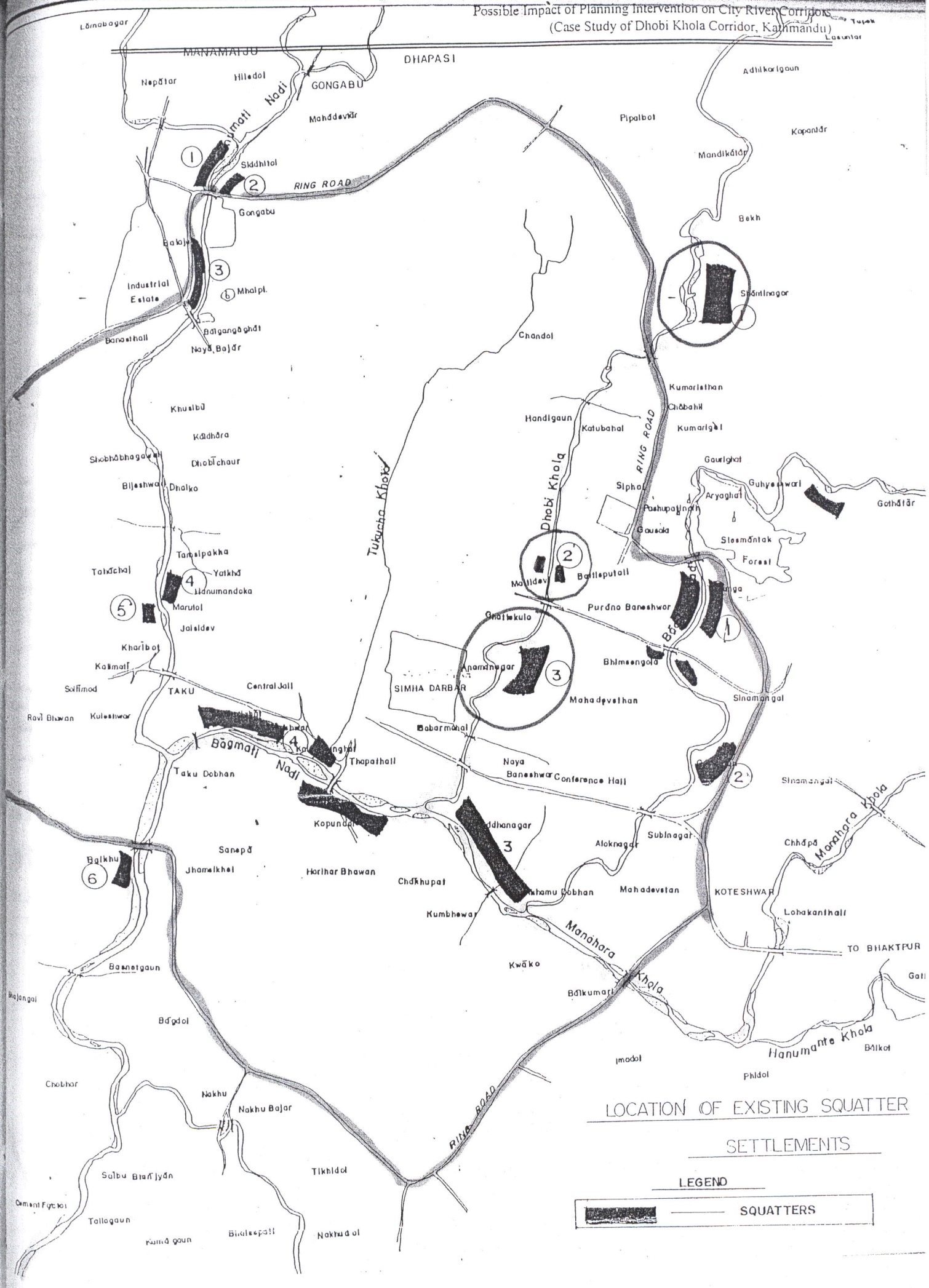
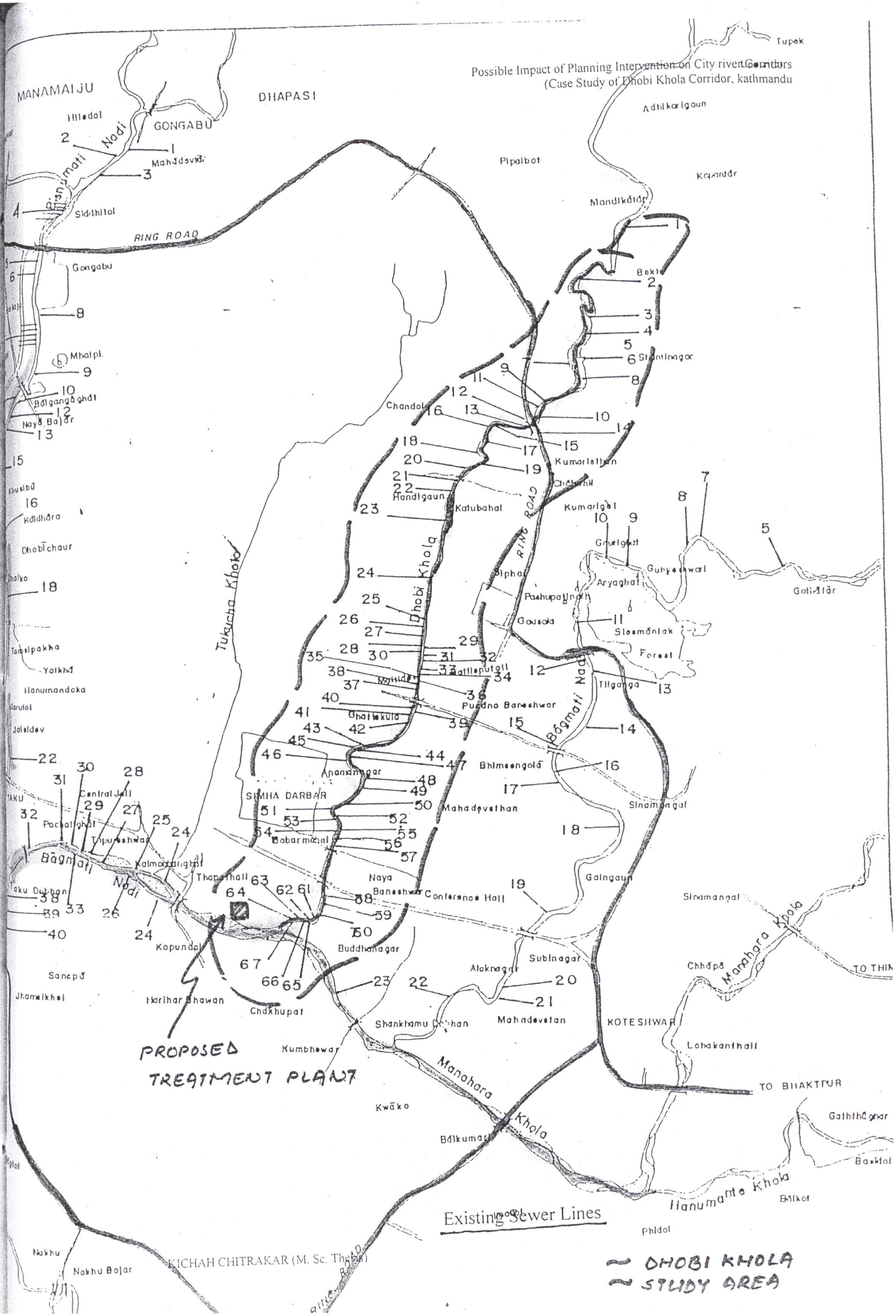
PLAN 5·8


FARM LAND
KAPAN
PHAVKA
RAPID HOUSING DEVELOPMENT
GARMENT HOUSE
BEKH
MODERATE DENSITY
VACANT LAND
LOW DENSITY
PLANNED AREA
DHOBIKHOLA BEYOND RING ROAD
RIVER
ROAD
MUNICIPAL BOUNDARY


3 RIVER BANKS TO FORM A INTERNAL RING ROAD.
KATHMANDU
PATAN
BALAJU WATER GARDEN
SWIMMING POOL
BALAJU
BALAJU INDUSTRIAL DISTRICT
COCO-COLA CO.
GONGABUR CENTRAL BUS PARK
RING ROAD
MINISTRY OF FOREIGN AFFAIRS
MAHARAJGUNJ
CHANDOL
DHUMBARAHI
PANIPOKHARI
BALUWATAR
BISHALNAGAR
GAIRIDHARA
HADIGAON
TANGAL
CHABHIL
ROYAL PALACE
NAXAL
SANU GAUCHARAN
SIPHAL
DEO PATAN
GYANESHWAR
GAUSALA
PASHUPATI
KATHMANDU VILLAGE HOTEL
DILLI BAZAR
BATTIS PUTALI
SINGH DURBAR
SECRETARIAT BUILDING
BANESHWAR
TRIPATHALI
DHOBIKHOLA
SANCHAL
HOTEL SUNSET VIEW
BALKHU
BAGMATI RIVER
T.U. CENTRAL OFFICE
T.U. STADIUM
LABORATORY SCHOOL
PROFFESORS QUARTER
BAGHDOL
CHOVAR
CHOVAR GANESH
NAKHU KHOLA
NAKHU
THASIKHEL
ASHOK STUPA
KUMBESHWAR
CHYASAL
BALKUMARI
DWARKO
TETA RIVER
ASHOK STUPA (EAST)
TO LUBHU (7km)
PID
1. BHIMSEN TE
2. VISHWANATH
3. KRISHNA MA
4. JAGANNARA
5. STATUE OF
6. HARI SHAN


MANAMAIJU
DHAPASI
GONGABU
Nepāl
Hiledol
Mahādevāl
Pipalbot
Kapanār
Mandikhāl
Bekh
Adhikarigaun
Siddhitol
RING ROAD
Gongabu
Balaju
Industrial Estate
Mhalpi
Bālgangā Ghāt
Banasthali
Naya Bajār
Chandol
Shāntinagar
Kumaristhan
Chhabahil
Kumarigal
Handigaun
Katubahal
Khusibu
Kaldhara
Dhobichaur
Shobhabhagawati
Bijeshwari
Dhalko
Tukucha Khola
Dhobi Khola
Gaurighat
Guhyeshwari
Gothatar
Aryaghat
Pashupatinath
Gausala
Sleemantak Forest
Tarkalpakha
Yatkha
Hanumandoka
Tokachal
Marutol
Jalsidev
Kharibot
Kalimati
Saifimod
TAKU
Central Jail
Ravi Bhawan
Kuleshwar
Bāgmati Nadi
Thapathali
Taku Dobhan
Kopundol
Babarmahal
SIMHA DARBAR
Anamnagar
Purdna Baneshwor
Bhimsengola
Mahadevsthan
Sinamangal
Naya Baneshwor
Conference Hall
Siddhanagar
Aloknagar
Subhnagar
Manahara Khola
Chhāpā
Balkhu
Sanepā
Jhamsikhel
Harihar Bhawan
Chakhupat
Thamu Dobhan
Mahadevsthan
KOTESHWAR
Lohakanthali
Kumbheswar
TO BHAKTPUR
Basnetgaun
Kwāko
Bālkumari
Bāgdol
Hanumante Khola
Bālkot
Imadol
Phidol
Chobhar
Nakhu
Nakhu Bajar
RING ROAD
Sālbu Bhanjyān
Tikhidol
Cement Factory
Tallogaun
Bhalesapati
Nakhudol
LOCATION OF EXISTING SQUATTER SETTLEMENTS
LEGEND
SQUATTERS


MANAMAIJU
DHAPASI
GONGABU
Nadi
Bishnumati
RING ROAD
Gongabu
Mhalpi
Balgangā ghāt
Naya Bajār
Kalimāti
Kalmochighat
Thapathali
Pachali ghāt
Tripureshwar
Central Jail
Taku Dobhan
Bāgmati Nadi
Kopundol
Sanepā
Jhamsikhel
Harihar Bhawan
Chakhupat
PROPOSED
TREATMENT PLANT
Kumbheswar
Kwāko
Bālkumari
Nakhu
Nakhu Bajar
Existing Sewer Lines
KICHAH CHITRAKAR (M. Sc. Thesis)
Pipalbot
Mandikhātār
Bakhundol
Shantinagar
Chandol
Kumaristhan
Handigaun
Katubahal
Dhobi Khola
Tukucha Khola
RING ROAD
Kumarigāl
Gaurighat
Guhyeshwari
Aryaghat
Pashupatinath
Gaushala
Sleemantak
Forest
Tilganga
Bāgmati Nadi
Pudano Bageshwor
Bhimsengolā
Sinamangal
SIMHA DARBAR
Mahadevsthan
Babarmahal
Naya Baneshwor Conference Hall
Gaingaun
Aloknagar
Subinagar
Buddhanagar
Shankhamul Bihan
Mahadevstan
KOTESHWAR
Lohakanthali
Manohara Khola
TO BHAKTPUR
Chhāpā
Gathighar
Baskot
Hanumante Khola
Balkot
Phidol
Nakhu
~ DHOBI KHOLA
~ STUDY AREA

Existing Sewer Outfalls

Dhobikhola River

1. Size:
   Quantity: Dry
   Location: 1
   Type: Open

2. Size: cm
   Quantity: 3 lpm
   Location: 2
   Type: Open drain

3. Size:
   Quantity: 5 lpm
   Location: 3
   Type: Open drain

4. Size: 30cm
   Quantity: Dry
   Location: 4
   Type: Hume Pipe

5. Size: 100cm wide
   Quantity: 200 lpm
   Location: 5
   Type: Open

6. Size:
   Quantity: Dry
   Location: 6
   Type: Open

7. Size: 30cm
   Quantity: Dry
   Location: 7
   Type: Circular

8. Size: 15cm
   Quantity: Dry
   Location: 8
   Type: Circular

9. Size:
   Quantity: 5 lpm
   Location: 9

10. Size:
    Quantity: 30 lpm
    Location: 10
    Type: Open

11. Size:
    Quantity: 1 lpm
    Type: Open
    Location: 11

12. Size: 20cm
    Quantity: 1 lpm
    Location: 12
    Type: Circular

13. Size:
    Quantity: 5 lpm
    Location: 13
    Type: Open

14. Size:
    Quantity:
    Location: 14
    Type: Open

15. Size:
    Quantity: 5 lpm
    Location: 15
    Type: Open

16. Size:
    Quantity: 5 lpm
    Location: 16
    Type: Open

17. Size: 20cm
    Quantity: 10 lpm
    Location: 17
    Type: Circular

18. Size:
    Quantity: Dry
    Location: 18
    Type: Open

19. Size: 30cm
    Quantity: Dry
    Location: 19
    Type: Circular

20. Size:
    Quantity: dry
    Location: 20
    Type: Open

21. Size:
Quantity: Dry
Location: 21
Type: Open

22. Size:
Quantity: 20 lpm
Location: 22
Type: Open

23. Size: 10cm
Quantity: Dry
Location: 23
Type: Circular

24. Size: 30cm
Quantity: 20 lpm
Location: 24
Type: Circular

25. Size: 30cm
Quantity: 15 lpm
Location: 24
Type: Circuiar

26. Size: 20cm
Quantity: 15 lpm
Location: 26
Type: Circular

27. Size: 15cm
Quantity: Dry
Location: 27
Type: Circular

28. Size: 10cm
Quantity: Dry
Location: 28
Type: Circular

29. Size:
Quantity: 5 lpm
Location: 29
Type: Open

30. Size: 10cm
Quantity: dry
Location: 30
Type: Circular

31. Size: 10cm
Quantity: 1 lpm
Location: 31
Type: Polythene

32. Size: 10cm
Quantity: 1 lpm
Location: 32
Type: Polythene

33. Size: 10cm
Quantity: 1 lpm
Location: 33
Type: Polythene

34. Size: 10cm
Quantity: Dry
Location: 34
Type: Polythene

35. Size:
Quantity: 3 lpm
Location: 35
Type: Open

36. Size: 30cm
Quantity: 1 lpm
Location: 36
Type: Circular

37. Size:
Quantity: Dry
Location: 37
Type: Open

38. Size:
Quantity: Dry
Location: 38
Type: Open

39 Size: 30 cm
Quantity: 15 lit/m
Location: 39
Type: Circular

40. Size: 20 cm
Quantity: Dry
Location: 40
Type: Circular

41. Size: 20 cm
Quantity: Dry
Location: 10
Type: Open

42. Size: 10
Quantity: Dry
Location: 42
Type: Polythene

43. Size: 30 cm
Quantity: 4 lit/m.
Location: 43
Type: Circular

44. Size: 40 cm
Quantity: Dry
Location: 44
Type: Circular

45. Size: 30cm
Quantity: 30 lit/m.
Location: 45
Type: Circular

46. Size: 50 cm
Quantity: 30 lit/m.
Location: 46
Type: Circular

47. Size: 10 cm
Quantity: 2 lit/m.
Location: Polythene
Type: 47

48. Size: 10cm
Quantity: Dry
Location: 48
Type: Polythene

49. Size: 10 cm
Quantity: Dry
Location: 49
Type: Polythene

50. Size: 10 cm
Quantity: Dry
Location: 50
Type: Polythene

51. Size: 10 cm
Quantity: Dry
Location: 10
Type: Polythene

52. Size: 100 cm
Quantity: 100 lit/m.
Location: 52
Type: Polythene

53. Size: 30 cm
Quantity: 3 lit/m
Location: 53
Type: Circular

54. Size: 30 cm
Quantity: 2 lit/m
Location: 54
Type: Circular

55. Size: 20 cm
Quantity: Dry
Location: 55
Type: Circular

56. Size: 40cm
Quantity: 5 lit/m.
Location: 56
Type: Circular

57. Size: 40 cm
Quantity: Dry
Location: 57
Type: Circular

58. Size:
Quantity: Dry
Location: 58
Type: Rect. Channel

59. Size: 70 cm
Quantity: 6 lit/m.
Location: 59
Type: Home Pipe

60. Size: 30 cm
Quantity: Dry
Location: 60
Type: Circular

61. Size: 20 cm
Quantity: Dry
Location: 61
Type: Circular

62. Size: 50 cm
Quantity: 15 lit/m.
Location: 62
Type: Circular

63. Size: 30 cm
Quantity: 50 lit/m.
Location: 63
Type: Circular

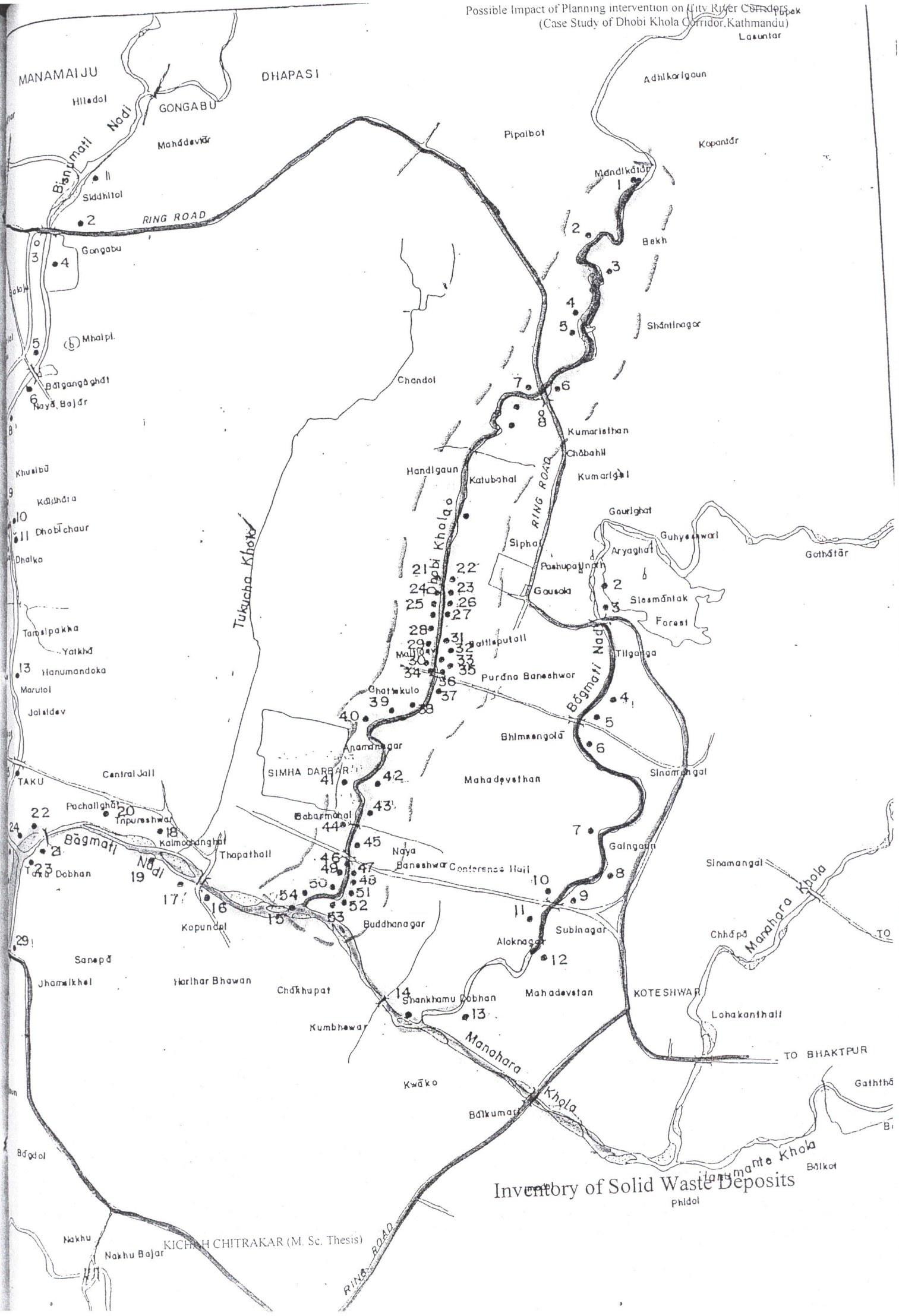
64. Size: 20 cm
Quantity: Dry
Location: 64
Type: Circular

65. Size: 10 cm
Quantity: Dry
Location: 65
Type: Circular

66. Size: 10 cm
Quantity: Dry
Location: 66
Type: Polythene

67. Size: 20 cm
Quantity: 1 lit/m.
Location: 67
Type: Circular

68. Size: 3 cm
Quantity: Dry
Location: 68
Type: Circular



Inventory of Solid Waste Deposits

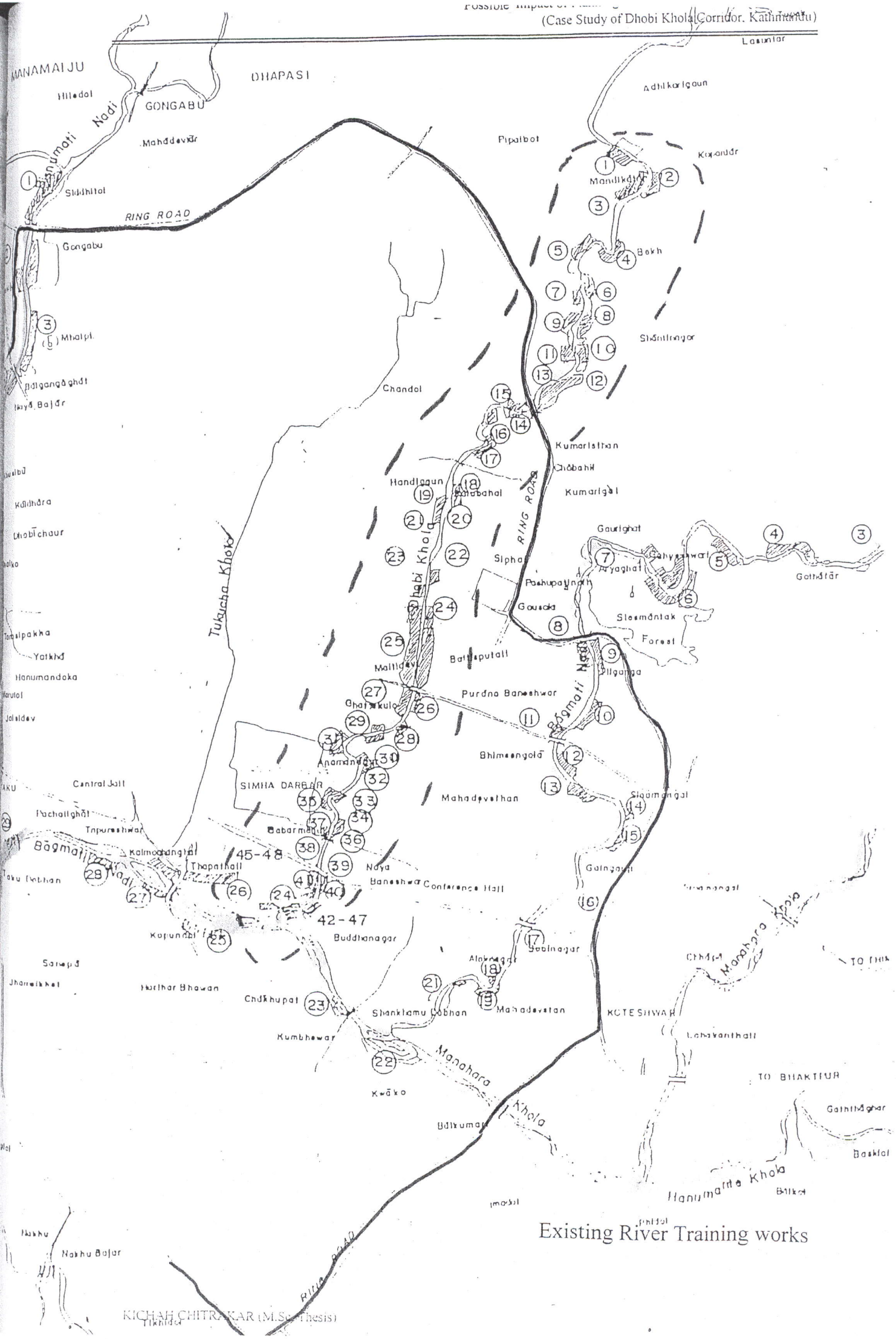
Existing Solid Waste Disposal area

Dhobikhola River

1.	Location:	1
	Quantity:	Low
	Degradable:	30%
	Non-degradable:	70%
2.	Location:	2
	Quantity:	Low
	Degradable:	50%
	Non-degradable:	50%
3.	Location:	3
	Quantity:	High
	Degradable:	60%
	Non-degradable:	40%
4.	Location:	4
	Quantity:	Low
	Degradable:	50%
	Non-degradable:	50%
5.	Location:	5
	Quantity:	Low
	Degradable:	70%
	Non-degradable:	30%
6.	Location:	6
	Quantity:	Moderate
	Degradable:	60%
	Non-degradable:	40%
7.	Location:	7
	Quantity:	Moderate
	Degradable:	50%
	Non-degradable:	50%
8.	Location:	8
	Quantity:	High
	Degradable:	60%
	Non-degradable:	40%
9.	Location:	9
	Quantity:	Low
	Degradable:	60%
	Non-degradable:	40%
10.	Location:	10
	Quantity:	High
	Degradable:	50%
	Non-degradable:	50%
11.	Location:	11
	Quantity:	Moderate
	Degradable:	60%
	Non-degradable:	40%
12.	Location:	12
	Quantity:	High
	Degradable:	60%
	Non-degradable:	40%
13.	Location:	13
	Quantity:	Moderate
	Degradable:	50%
	Non-degradable:	50%
14.	Location:	14
	Quantity:	Moderate
	Degradable:	40%
	Non-degradable:	60%
15.	Location:	15
	Quantity:	Low
	Degradable:	50%
	Non-degradable:	50%
16.	Location:	16
	Quantity:	Moderate
	Degradable:	50%
	Non-degradable:	50%
17.	Location:	17
	Quantity:	Low
	Degradable:	70%
	Non-degradable:	30%
18.	Location:	18
	Quantity:	Moderate
	Degradable:	50%
	Non-degradable:	50%
19.	Location:	19
	Quantity:	Moderate
	Degradable:	60%
	Non-degradable:	40%
20.	Location:	20
	Quantity:	Moderate
	Degradable:	60%
	Non-degradable:	40%

21.	Location:	21
	Quantity:	Low
	Degradable:	70 %
	Non-degradable:	30 %
22.	Location:	22
	Quantity:	High
	Degradable:	70%
	Non-degradable:	30%
23.	Location:	23
	Quantity:	High
	Degradable:	70%
	Non-degradable:	30%
24.	Location:	24
	Quantity:	Low
	Degradable:	60%
	Non-degradable:	40%
25.	Location:	25
	Quantity:	Moderate
	Degradable:	60%
	Non-degradable:	40%
26.	Location:	26
	Quantity:	Low
	Degradable:	100%
	Non-degradable:	0%
27.	Location:	27
	Quantity:	High
	Degradable:	100%
	Non-degradable:	0%
27.	Location:	27
	Quantity:	High
	Degradable:	100%
	Non-degradable:	0%
28.	Location:	28
	Quantity:	Moderate
	Degradable:	80%
	Non-degradable:	20%
29.	Location:	29
	Quantity:	High
	Degradable:	70%
	Non-degradable:	30%
30.	Location:	30
	Quantity:	Moderate
	Degradable:	80%
	Non-degradable:	20%
31.	Location:	31
	Quantity:	Moderate
	Degradable:	70%
	Non-degradable:	30%
32.	Location:	32
	Quantity:	High
	Degradable:	60%
	Non-degradable:	40%
33.	Location:	33
	Quantity:	Moderate
	Degradable:	50%
	Non-degradable:	50%
34.	Location:	34
	Quantity:	High
	Degradable:	70%
	Non-degradable:	30%
35.	Location:	35
	Quantity:	High
	Degradable:	60%
	Non-degradable:	40%
36.	Location:	36
	Quantity:	Moderate
	Degradable:	80%
	Non-degradable:	20%
37.	Location:	37
	Quantity:	High
	Degradable:	70%
	Non-degradable:	30%
38.	Location:	38
	Quantity:	High
	Degradable:	70%
	Non-degradable:	30%
39.	Location:	39
	Quantity:	Moderate
	Degradable:	50%
	Non-degradable:	50%

40.	Location:	40
	Quantity:	High
	Degradable:	50%
	Non-degradable:	50%
41.	Location:	41
	Quantity:	Low
	Degradable:	60%
	Non-degradable:	40%
42.	Location:	42
	Quantity:	Moderate
	Degradable:	60%
	Non-degradable:	40%
43.	Location:	43
	Quantity:	Moderate
	Degradable:	70%
	Non-degradable:	30%
44.	Location:	44
	Quantity:	High
	Degradable:	40%
	Non-degradable:	60%
45.	Location:	45
	Quantity:	Moderate
	Degradable:	40%
	Non-degradable:	60%
46.	Location:	46
	Quantity:	Moderate
	Degradable:	50%
	Non-degradable:	50%
47.	Location:	47
	Quantity:	Moderate
	Degradable:	30%
	Non-degradable:	70%
48.	Location:	48
	Quantity:	High
	Degradable:	50%
	Non-degradable:	50%
49.	Location:	49
	Quantity:	Low
	Degradable:	30%
	Non-degradable:	70%
50.	Location:	50
	Quantity:	High
	Degradable:	60%
	Non-degradable:	40%
51.	Location:	51
	Quantity:	Low
	Degradable:	70%
	Non-degradable:	30%
52.	Location:	52
	Quantity:	High
	Degradable:	90%
	Non-degradable:	10%
53.	Location:	53
	Quantity:	High
	Degradable:	70%
	Non-degradable:	30%
54.	Location:	54
	Quantity:	Moderate
	Degradable:	70%
	Non-degradable:	30%


MANAMAIJU
DHAPASI
GONGABU
Hiledol
Mahadevsthan
Siddhitol
RING ROAD
Gongabu
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Adhikarigaun
Mandikhatar
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Sitalnagar
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Kumarigal
Handigaun
Gaurighat
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Dhobi Khola
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Bhimsengola
Sidamangal
SIMHA DARBAR
Mahadevsthan
Central Jail
Tripureshwar
Kalmochangal
Thapathali
45-48
Naya Baneshwar Conference Hall
42-47
Buddhanagar
Gaingaun
Alokenagar
Gaolnagar
Manohara Khola
TO THIMI
Nardhar Bhawan
Chakhupat
Shankhamu Gobhan
Mahadevsthan
KOTESHWAR
Lokasthanthali
Kumbheswar
TO BHAKTPUR
Gathighar
Baskot
Hanumanta Khola
Nakhu
Nakhu Bajar
RING ROAD
Existing River Training works

Existing River Training works

Dhobikhola River

Type: Gabion

Bank Height: 2m

Water Way Width: 2 m

S. No.	Length	S. No.	Length
1.	70 m	20.	500 m
2.	20 m	21.	15 m
3.	70 m	22.	500 m
4.	60 m	23.	15 m
5.	30 m	24.	600 m
6.	4 m	25.	600 m
7.	50 m	26.	200 m
8.	200 m	27.	300 m
9.	200 m (Some part of Proposed also)	28.	50 m
		29.	5 m
10.	100 m	30.	10 m
11.	100 m	31.	5 m
12.	800 m	32.	40 m
13.	400 m	33.	10 m (both side)
14.	150 m	34.	25 m
15.	15 m	35.	200 m
16.	20 m	36.	250 m
17.	150 m	37.	10 m
18.	150 m	38.	100 m
19.	100 m	39.	200 m

⊙ EXISTING RING ROAD AS NORTH WING OF DHOBIKHOLA RING ROAD (IMMEDIATE)

• IMPROVED NORTH WING FOR DK RING ROAD

⊛ ARNIKO H/W AS SOUTH WING.

OUTER RING ROAD (4)

MAJOR SETTLEMENTS

RING ROAD (EXT.) (3)

INNER RING ROAD (1)

DHOBIKHOLA RING ROAD (2)

KATHMANDU & LALITPUR CITY ROAD

1987

DHOBIKHOLA RING ROAD (2)

EXISTING RING ROAD (3)

INNER RING ROAD (1)

MAJOR TRAFFIC DECONGESTION NODES.

DECONGESTION POINT

PROPOSED BAGMATI LINK ROAD

Kathmandu & Lalitpur City Road

INDEX	1987 July Total Length
Black Topped Road	183.0 K.m.
Gravelled Road	109.0 K.m.
Earthen Road	112.0 K.m.
Total Length	404.0 K.m.
नियमित कच्चेरो प्रवेश मार्ग	
नियमित जोरेको प्रवेश मार्ग	

GREATER KATHMANDU

KATHMANDU URBAN DEVELOPMENT PROJE

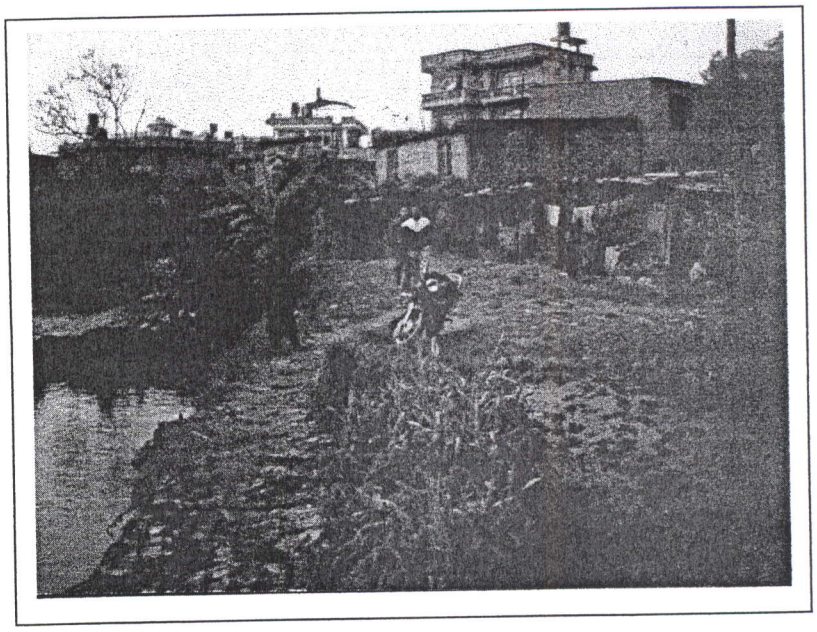
DEVELOPMENT OF HOUSING AND URBAN DEVELOPMENT

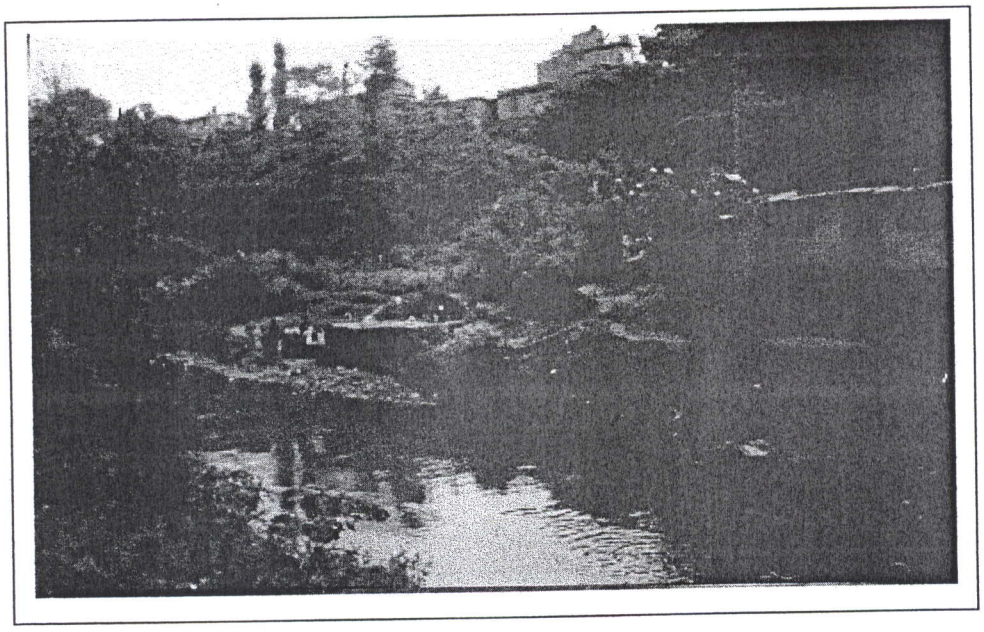
BABARMAHAL, KATHMANDU

Scale : 1:10,000	Date : 2056\3\27	Contour Interval : 2m
Prepared by : Shanti Shrestha	Checked by :	Map No : 1

PHOTO FEATURES

New squatter is emerging at Ghattekulo (Section 3).

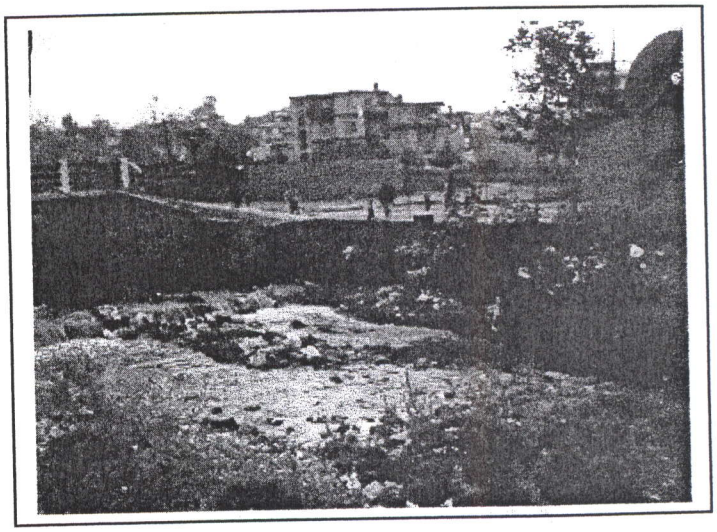


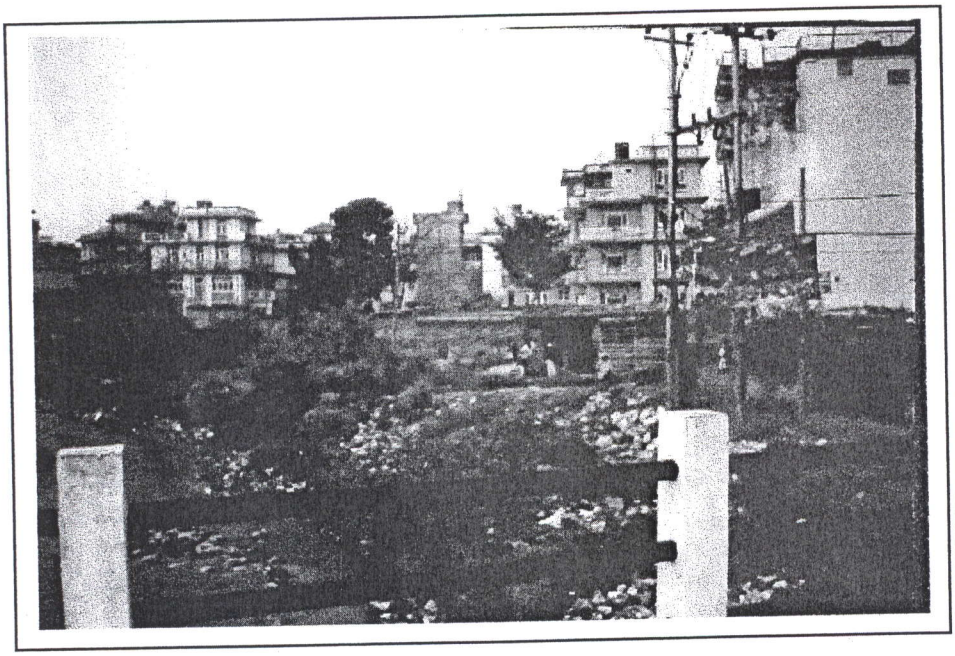


A public tap near squatters.

Ducks & hens at narrow track and at river (Section 3).

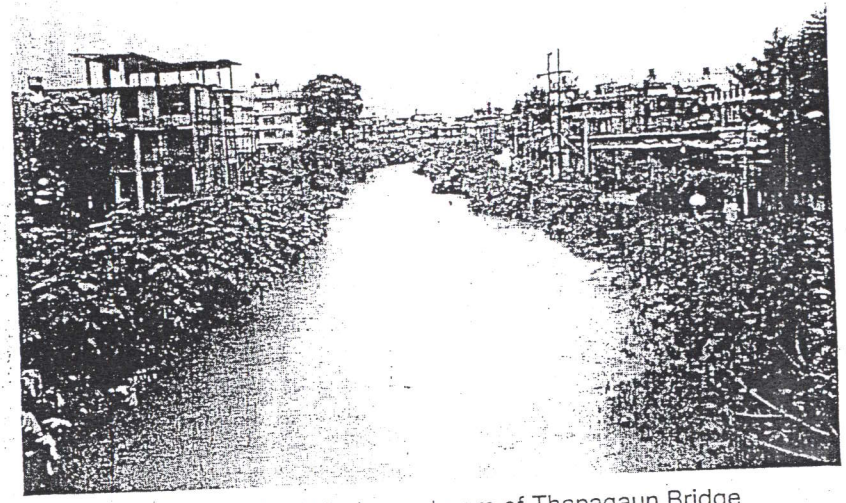
A Play ground near skew bridge at Ghattekulo (Section 3).



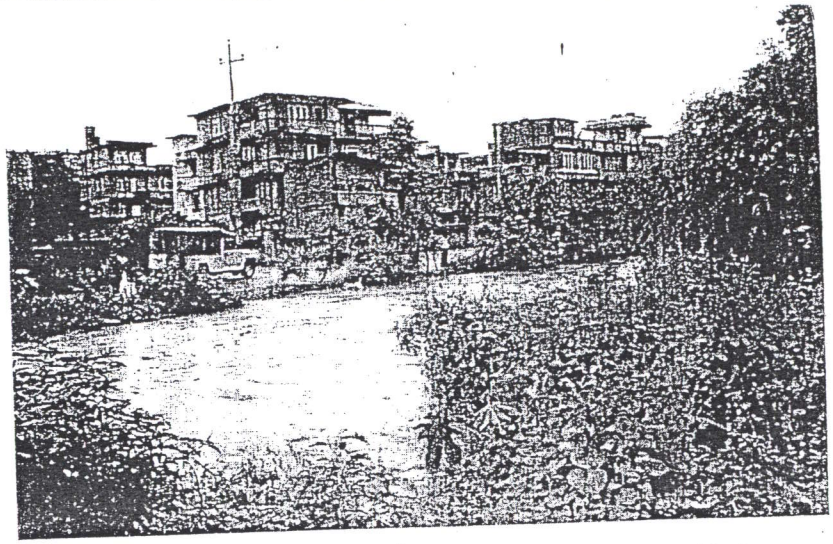


Solid waste deposits and carpentry workshops (Section 3)

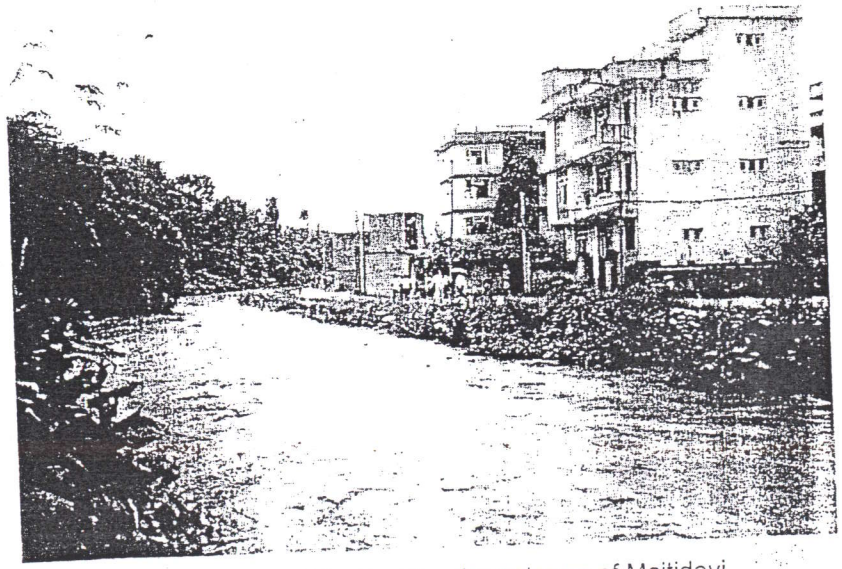
A view of squatter settlement at Ghattekulo (Section 3)



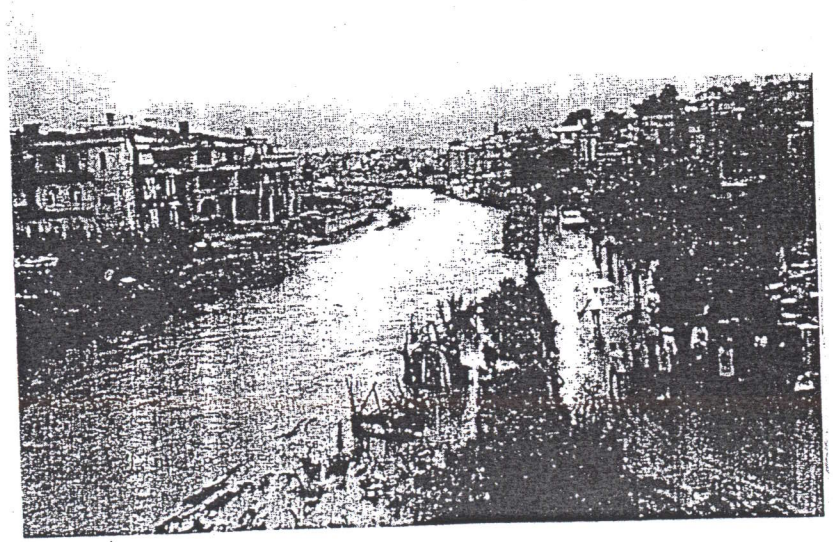
A view of Dhobi Khola, upstream of Thapagaun Bridge during recent flood in July 23, 2002.



A view of left bank of Dhobi Khola in between Maitidevi and Ratopul during flooding of July 23, 2002

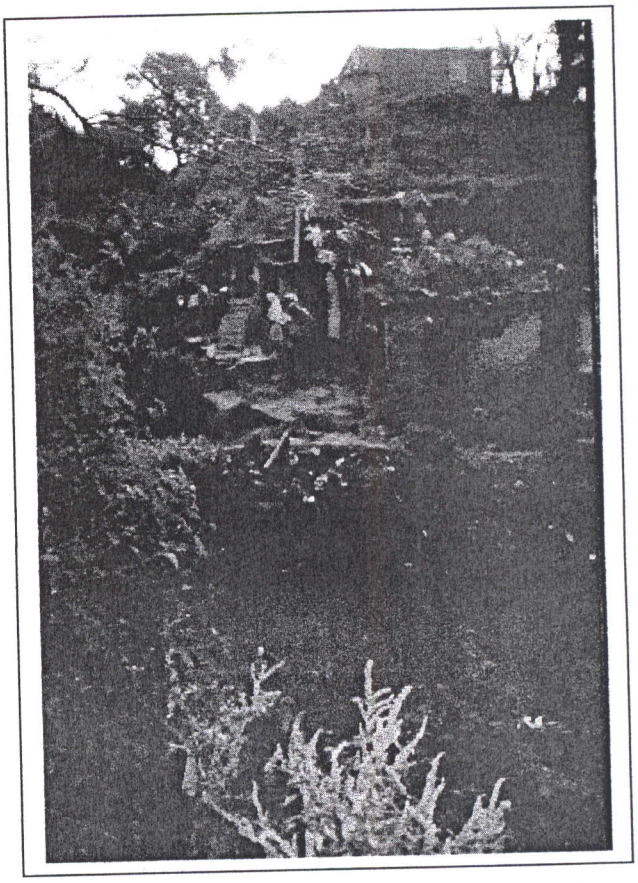


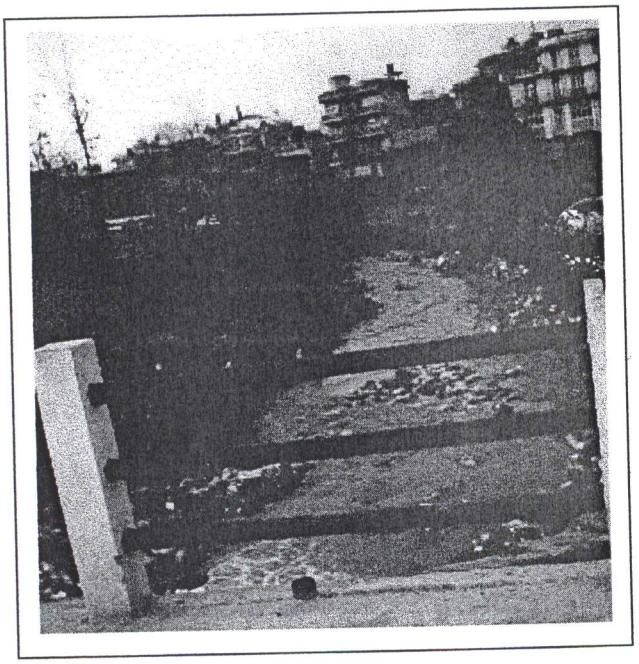
A view of Dhobi Khola at the downstream of Maitidevi bridge during flooding of July 23, 2002.



A view of Dhobi Khola at the upstream of Kalopul during flooding of July 23, 2002.

A view of direct discharge from toilet to river.

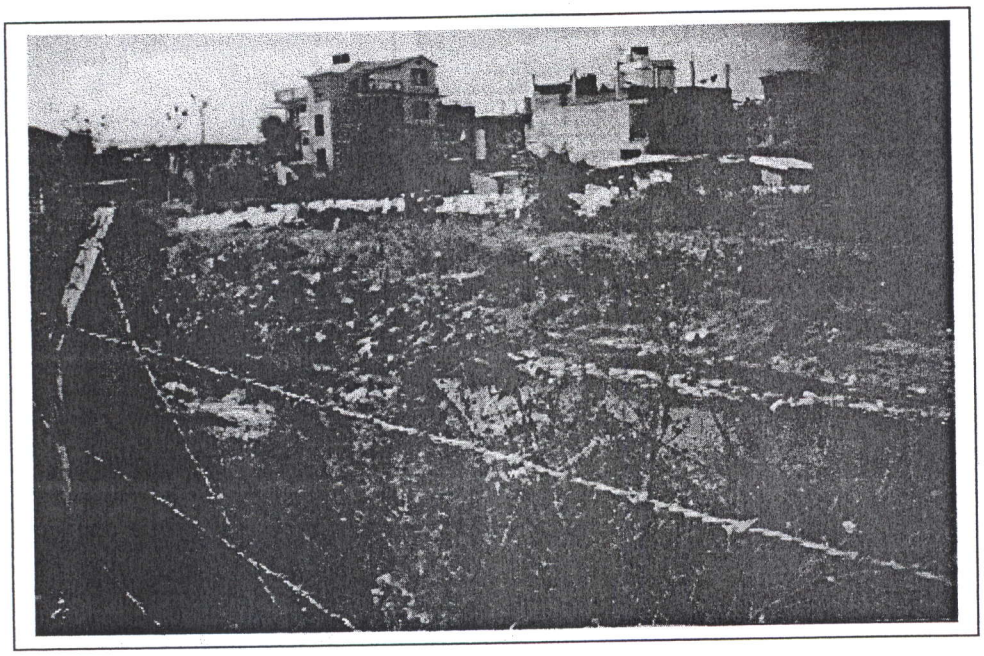




A view of dry weather flow at Dhobi Khola.

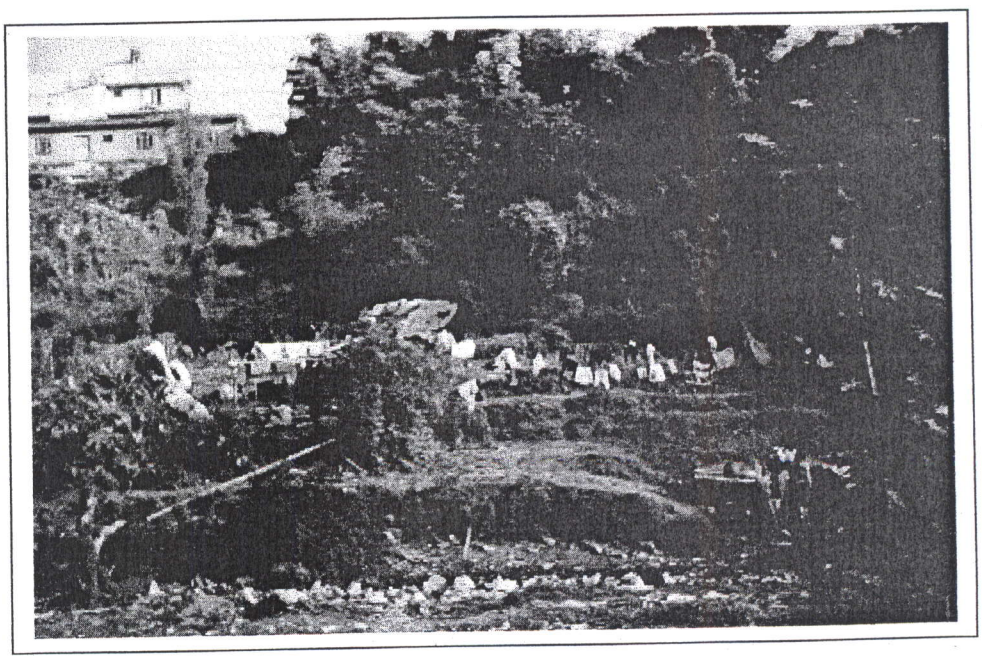
Vaccant lands near Hira ratna Hall. Monsoon Water on the river.

A cart disposing solid waste at the Riverbank.



Nepali paper (Lokta) making at the bank (Section 6).

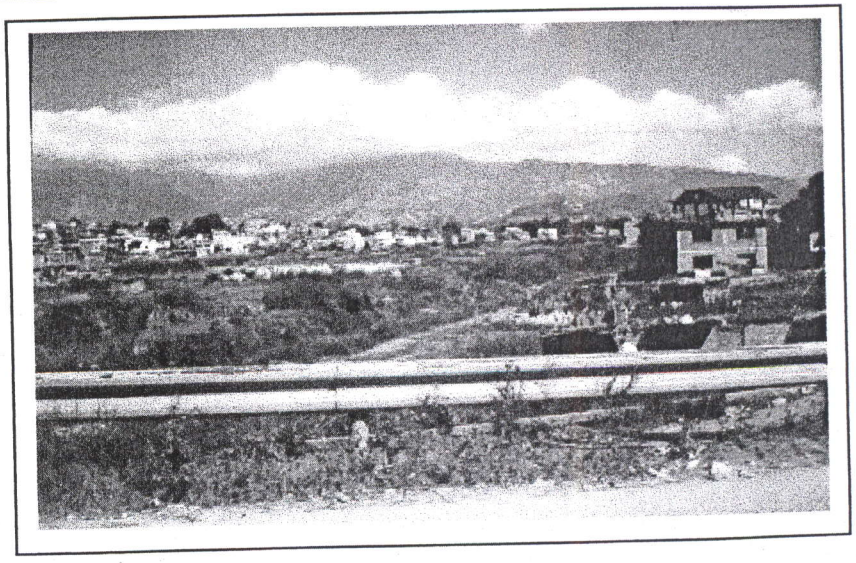
'Dhobis' drying cloths near public tap.



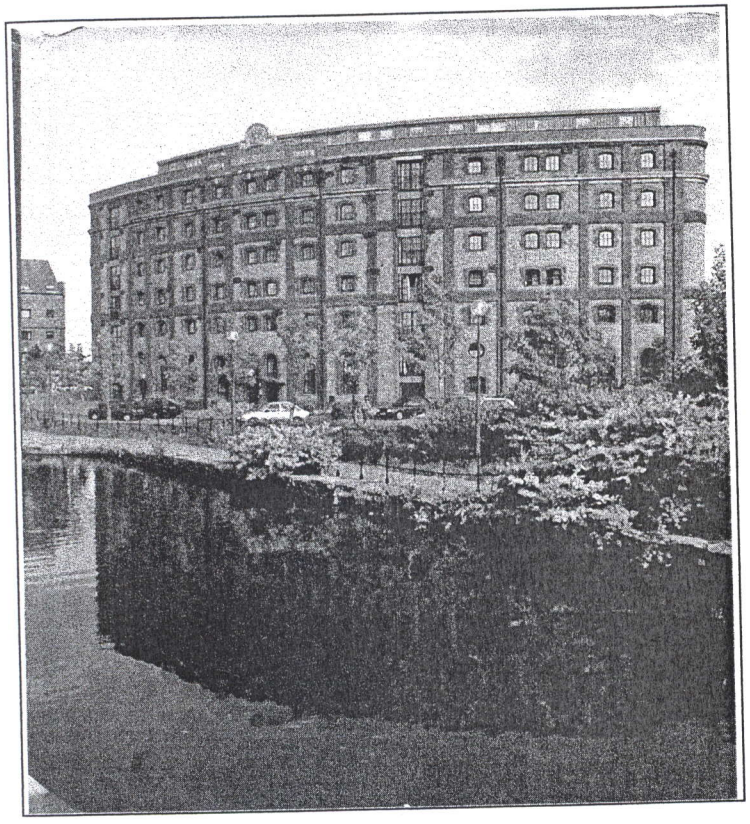
A view of scavengers (Girls) collecting solid waste near chabahil Bridge (Section 7).

A flower garden maintained by private effort at the Riverside.

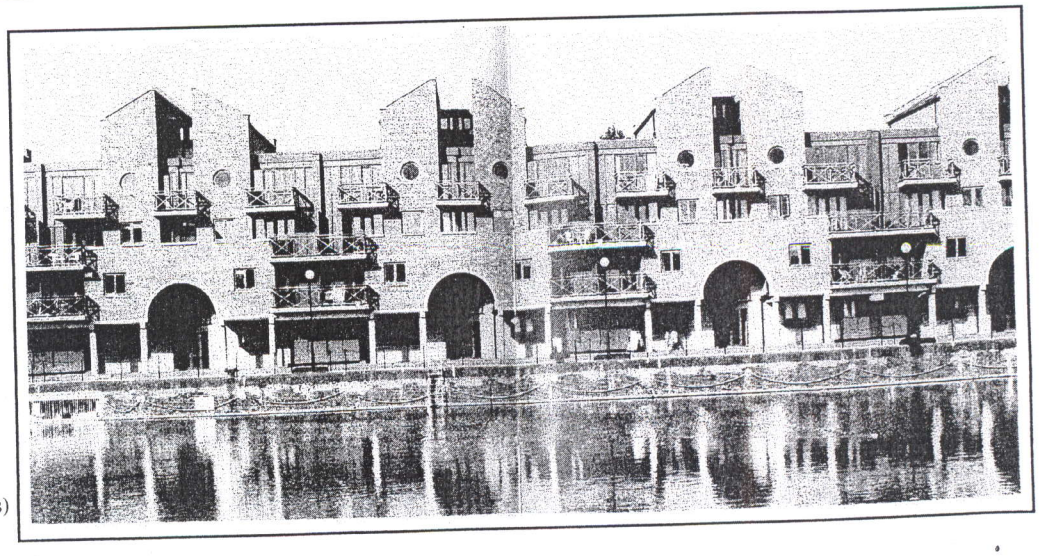
Potential Land Development site of Chabahil Dhumbarahi (Section 7).



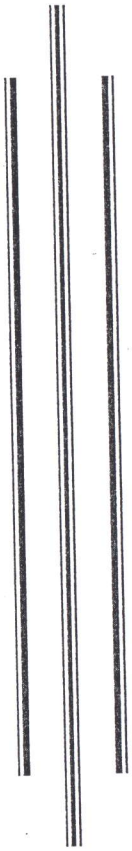
Earthen road and monsoon flow at Section 4.



Views of the small river sides and houses in Europe.



SAMPLE SURVEY SHEETS AND DATA



Tribhuvan University
Institute of Engineering
Department of Architecture & Urban Planning
Pulchowk Campus

Survey for M.Sc.Urban Planning Thesis

*S.N.*_____ *Location:* _____ *Ward No.* _____ *Date:* _____

1. Age: _____ **2. Education:** _____

3. Occupation: Retired ☐ Service ☐ Private Service ☐ Business ☐
Farming/Live stoking ☐ Others_____

4. How long have you been here: _____

5. Resident Type: Own ☐ Rent ☐

6. Land Owned: _____ana _____Ropani

7. Age of Building _____ Years

8. Building Use by owner: Residential ☐ Commercial ☐ Institutional ☐ Others_____
If rented, rented for: Residential ☐ Commercial ☐ Institutional ☐ Others_____

9. Why did you come to stay here? Own land ☐ Peaceful environment ☐
Near to workplace ☐ Cheap Rent/Land/Bldg ☐ Others_____

10. Vehicle ownership: Cycle_____ Motorbike_____Car/Jeep/Taxi_____ Others_____

.....

11. Are you satisfied with the following? [Y/N]
Road___Drainage____ W/S_____Street Lights_____Open Spaces____ Plot Size____Pollution____

12. How do you find daily travel to and from the area? Better ☐ Ok ☐ Difficult ☐

13. Accessibility to public transportation: Better ☐ Ok ☐ Difficult ☐

14. Where do you go for market: Local Shops ☐ Supermarket ☐ City Centers ☐

15. Where are you disposing solid waste?
Own compound ☐ River side ☐ Municipality Container ☐
House collection - by private ☐ by public ☐ Streets ☐ Others_____

16. What is your sewerage system?
Septic Tank ☐ Direct Connection to River ☐ Others_____

17. Source of Water Supply?
Pipe Connection ☐ Well ☐ Tube well ☐
Stone Tap ☐ Tanker ☐ Others

18. Is the Water supply sufficient?
Tolerable ☐ Insufficient ☐ Sufficient ☐

.....

19.Do you use open space in area? No ☐ Sometimes ☐ Often ☐

20.For what purpose you use the open space?
Domestic work ☐ Playing ☐ To take stroll ☐ For Children ☐ Social gatherings ☐

21.Is your family health been affected by river pollution in last 10 years?

No ☐ Moderately ☐ Highly ☐

22. Is your compound affected by Dhobi Khola River water? **Yes** ☐ **No** ☐

if yes.. 23) Likely to entered floodwater .....times in last 10 years.

24) Floodwater entered the compound.....times in last 10 years.

25) Others.....

26. Do you want road on the both sides of river. Yes ☐ **No** ☐

If yes, Why?_____

If NO, What it should be?_____

27. Do you have any cultural/religious linkage with the river? Yes ☐ No ☐

If yes, 28) How many times a year you go? _____

29) For what Purpose_____

30. Monthly family income: NRs_____

31. What do you feel lacking in the area (Or Problems)?

1. _____
2. _____
3. _____

32. What the land is being used for at present? Rented Courtyard ☐ Cultivated ☐ Others____

33. What do you plan to do with land?

Continue as present ☐ Build house ☐ Sell ☐ Lease ☐ Other_____

.....

34.Have you heard about the DKCIP ? Yes ☐ No ☐

35. Do you support the project? Yes ☐ No ☐

36. Benefits may brought about by the project:

1. _____
2. _____
3. _____

37. Problems may brought about by the project:

1. _____
2. _____
3. _____

38. How many land you wish to contribute for project?

<25% ☐ 25% - 40% ☐ >40% ☐

39. What do you want after development from project?

1. Developed Land for land/house for house ☐ 2. Full Monetary Compensation ☐

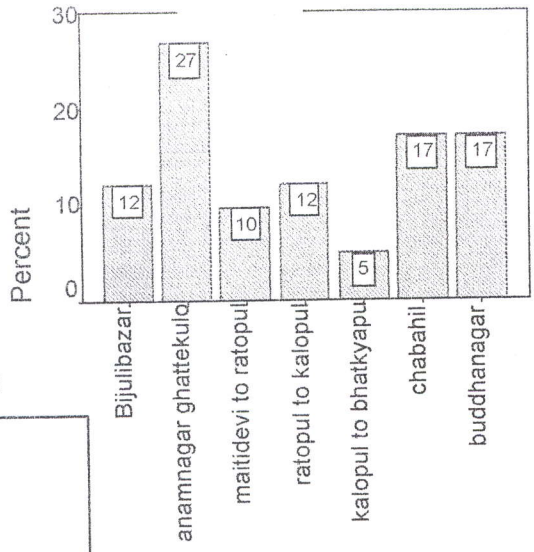
40. What will you do for your land/house after development (price hike)?

Sale the house ☐ Sale land ☐ Give in rent ☐ Continue as present ☐ Others_____

Repondents Name: _____ Observer's Name_____

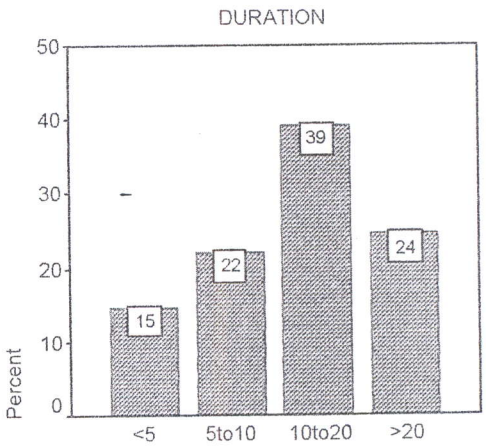
LOCATION

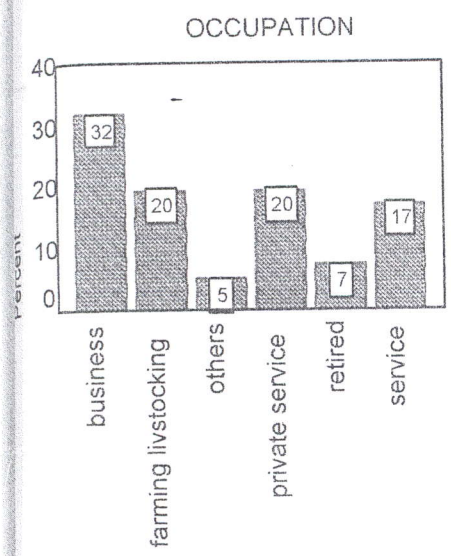
	Percent
uddhanagar	17.1
ijulibazar	12.2
namnagar ghattekulo	26.8
naitidevi to ratopul	9.8
atopul to kalopul	12.2
alopul to bhatkyapul	4.9
habahil	17.1
Total	100.0



DURATION

	Percent
<5	14.6
5to10	22.0
10to20	39.0
>20	24.4
Total	100.0



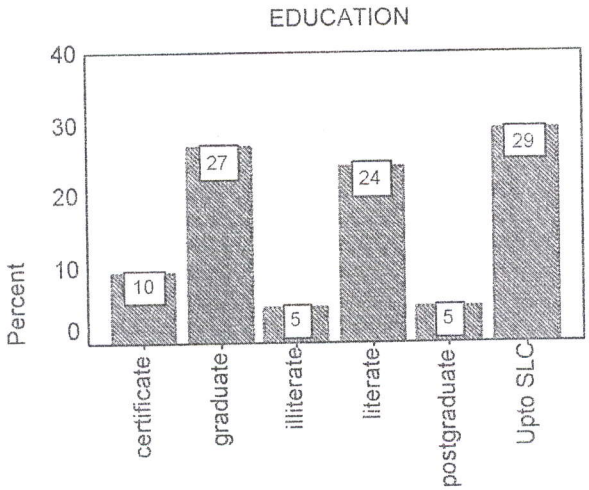


OCCUPA

	Percent
business	31.7
farming livstocking	19.5
others	4.9
private service	19.5
retired	7.3
service	17.1
Total	100.0

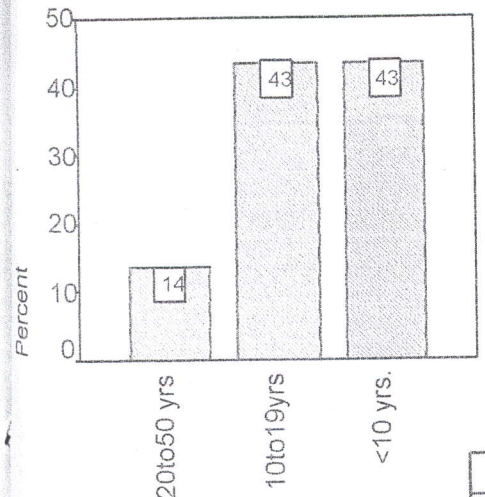
EDUCATIO

	Percent
certificate	9.8
graduate	26.8
illiterate	4.9
literate	24.4
postgraduate	4.9
Upto SLC	29.3
Total	100.0



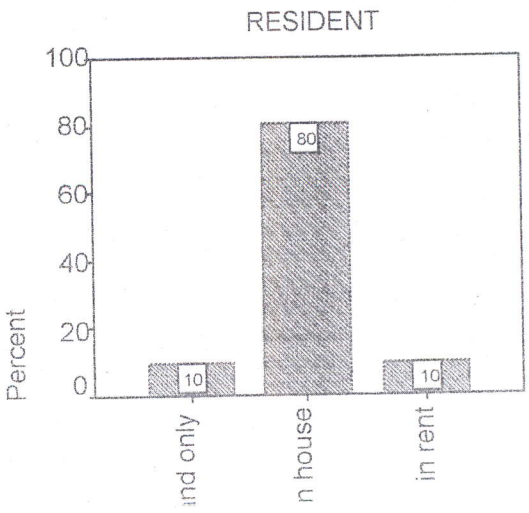
AGE

	Percent
25to35	22.0
35to45	34.1
>45	43.9
Total	100.0



RESIDENT

	Percent
land only	9.8
own house	80.5
in rent	9.8
Total	100.0

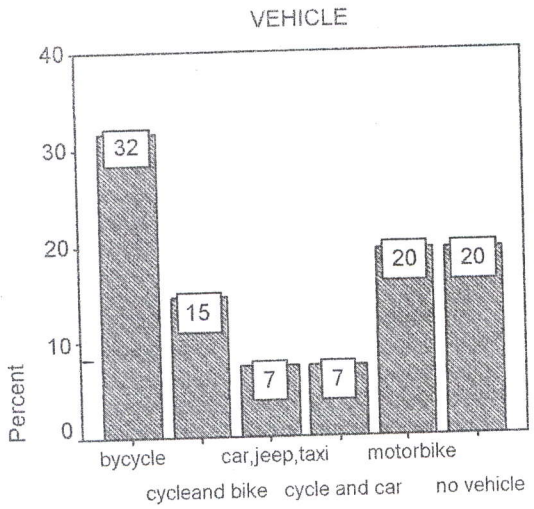


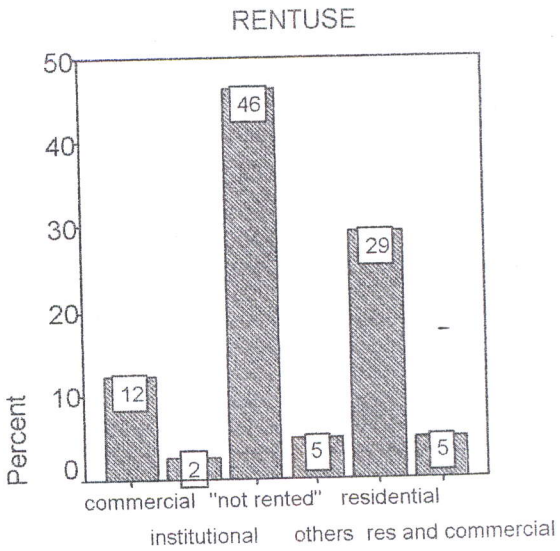
BLAGE

	Percent
"land only"	9.8
20to50 yrs	12.2
10to19yrs	39.0
<10 yrs.	39.0
Total	100.0

VEHICLE

	Percent
bycycle	31.7
cycleand bike	14.6
car,jeep,taxi	7.3
cycle and car	7.3
motorbike	19.5
no vehicle	19.5
Total	100.0



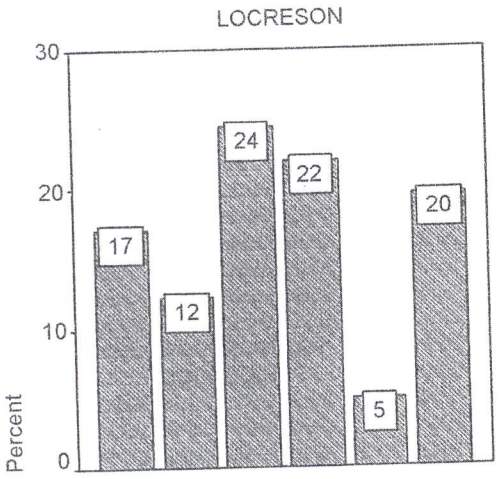


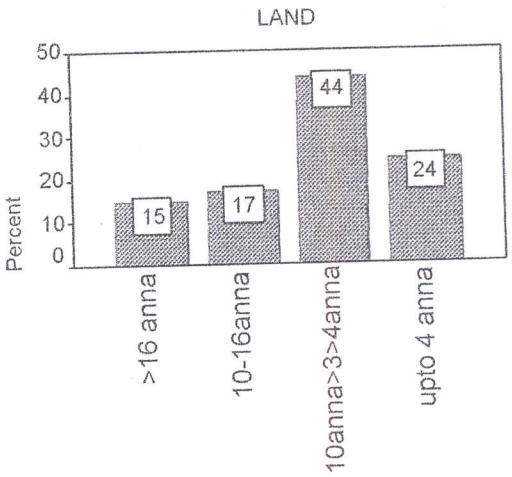
LOCRESON

	Percent
cheap rent,land	17.1
good environment	12.2
near and dears,relatives	24.4
ownland	22.0
"no response"	4.9
near to workpalace	19.5
Total	100.0

RENTUSE

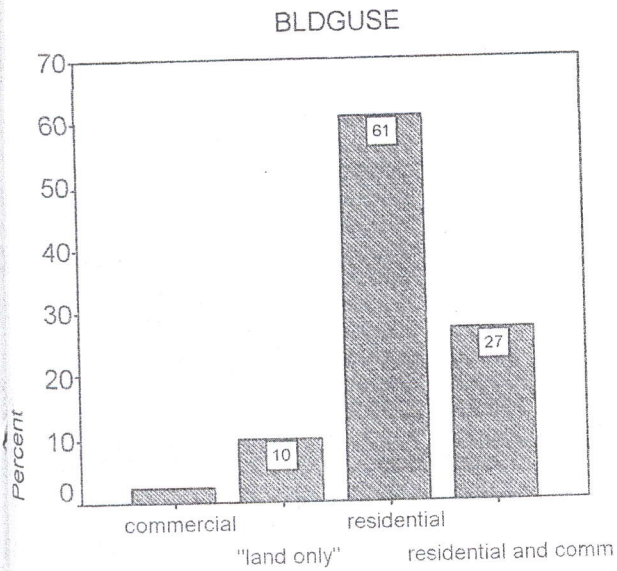
	Percent
commercial	12.2
institutional	2.4
"not rented"	46.3
others	4.9
residential	29.3
res and commercial	4.9
Total	100.0





LAND

	Percent
>16 anna	14.6
10-16anna	17.1
10anna>3>4anna	43.9
upto 4 anna	24.4
Total	100.0

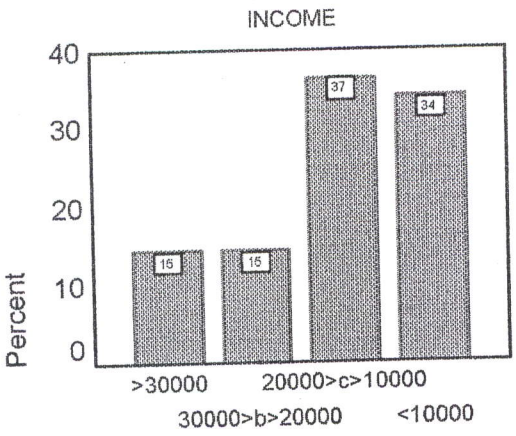


BLDGUSE

	Percent
commercial	2.4
"land only"	9.8
residential	61.0
residential and commercial	26.8
Total	100.0

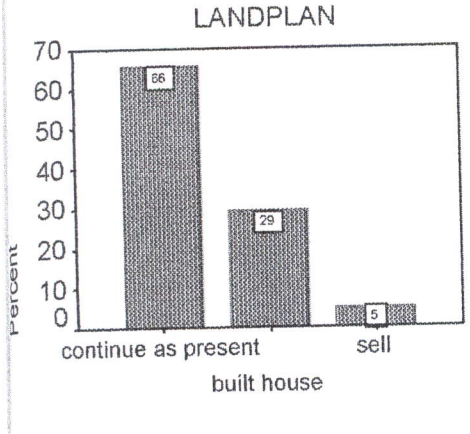
LANDUSE

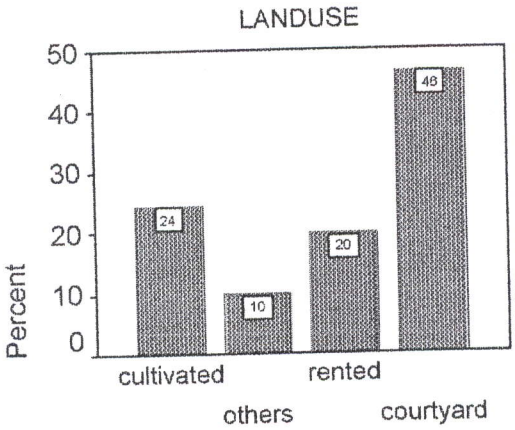
	Percent
cultivated	24.4
others	9.8
rented	19.5
courtyard	46.3
Total	100.0



INCOME

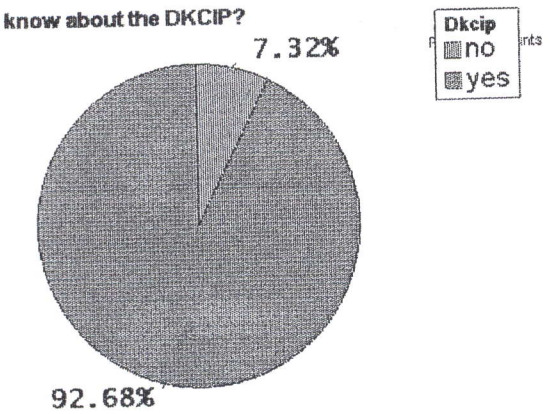
	Percent
>30000	14.6
30000>b>20000	14.6
20000>c>10000	36.6
<10000	34.1
Total	100.0





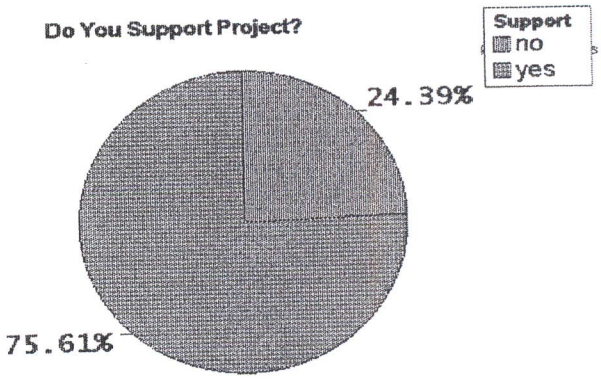
LANDPLAN

	Percent
continue as present	65.9
built house	29.3
sell	4.9
Total	100.0



DKCIP

	Percent
no	7.3
yes	92.7
Total	100.0

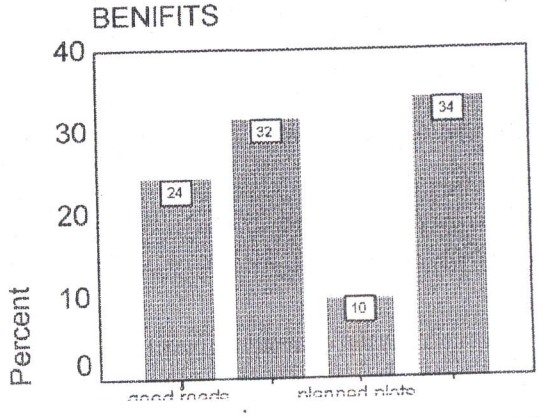


SUPPORT

	Percent
no	24.4
yes	75.6
Total	100.0

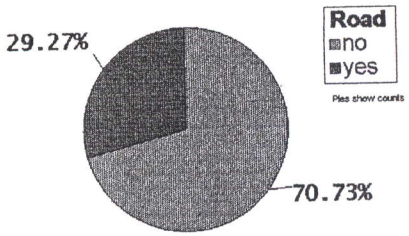
BENIFITS

	Percent
good roads	24.4
no response	31.7
planned plots	9.8
river improved	34.1
Total	100.0



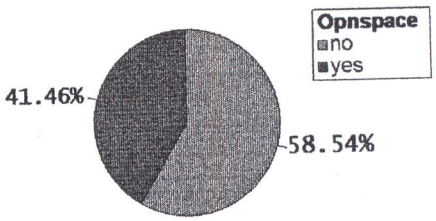
ROAD

	Percent
no	70.7
yes	29.3
Total	100.0



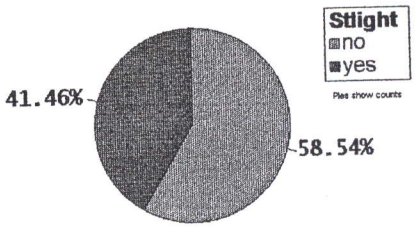
OPNSPACE

	Percent
no	58.5
yes	41.5
Total	100.0



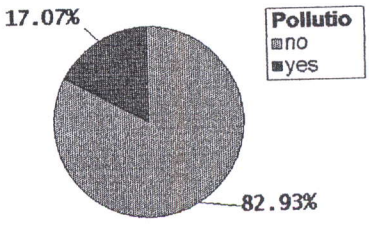
STLIGHT

	Percent
no	58.5
yes	41.5
Total	100.0



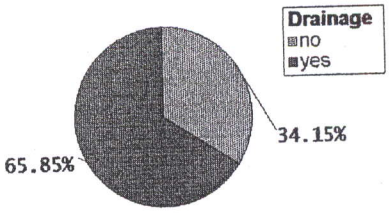
POLLUTIO

	Percent
no	82.9
yes	17.1
Total	100.0



DRAINAGE

	Percent
no	34.1
yes	65.9
Total	100.0

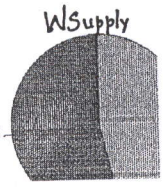


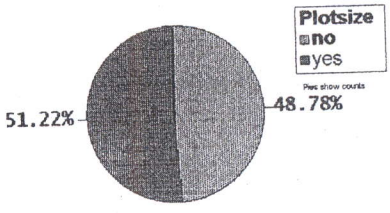
PLOTSIZE

	Perce
no	48·8
yes	51·2
Total	100·0

WSUPPL

no	46.3



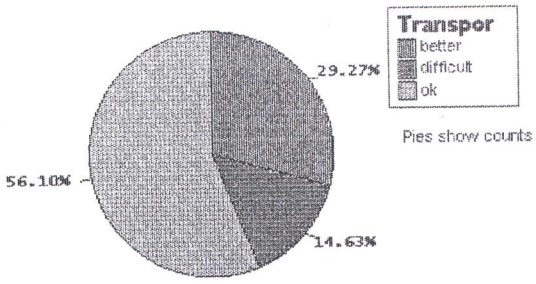


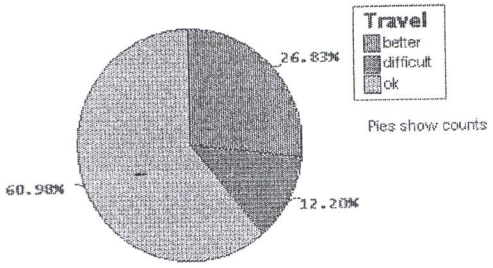
TRAVEL

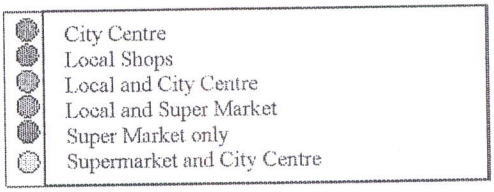
	Percent
better	26.8
difficult	12.2
ok	61.0
Total	100.0

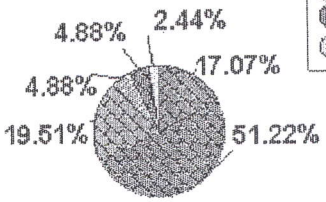
TRANSPOR

	Percent
better	29.3
difficult	14.6
ok	56.1
Total	100.0



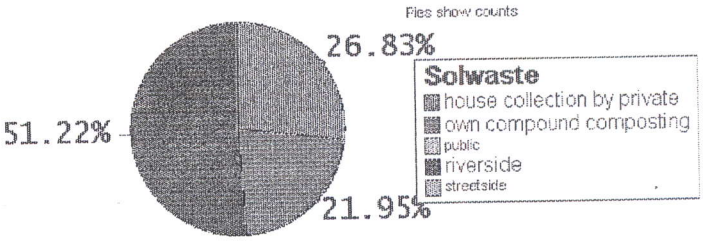






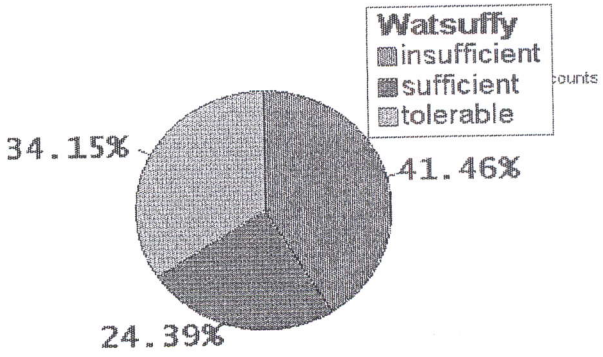
MARKET

	Percent
city center	17.1
local shops	51.2
local and city center	19.5
local and supermarket	4.9
supermarket	4.9
supermarket and city centre	2.4
Total	100.0



SOLWASTE

	Percent
house collection by private	26.8
own compound composting	22.0
riverside	51.2
Total	100.0

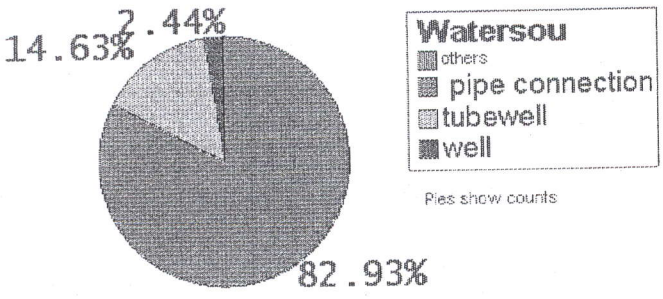


WATSUFFY

	Percent
insufficient	41.5
sufficient	24.4
tolerable	34.1
Total	100.0

WATERSOU

	Percent
pipe connection	82.9
tubewell	14.6
well	2.4
Total	100.0

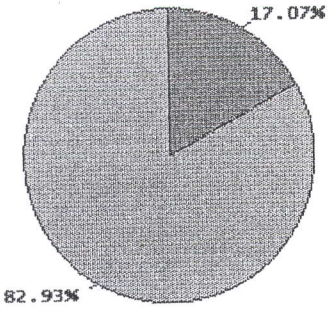


SEWERAGE

	Percent
riverside	100.0

HELTHAFF

	Percent
moderate	17.1
no	82.9
Total	100.0



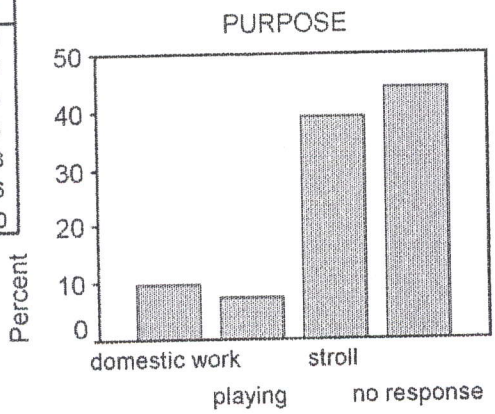
Pies show counts

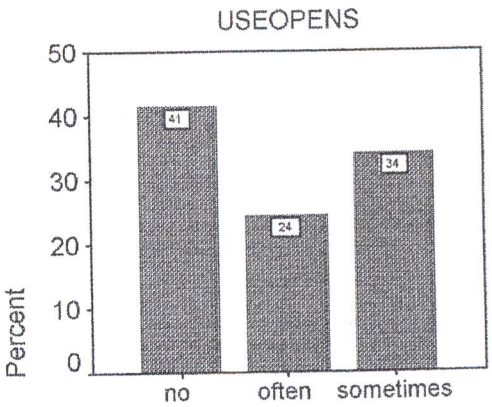
USEOPENS

	Percent
no	41.5
often	24.4
sometimes	34.1
Total	100.0

WHY

	Percent
good access	34.1
good environment	7.3
good road quality	7.3
increased rent	9.8
no response	26.8
nice river and control	14.6
Total	100.0

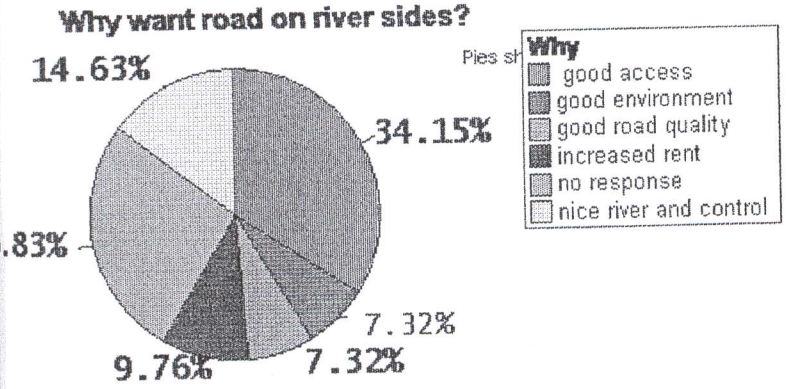


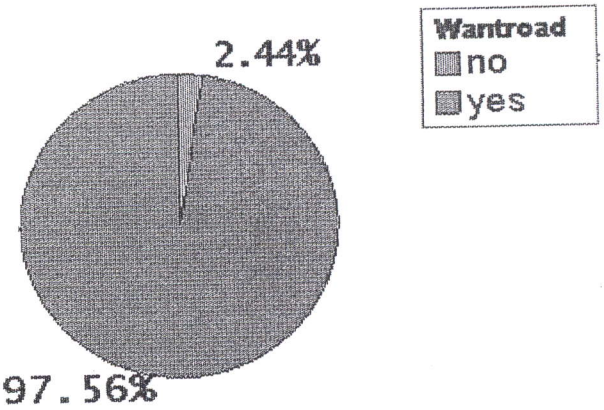


WANTROAD

	Percent
no	2.4
yes	97.6
Total	100.0

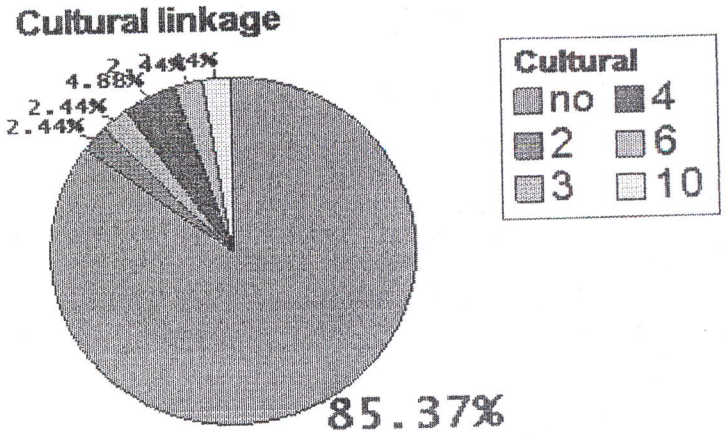
	Percent
domestic work	9.8
playing	7.3
stroll	39.0
no response	43.9
Total	100.0





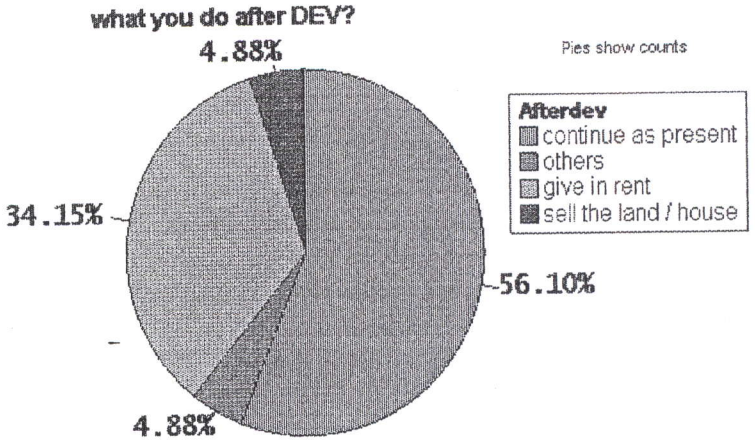
CULTURAL

	Percent
no	85.4
2	2.4
3	2.4
4	4.9
6	2.4
10	2.4
Total	100.0



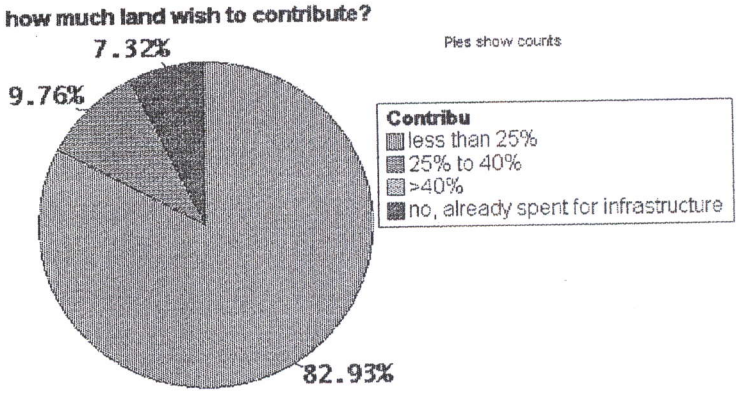
AFTERDEV

	Percent
continue as present	56.1
others	4.9
give in rent	34.1
sell the land / house	4.9
Total	100.0



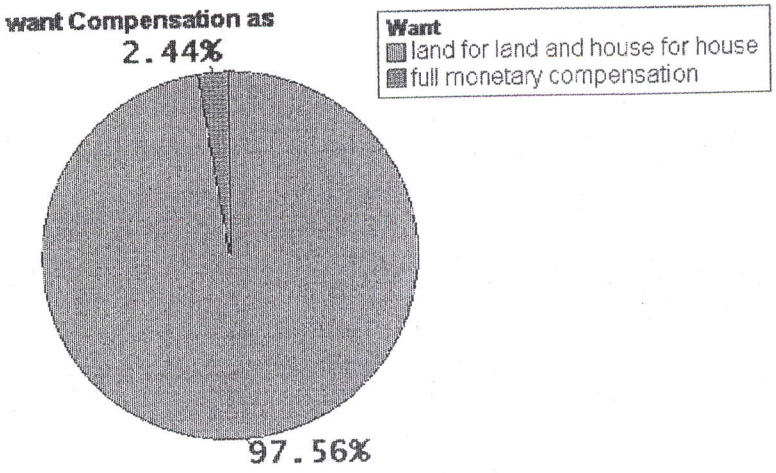
CONTRIBU

	Percent
less than 25%	82.9
25% to 40%	9.8
no, already spent for infrastructure	7.3
Total	100.0



WANT

	Percent
land for land and house for house	97.6
full monetary compensation	2.4
Total	100.0



Tribhuvan University
Institute of Engineering
Department of Architecture & Urban Planning
Pulchowk Campus

River Use Survey

Date: Ward No. ..... Observer:.....

Section/Location: ..... Time: From..... .....To.....

S. NO.	Ritual Bath /Functions	Crem-ation	Vehicle Clean	Veg. clean	Dumping Waste	Bath	To take stroll	Use as Toilet	Wash Cloths	Wash Dishes	Animal Drink	Kids Play	Grazing Animals	Commuters	Others

Date: Time: From..... .....To.....

Date: Time: From..... .....To.....

River Use Survey

Date: Nov. 9 Saturday **Ward No. 10/11** **Observer: Kichah**
Section/Location: DK/Bagamati Confluence to skew Bridge **Time: From…6:30 A M To 8:30 A M.**

S. No.	Ritual Bath /Functions	Crem -ation	Vehicle Clean	Veg. clean	Dumping Waste	Bath	To take stroll	Use as Toilet	Wash Cloths	Wash Dishes	Animal Drink	Kids Play	Grazing Animals	Commuters	Others /Scavenger
1.	33	0	0	0	3	0	6	0	0	0	0	0	0	13	

Date: Nov. 9 Saturday **Time: From…12:45 To 2:45**

2.	0	0	0	0	0	0	3	0	0	0	0	16	0	20	2 Scavenger drying stuffs

Date: Nov. 8 Friday **Time: From 4:30 To 6:30**

3.	10	0	0	0	0	0	7	0	0	0	0	12	0	18	2

Date: Nov. 10 Sunday **Ward No. 10/11** **Observer: Kichah Chitrakar / Raju**
Section/Location: Bijuli Bajar (Anam Nagar to Baneshwor Bridge) **Time: From…9:35 A M To 10:35 A M.**

1.	Dead boy of children /infants animal brought to buried	0	0	0	8	0	0	8	0	0	0	0	2	290	4 Scav. 25 Cows

Date: Nov. 10 Sunday **Time: From 1:00 P M To 2:00 P M**

2.	0	0	0	0	0	0	0	3	0	0	0	4	3	128	2

Date: Nov. 21 Sunday **Time: From 5:30 To 6:30**

3.	0	0	0	0	3	0	3	1	0	0	0	3	0	603	1

Date: Nov. 16, 002 **Ward No. 32/10** **Observer Kichah / Raju**
Section/Location: Ghattekulo Bridge **Time: Fro 8 A M To 9 A M.**

1.	11	0	0	0	3 (Thela)	0	8	5	0	0	0	0	2	104	

Date: Nov. 21 Thursday **Time: From 3:00 To 4:00**

2.	0	0	0	0	0	0	4	3	0	0	0	14	10	320	

Date: Nov. 21 Thursday **Time: From 5:30 To 6:30**

3.	0	0	0	0	1	0	6	2	0	0	0	4	1	373	

Date: Nov. 7, 002 Ward No. 33/9 Observer: Kicha

Section/Location: Maitidevi/Ratopul Time: From 7 A M To 8 A M.

S. No.	Ritual Bath /Functions	Crem-ation	Vehicle Clean	Veg. clean	Dumping Waste	Bath	To take stroll	Use as Toilet	Wash Cloths	Wash Dishes	Animal Drink	Kids Play	Grazing Animals	Commuters	Others/ Scavengers
1.	0	0	0	0	9	0	16	5	0	0	0	0	0	48	1

Date: Nov. 8 Time: From 12:00 to 1:00

2.	0	0	0	0	3	0	0	2	0	0	1	0	2	80	1

Date: Nov. 7 Time: From 5:30 to 6:30

3.	0	0	0	0	0	0	6	3	0	0	0	0	0	158	

Observer: Kichah / Raju

Date: Nov. 14, 002 Ward No. 33/7 Time: From 9:00 A M To 10:00 A M.

Section/Location: Kalopul/Ratopul

1.	0	0	0	0	13	0	8	2	0	0	0	0	2	160	3

Date: Nov. 6, 002 Time: From 12:00 to 1:00

2.	0	0	0	0	3	0	0	5	0	0	0	2	3	119	1

Date: Nov. 6, 002 Time: From 12:00 to 1:00

3.	0	0	0	0	7	0	7	2	0	0	0	7	2	93	3

Observer: Kichah / Raju

Date: Nov. 14, 002 Ward No. 33/7 Time: From 9:00 A M To 10:00 A M.

Section/Location: Kalopul/Bhatkyapul

1.	0	0	0	0	3(Cart)	0	8	0	0	0	0	5	2	63	6

Date: Nov. 15, 002 Time: From 12:00 to 1:00

2.	0	0	0	0	3(Cart)	0	10	3	0	0	0	10	4	73	2

Date: Nov. 15, 002 Time: From 12:00 to 1:00

3.	0	0	0	0	0	0	12	0	0	0	3	17	2	76	

Date: Nov. 21, 002 Ward No. 4/7 Observer: Kichah

Section/Location: Chabahil Time: From 10.00 A M To 11.00 A M.

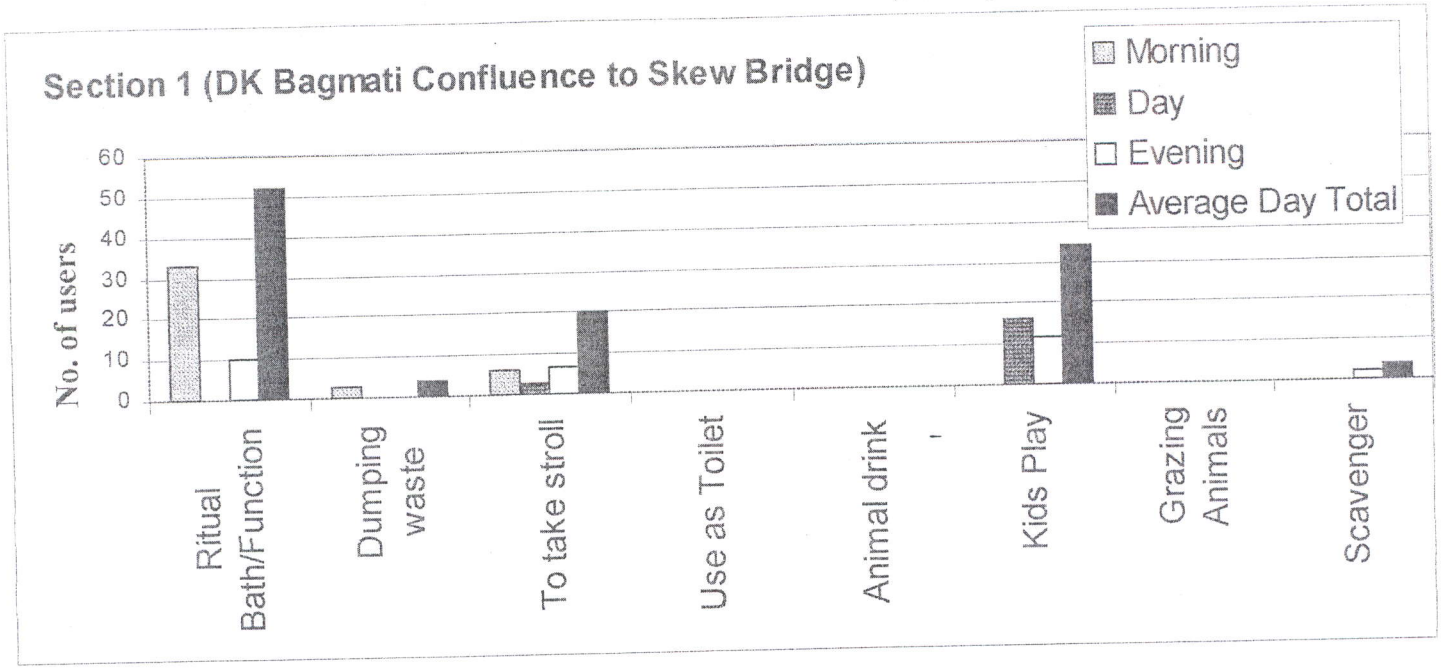
S. No.	Ritual Bath /Functions	Crem-ation	Vehicle Clean	Veg. clean	Dumping Waste	Bath	To take stroll	Use as Toilet	Wash Cloths	Wash Dishes	Animal Drink	Kids Play	Grazing Animals	Commuters	Others/ Scavengers
1.	100m apart "Dipa" is there	0	0	0	5	0	0	5	0	0	23	0	30	16	4

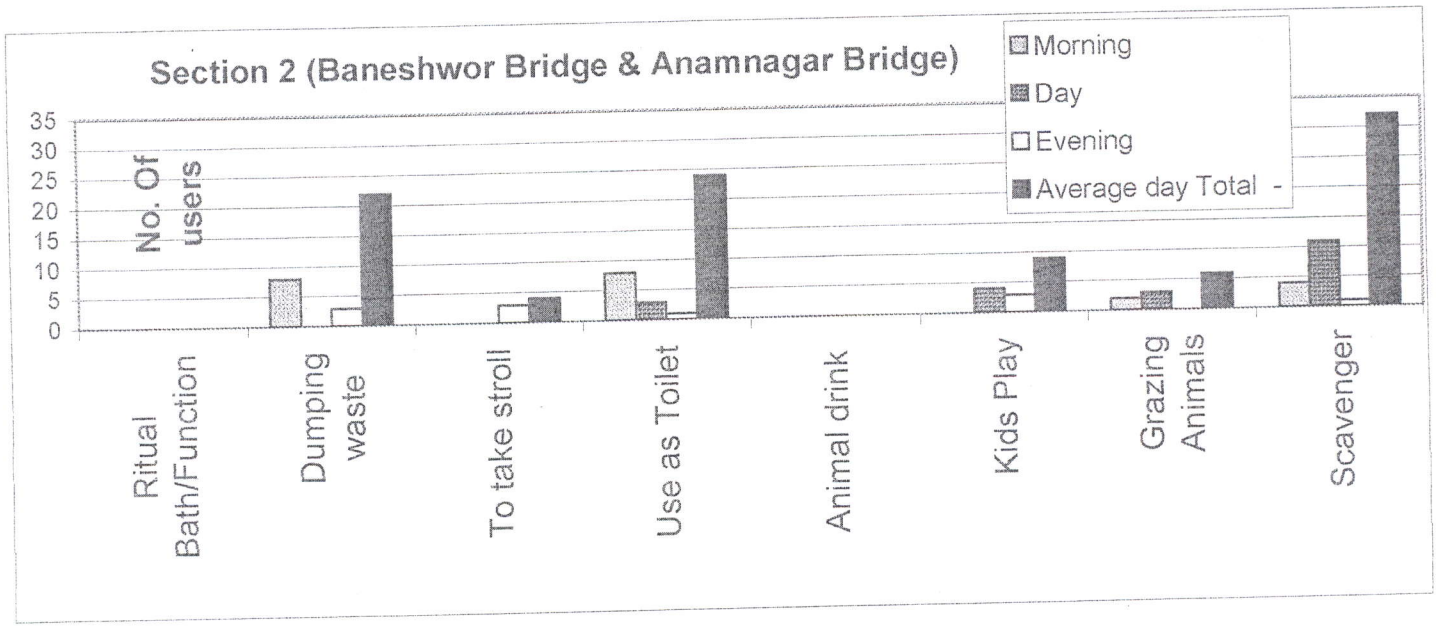
Date: Nov. 20 Time: From 1:00 to 2:00

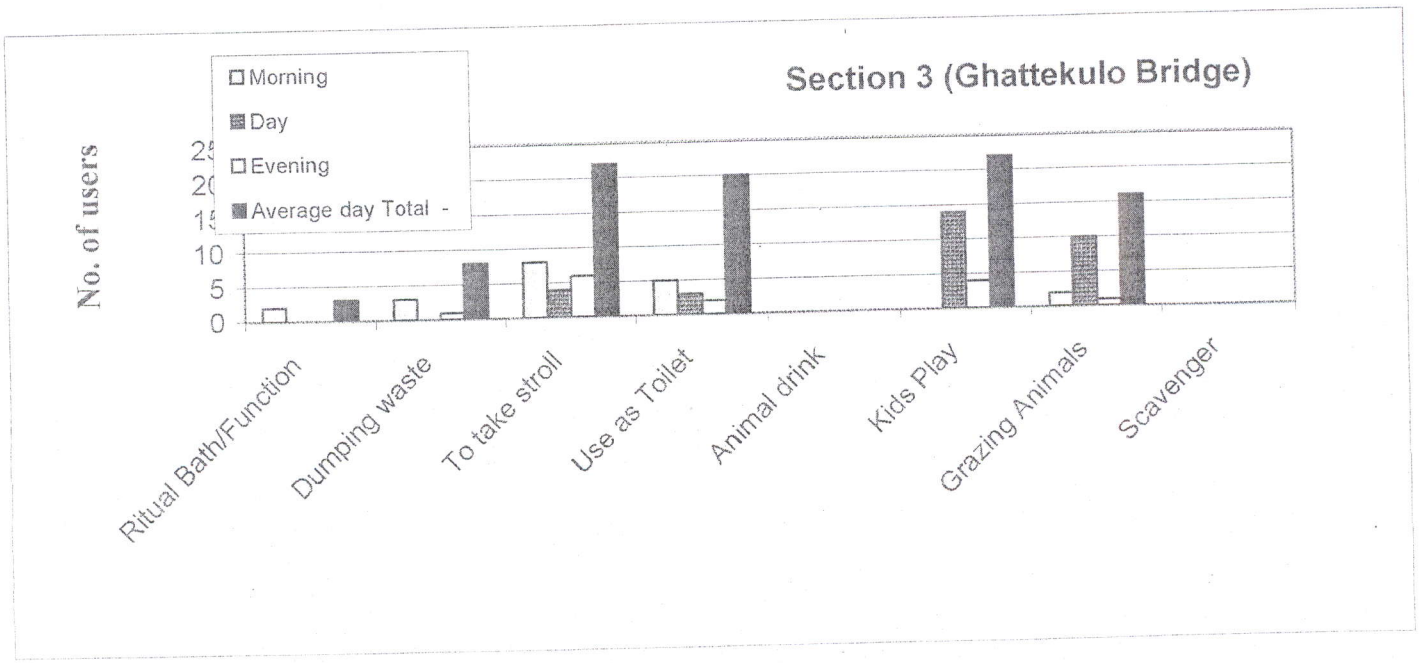
2.	0	0	0	0	4(Cart)	0	0	3	0	0	13	3	23	15	6

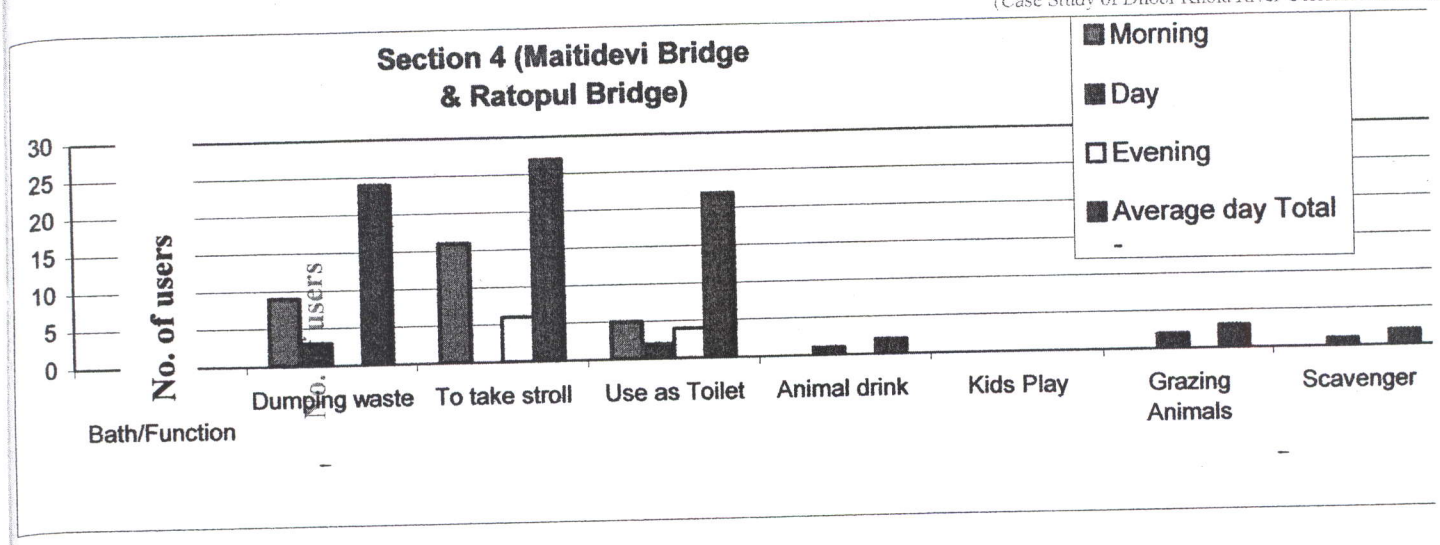
Date: Nov. 20 Time: From 5:00 to 6:00

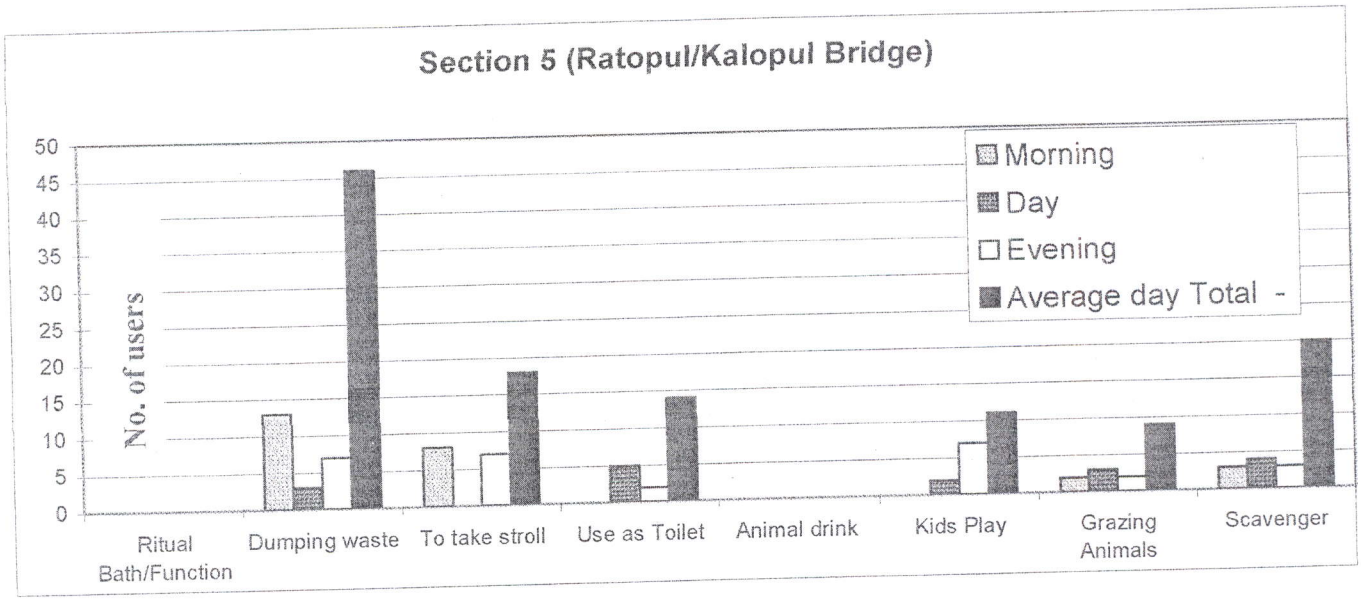
3.	0	0	0	0	0	0	15	6	0	0	0	8	9	30	0

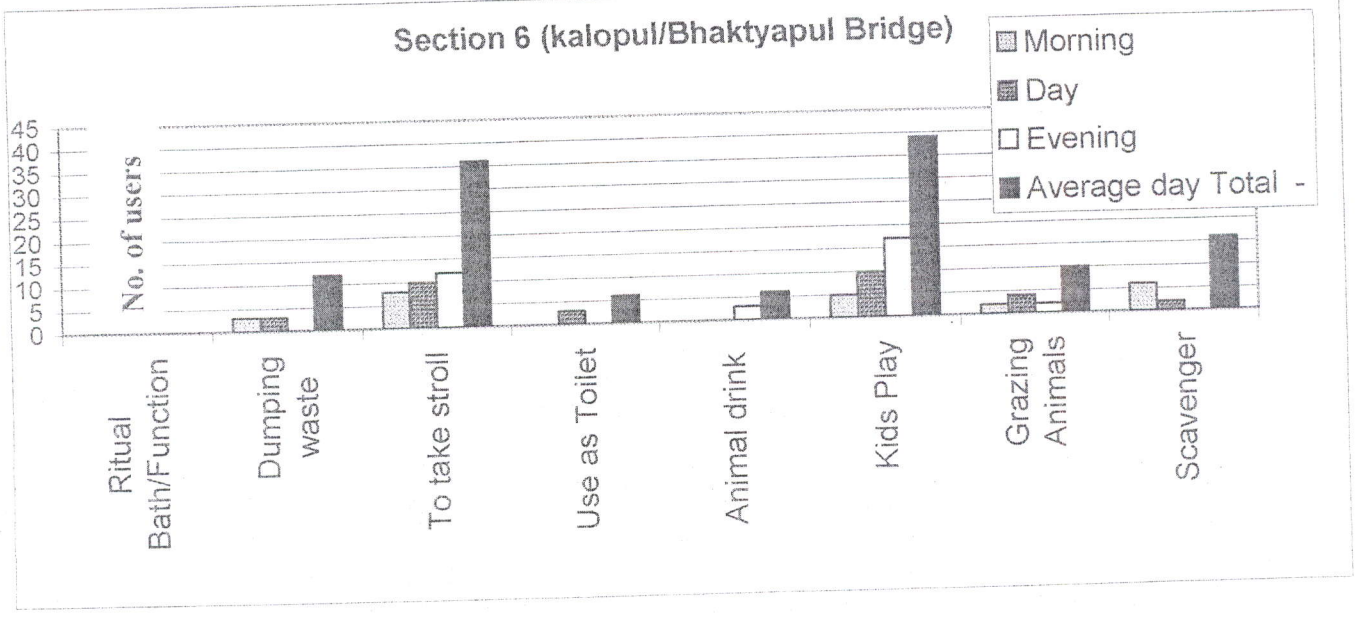

Section 1 (DK Bagmati Confluence to Skew Bridge)
Morning
Day
Evening
Average Day Total
No. of users
60
50
40
30
20
10
0
Ritual Bath/Function
Dumping waste
To take stroll
Use as Toilet
Animal drink
Kids Play
Grazing Animals
Scavenger

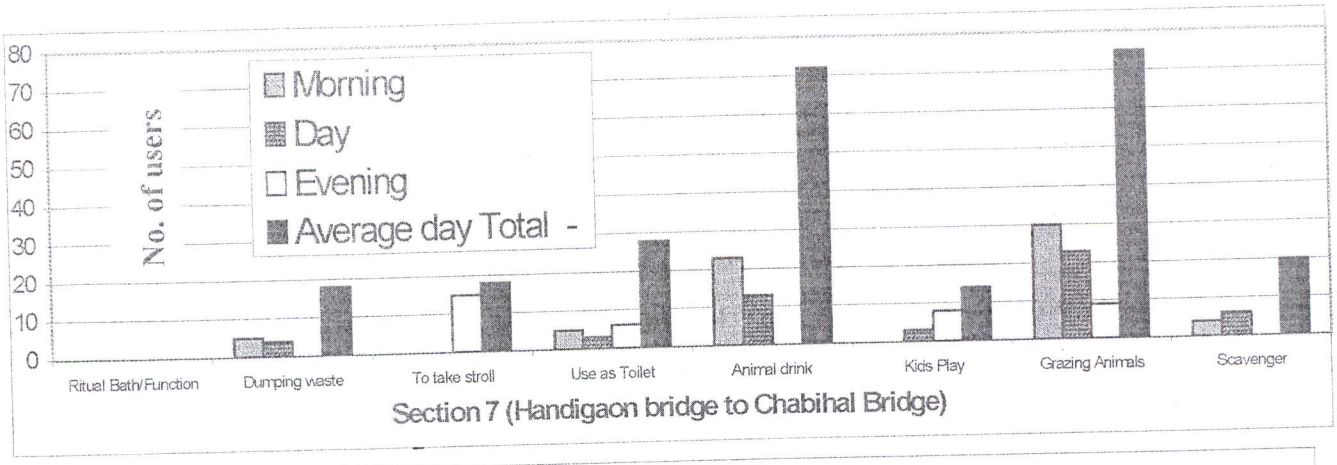

Section 2 (Baneshwor Bridge & Anamnagar Bridge)
Morning
Day
Evening
Average day Total
No. Of users
35
30
25
20
15
10
5
0
Ritual Bath/Function
Dumping waste
To take stroll
Use as Toilet
Animal drink
Kids Play
Grazing Animals
Scavenger

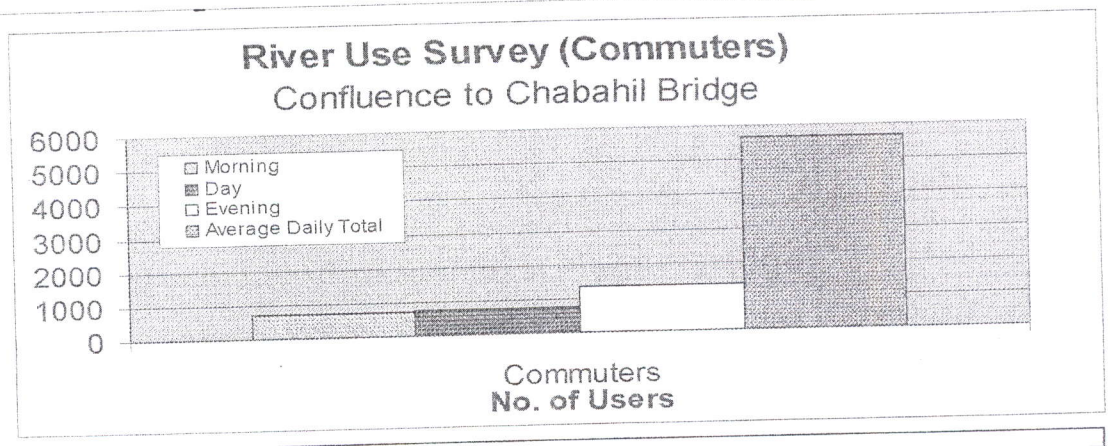

Section 3 (Ghattekulo Bridge)
Morning
Day
Evening
Average day Total
No. of users
25
20
15
10
5
0
Ritual Bath/Function
Dumping waste
To take stroll
Use as Toilet
Animal drink
Kids Play
Grazing Animals
Scavenger

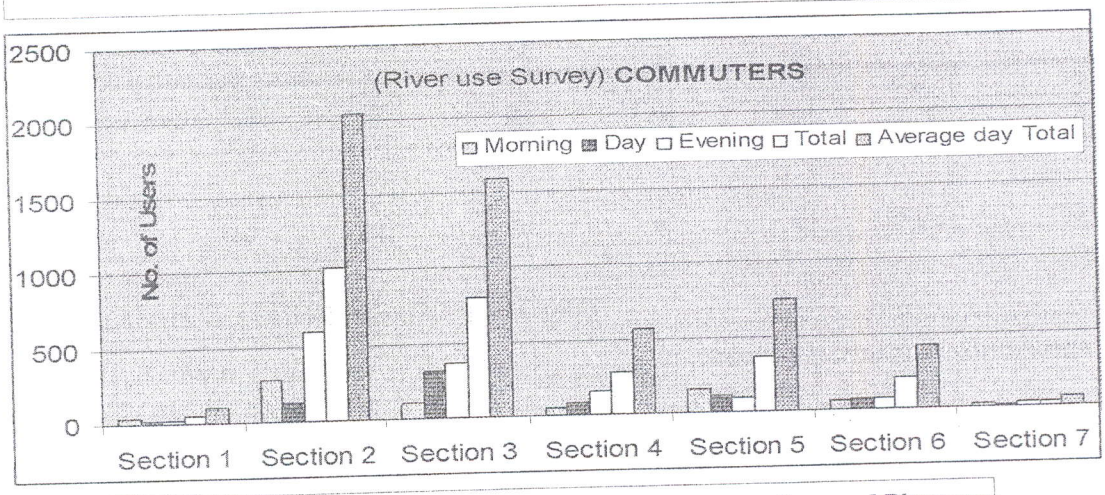

Section 4 (Maitidevi Bridge & Ratopul Bridge)
Morning
Day
Evening
Average day Total
No. of users
30
25
20
15
10
5
0
Dumping waste
To take stroll
Use as Toilet
Animal drink
Kids Play
Grazing Animals
Scavenger
Bath/Function

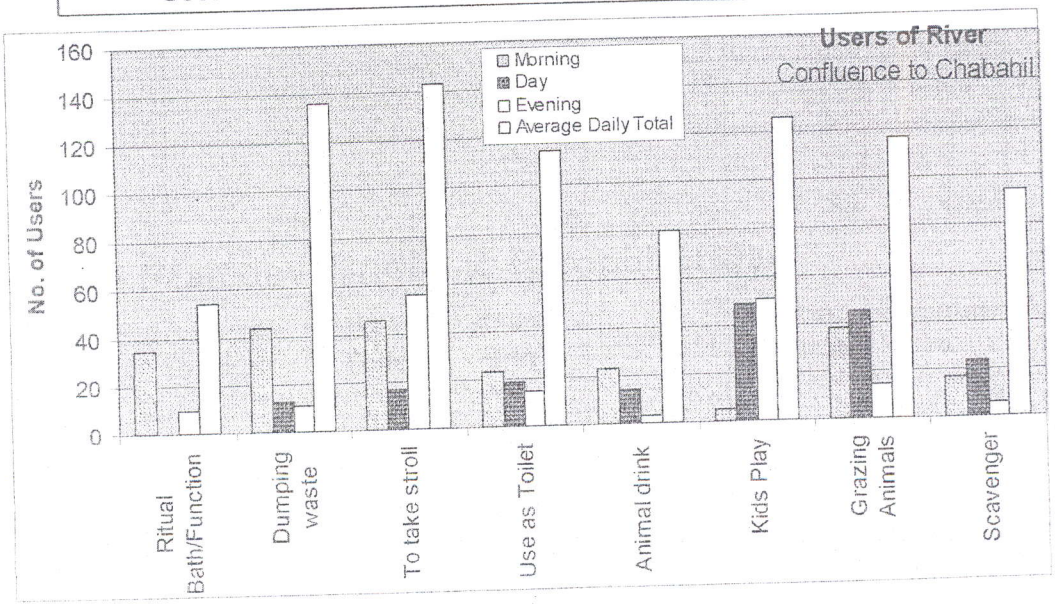

Section 5 (Ratopul/Kalopul Bridge)
Morning
Day
Evening
Average day Total
No. of users
50
45
40
35
30
25
20
15
10
5
0
Ritual Bath/Function
Dumping waste
To take stroll
Use as Toilet
Animal drink
Kids Play
Grazing Animals
Scavenger


Section 6 (kalopul/Bhaktyapul Bridge)
Morning
Day
Evening
Average day Total
No. of users
45
40
35
30
25
20
15
10
5
0
Ritual Bath/Function
Dumping waste
To take stroll
Use as Toilet
Animal drink
Kids Play
Grazing Animals
Scavenger


80
70
60
50
40
30
20
10
0
No. of users
Morning
Day
Evening
Average day Total
Ritual Bath/Function
Dumping waste
To take stroll
Use as Toilet
Animal drink
Kids Play
Grazing Animals
Scavenger
Section 7 (Handigaon bridge to Chabihal Bridge)


River Use Survey (Commuters)
Confluence to Chabahil Bridge
6000
5000
4000
3000
2000
1000
0
Morning
Day
Evening
Average Daily Total
Commuters
No. of Users


2500
2000
1500
1000
500
0
(River use Survey) COMMUTERS
Morning
Day
Evening
Total
Average day Total
No. of Users
Section 1
Section 2
Section 3
Section 4
Section 5
Section 6
Section 7


160
140
120
100
80
60
40
20
0
No. of Users
Morning
Day
Evening
Average Daily Total
Users of River
Confluence to Chabahil
Ritual Bath/Function
Dumping waste
To take stroll
Use as Toilet
Animal drink
Kids Play
Grazing Animals
Scavenger

River Use Survey

Output Data

Section 1 (Dk/Bagmati Confluence to Skew Bridge)

te	1 hr.Time	Ritual Bath/Function	Dumping waste	To take stroll	Use as Toilet	Animal drink	Kids Play	Grazing Animals	Commuters	Scavenger
9	Morning	33	3	6	0	0	0	0	43	0
9	Day	0	0	3	0	0	16	0	20	0
8	Evening	10	0	7	0	0	12	0	18	2
	-	43	3	16	0	0	28	0	51	2
r	-	1.2	1.2	1.2	2	2	1.2	1.2	2	2
ge otal	-	52	4	20	0	0	34	0	102	4

Section 2 (Baneshwor Bridge to Anam Nagar Bridge)

te	1 hr.Time	Ritual Bath/Function	Dumping waste	To take stroll	Use as Toilet	Animal drink	Kids Play	Grazing Animals	Commuters	Scavenger
9	Morning	0	8	0	8	0	0	2	290	4
9	Day	0	0	0	3	0	4	3	128	11
8	Evening	0	3	3	1	0	3	0	603	1
	-	0	11	3	12	0	7	5	1021	16
r	-	1.2	2	1.2	2	2	1.2	1.2	2	2
ge Total	-	0	22	4	24	0	9	6	2042	32

Section 3 (Ghattekulo Bridge)

ate	1 hr.Time	Ritual Bath/Function	Dumping waste	To take stroll	Use as Toilet	Animal drink	Kids Play	Grazing Animals	Commuters	Scavenger
9	Morning	2	3	8	5	0	0	2	104	0
9	Day	0	0	4	3	0	14	10	320	0
8	Evening	0	1	6	2	0	4	1	373	0
	-	2	4	18	10	0	18	13	797	0
r	-	1.2	2	1.2	2	2	1.2	1.2	2	2
age Total	-	3	8	22	20	0	22	16	1594	0

Section 4 (Maitidevi Bridge to Ratopul Bridge)

ate	1 hr.Time	Ritual Bath/Function	Dumping waste	To take stroll	Use as Toilet	Animal drink	Kids Play	Grazing Animals	Commuters	Scavenger
9	Morning	0	9	16	5	0	0	0	49	0
9	Day	0	3	0	2	1	0	2	80	1
8	Evening	0	0	6	4	0	0	0	158	0
	-	0	12	22	11	1	0	2	287	1
or	-	1.2	2	1.2	2	2	1.2	1.2	2	2
age Total	-	0	24	27	22	2	0	3	574	2

Section 5 (Ratopul to Kalopul Bridge)

ate	1 hr.Time	Ritual Bath/Function	Dumping waste	To take stroll	Use as Toilet	Animal drink	Kids Play	Grazing Animals	Commuters	Scavenger
9	Morning	0	13	8	0	0	0	2	160	3
9	Day	0	3	0	5	0	2	3	119	4
8	Evening	0	7	7	2	0	7	2	93	3
	-	0	23	15	7	0	9	7	372	10
or	-	1.2	2	1.2	2	2	1.2	1.2	2	2
age Total	-	0	46	18	14	0	11	9	744	20

Section 6 (Kalopul to Bhatkyapul Bridge)

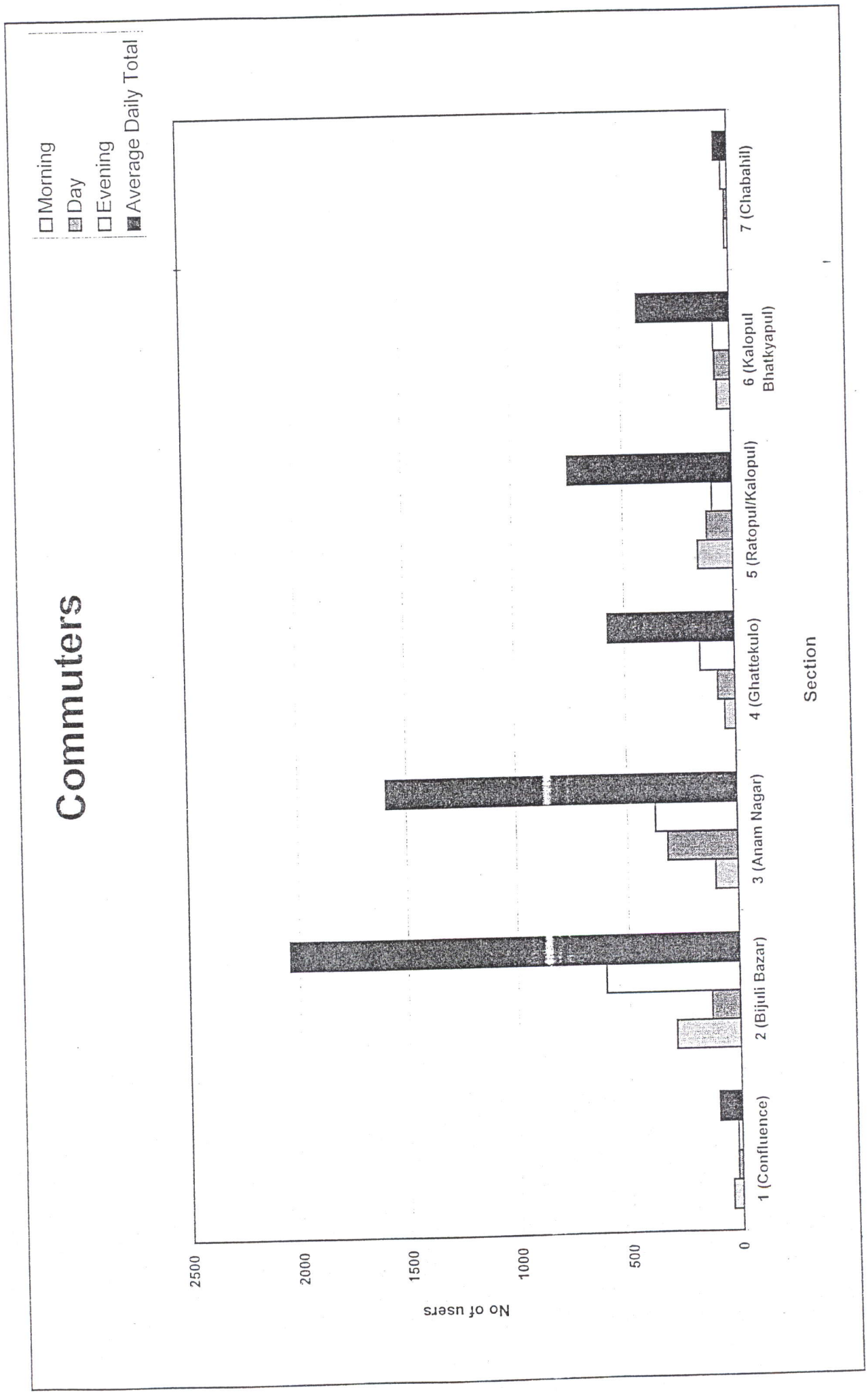
ate	1 hr. Time	Ritual Bath/Function	Dumping waste	To take stroll	Use as Toilet	Animal drink	Kids Play	Grazing Animals	Commuters	Scavenger
9	Morning	0	3	8	0	0	5	2	63	6
9	Day	0	3	10	3	0	10	4	73	2
8	Evening	0	0	12	0	3	17	2	76	0
	-	0	6	30	3	3	32	8	212	8
or	-	1.2	2	1.2	2	2	1.2	1.2	2	2
rage Total	-	0	12	36	6	6	39	10	424	16

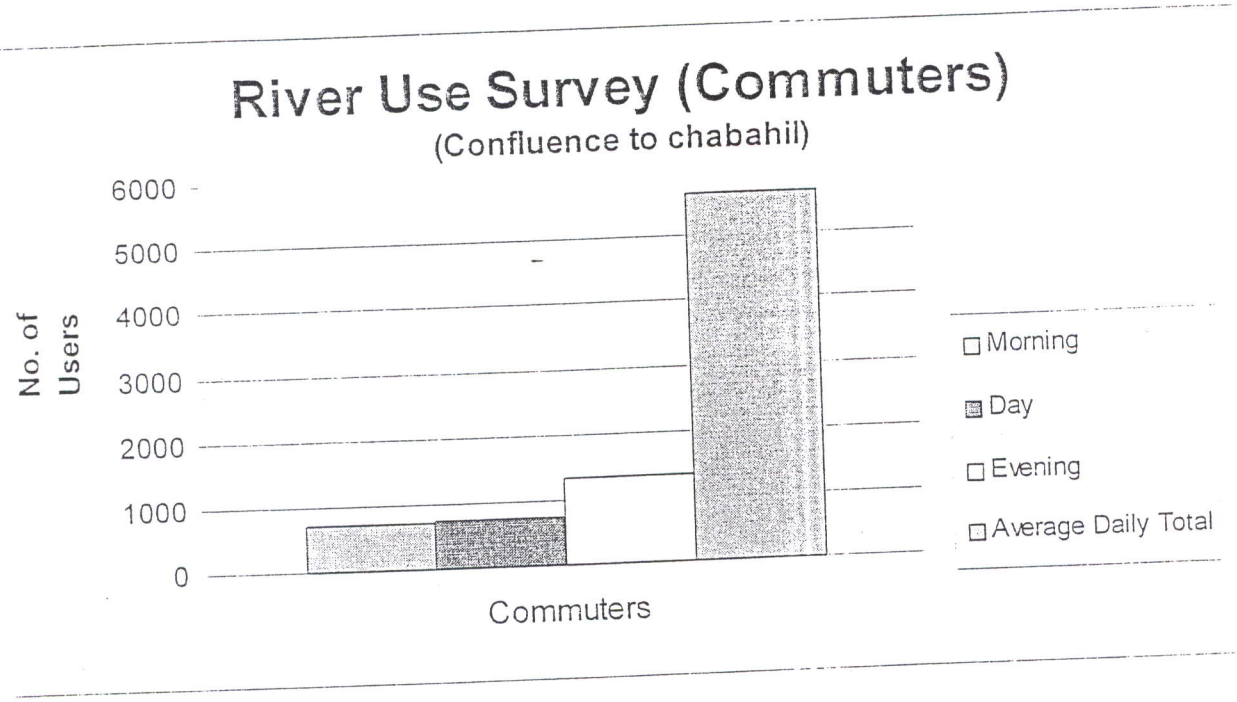
Section 7 (Bhatkya pul at handigaon to Chabahil Bridge)

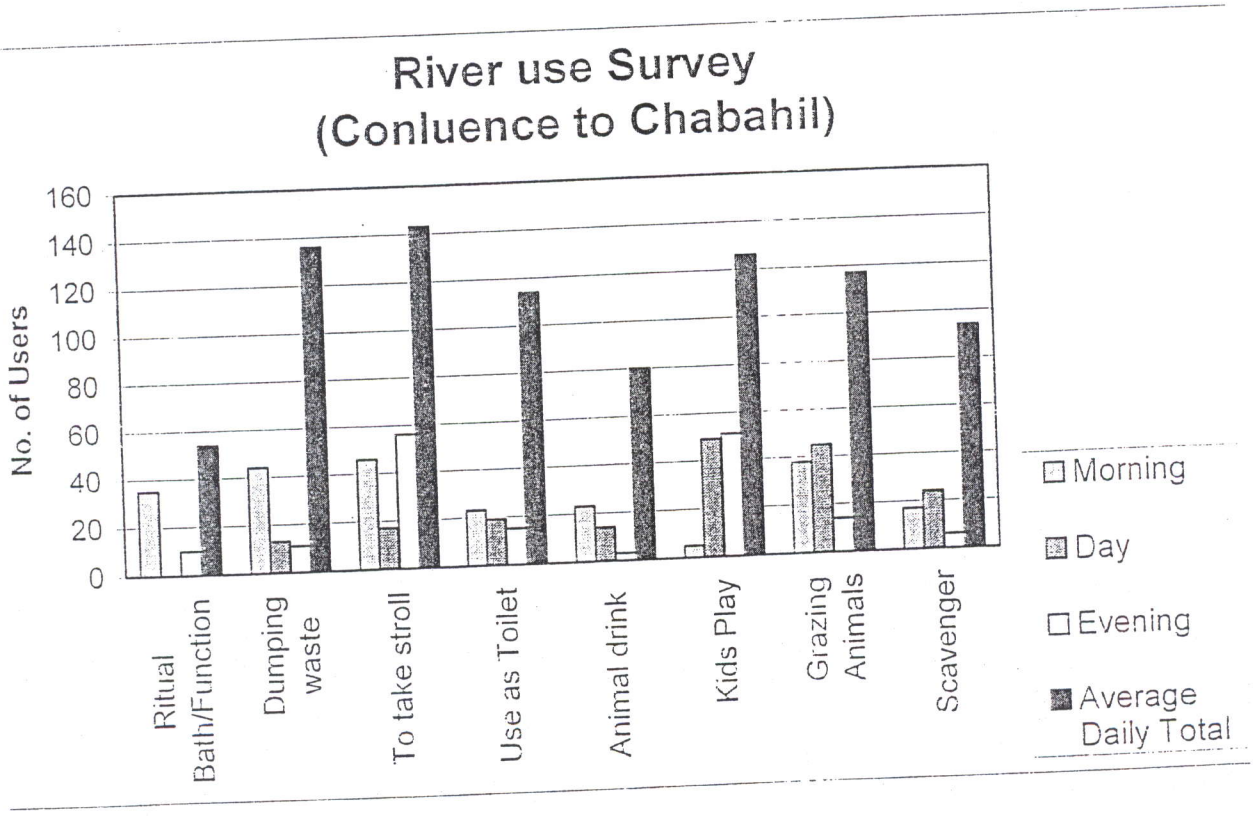
ate	1 hr.Time	Ritual Bath/Function	Dumping waste	To take stroll	Use as Toilet	Animal drink	Kids Play	Grazing Animals	Commuters	Scavenger
9	Morning	0	5	0	5	23	0	30	16	4
9	Day	0	4	0	3	13	3	23	15	6
8	Evening	0	0	15	6	0	8	9	30	0
	-	0	9	15	14	36	11	62	31	10
or	-	1.2	2	1.2	2	2	1.2	1.2	2	2
rage Total	-	0	18	18	28	72	14	75	62	20

Confluence to Chabahil

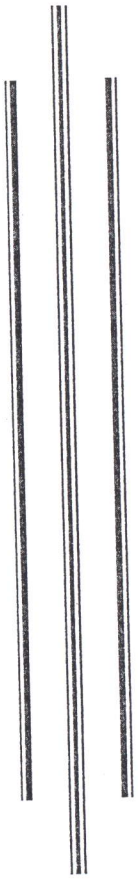
	1 hr.Time	Ritual Bath/Function	Dumping waste	To take stroll	Use as Toilet	Animal drink	Kids Play	Grazing Animals	Scavenger	Commuters
	Morning	35	44	46	23	23	5	38	17	725
	Day	0	13	17	19	14	49	45	24	755
	Evening	10	11	56	15	3	51	14	6	1351
	Total	45	68	119	57	40	105	97	47	2831
	Factor	1.2	2	1.2	2	2	1.2	1.2	2	2
	Average D	54	136	143	114	80	126	117	94	5662


Commuters
Morning
Day
Evening
Average Daily Total
No of users
2500
2000
1500
1000
500
0
1 (Confluence)
2 (Bijuli Bazar)
3 (Anam Nagar)
4 (Ghattekulo)
5 (Ratopul/Kalopul)
6 (Kalopul Bhatkyapul)
7 (Chabahil)
Section

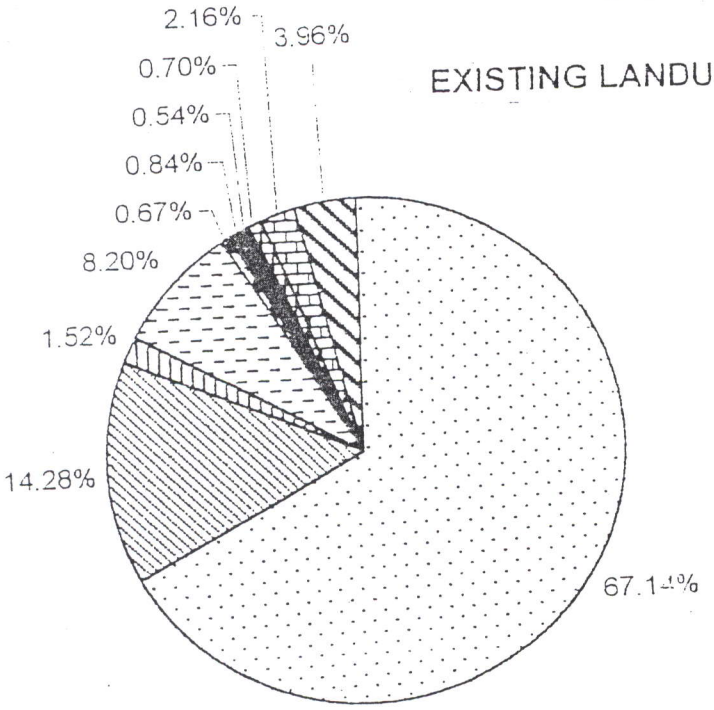

River Use Survey (Commuters)
(Confluence to chabahil)
6000
5000
4000
3000
2000
1000
0
No. of Users
Commuters
Morning
Day
Evening
Average Daily Total


River use Survey
(Conluence to Chabahil)
160
140
120
100
80
60
40
20
0
No. of Users
Ritual Bath/Function
Dumping waste
To take stroll
Use as Toilet
Animal drink
Kids Play
Grazing Animals
Scavenger
Morning
Day
Evening
Average Daily Total

TABLES AND CHARTS



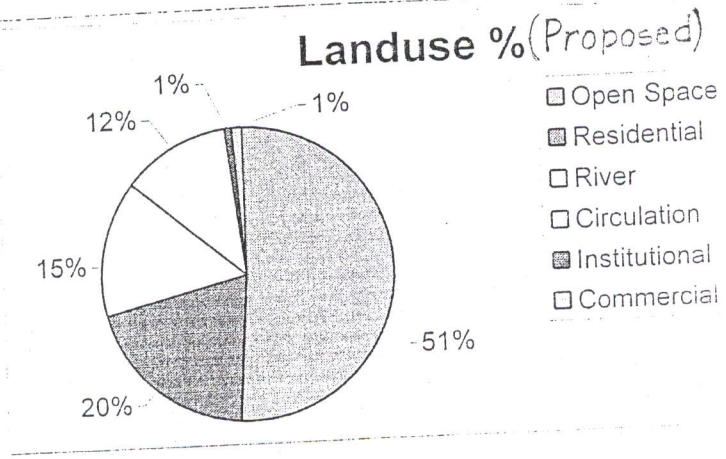
LANDUSE OF DHOBIKHOLA RIVER CORRIDOR



TOTAL AREA: 835015 Sq. M.

- CULTIVATION / FLOOD PLAIN
- FOREST / GREENBELT
- INDUSTRIAL
- COMMERCIAL
- METALLED ROAD
- RESIDENTIAL
- WATER COURSE
- SQUATTER
- INSTITUTIONAL
- UNMETALLED ROAD

LAND USE %	
Open Space	51
Residential	20
River	15
Circulation	12
Institutional	1
Commercial	1
Total	100



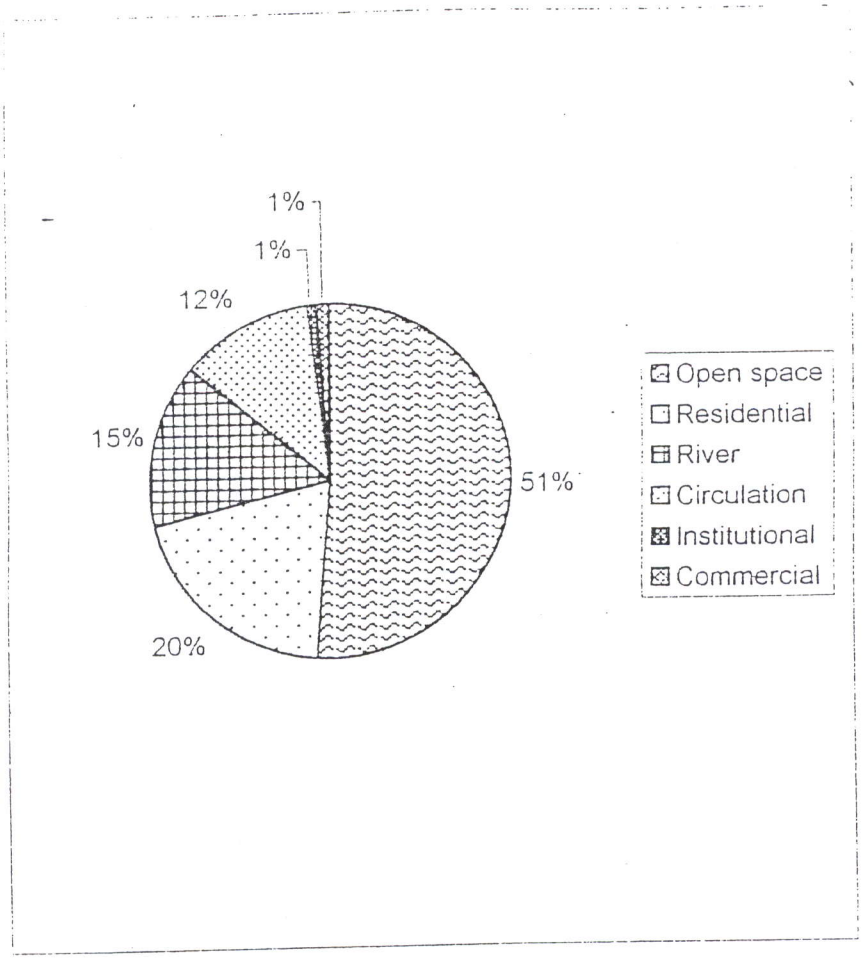
Open Space	
Organized Park	6
Plant/Forest	25
Cultivated	20
Total	51

Residential	
General	3
LAND POOLING	9
GLD	8
TOTAL	20

CIRCULATION	
METALLED	7
UNMETALLED	5
TOTAL	12

Proposed Landuse Dhobikhola River Corridor

Landuse	
Open space	51
Residential	20
River	15
Circulation	12
Institutional	1
Commercial	1
Total	100



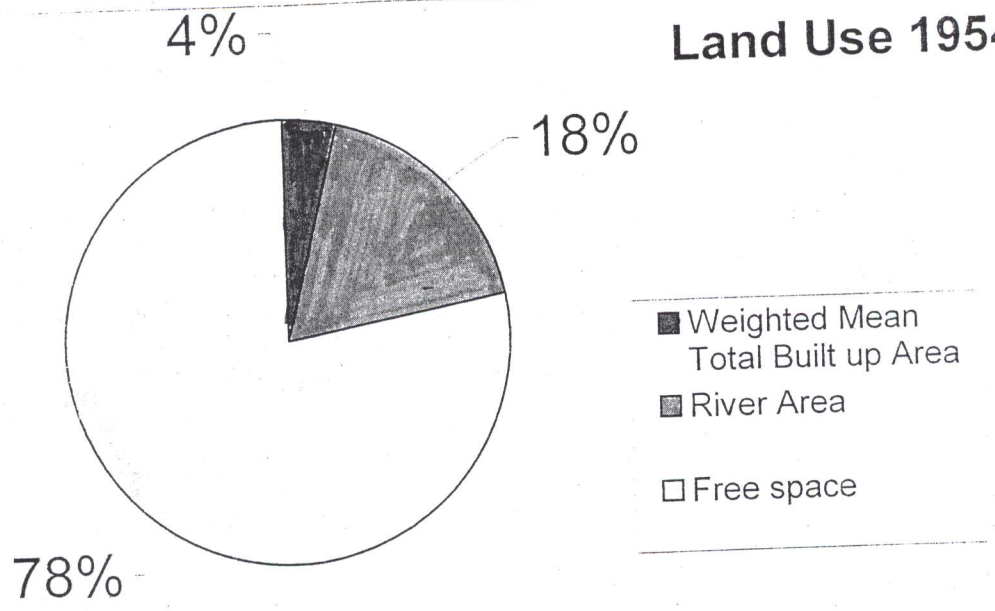
Open space	
Organized Park	6
Plant/Forest	25
Cultivated	20
Total	51

Residential	
General	3
Land Pooling	9
GLD	8
Total	20

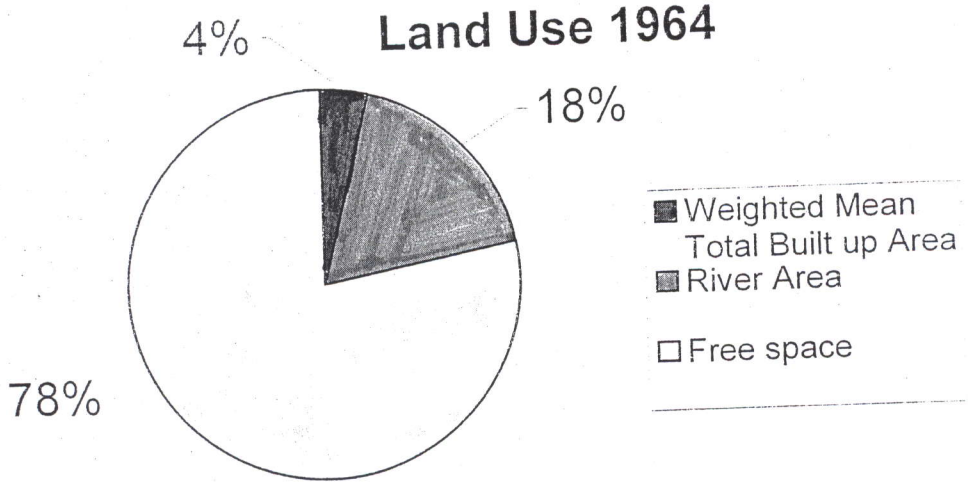
Circulation	
Metalled	7
Unmetalled	5
Total	12

AERIAL PHOTO INTERPRETATION

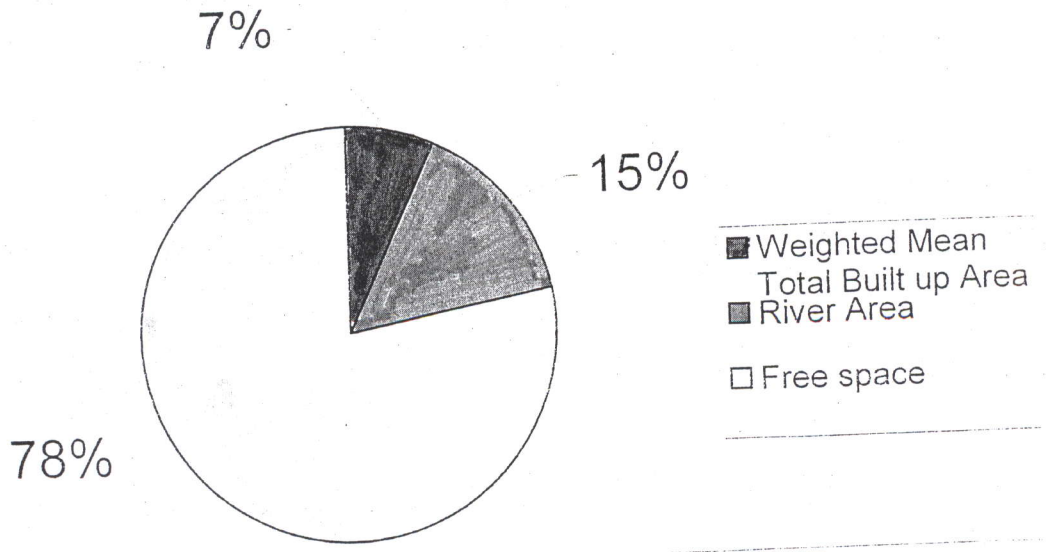
Land Use 1954



Land Use 1964



Land Use 1981



AERIAL PHOTO 1998, SATTELITE IMAGE 2001 INTERPRETATION