

# Sustainable Urban Riverfront Development - A Case of Bagmati River (Shankhamul to Teku)

Samridhi Shrestha <sup>a</sup>, Sangeeta Singh <sup>b</sup>

<sup>a, b</sup> Department of Architecture, Energy for Sustainable Social Development (MSESSD), Pulchowk Campus, IOE, Tribhuvan University, Nepal

Corresponding Email: <sup>a</sup> samridi2015@gmail.com , <sup>b</sup> sangeeta@ioe.edu.np

## Abstract

Water is something that has gave birth to human life and the civilization. Many famous cities all over the world are generally located at the junctions of rivers and the sea. Riverfront development may contribute to the urban environment. The riverfront development provides a unique opportunity for developing a strong city. And the connection between human and water is the most important in any river front development. Riverfront development is a zone of interaction between urban development and the water. Urban areas are the main economic base for the countries. Urban waterfronts are interface between city and water bodies of sea, river and lake. Nepal's capital today ranks as among the most congested cities in the world, bringing with it a slew of other environmental problems like air pollution, visual pollution, water pollution, solid waste, etc. The most emblematic evidence of this decay is the Bagmati River. Along with its tributaries, the river is a key landmark, the artery of the Kathmandu Valley civilization. Riverfront not only play important ecological roles but also supply bases of stability, comfort, and sustainability in urban development. The research has studied about the urban riverfronts along the Bagmati river discussing the connectivity between river, city and the people for its improvement and sustainable riverfront development. River-City-People are very closely interconnected with one another and playing a vital role in any kind of waterfront development of any place. By passing any one of them, the other two cannot be exist or developed.

## Keywords

Water, Riverfront, Urban riverfront, Bagmati River, River, City and People Connection

## 1. Introduction

Presently, urbanization is rapid worldwide and is expected to continue in the coming decades. Our Kathmandu Valley is being overcrowded and polluted day by day. Kathmandu is one of the fastest growing cities in South Asia [1]. And the rapid transformation of the metropolitan area of the Valley over the past decades has been dramatic, especially in the reduction of the green spaces. Nepal's capital today ranks as among the most congested cities in the world, bringing with it a slew of other environmental problems like air pollution, visual pollution, water pollution, solid waste, etc. The most emblematic evidence of this decay is the Bagmati River. Along with its tributaries, the river is a key landmark, the artery of the Kathmandu Valley civilization.

Due to heavy disturbances throughout the urbanization process, urban rivers have become one of

the most intensively influenced areas in the interaction between humans and natural processes. And the rapid urbanization has also affected river water, quality of air and energy resources. Urban rivers and waterfront space are part of the urban open space and plays a vital role in affording urban resilience and health. Rivers, waterfront and open space links should together, be making a recreational space system that benefits people and the city. Human activities have vastly altered the structure and the function of urban river landscapes. It has resulted in the decrease of naturalness, diversity, feasibility and beauty of the urban river landscapes. Urban rivers are important physical elements and important ecological corridors. They not only play important ecological roles but also supply bases of stability, comfort, and sustainability in urban development.

Water is something that has gave birth to human life and the civilization. Rivers have been playing

significant role in the life of people, their activities and in the development of the human settlement. Rivers, river corridors, lakes and other water reservoirs with their waterfront plays a very important role in the sustainable urban development. Many civilizations have been originated and flourished from the banks of rivers such as Indus Valley Civilization on Sindhu River, Egyptian Civilization on Nile River, Mesopotamia Civilization on Tigris and Euphrates, and many more. Early settlements of the Kathmandu valley have also been developed along the banks of Bagmati, Dhobikhola, Tukucha and Bishnumati Rivers. Urban river corridors of the Kathmandu valley play a vital role in the urban and sustainable development. Kathmandu valley is rich in small rivers and watersheds. Almost all the watercourses flow through the middle of the city.

The connection between human and water (river) is the most important in any river front development. It leads to the failure of the riverfront development if there is no connection with the human (human interaction) no matter how big is the project. That is why human interaction with water is the most important element in riverfront development.

### 2. Research Problem

Urban river corridors (Bagmati) in Kathmandu, despite their potential usefulness to the wellbeing of the society and environment are in a degraded state. The Bagmati river has continued to suffer unprecedented levels of pollution due to polluting industries, developers, individuals and consequent inaction by the authorities charged with its protection. The river which was formerly a fresh water river in the past has been degraded to black liquid soaked with suspended and dissolved solid materials, raw sewage, used oil, etc. This indiscriminate disposal of waste into the river corridor has not only lowered its aesthetic and economic value, but has also affected the scenic beauty of the riverscape. River has negatively transformed the riverscape from its natural state to an alien one, devoid of natural character and form with few or no fauna and/or flora.

Today we are in a generation that has turned flowing fresh water rivers to the rivers of sewage and garbage disposal. There was a time in the past when there was a river in everybody's life. Cultures developed alongside rivers. Rivers sustained farmlands, they were home to variety of fishes, it was the area where children could

play and a place of joy for a people after a hard day of work. Today many grow into adulthood without having seen a river in its full glory. Connection between river and people has been lost. There is no desire left to connect with the river or to at least protect what is left or to once again build up the great relationship that is lost. The strong bond between the river and the people of the city has been broken.

### 3. Need and Importance of Research

Urban populations interact with their environment. Kathmandu valley is becoming a grey city, lacking even the basic greenery required for its citizens. It is even failing to conserve the existing open and green spaces which are now present in the form of agricultural land, trees and forest cover. This is one of the major problems in context of the Kathmandu Valley which has adverse effect in climate, environments, society, etc. It has given rise to many problems such as environmental, social as well as economic problems. The lack of green cover in the city is not only depriving locals of a visually stimulating cityscape, but also of clean air and public areas to entertain themselves and future generations. The river corridors can be the most important natural element connecting organ which relates human beings, city and the nature together and plays a very important role in promotion of city's natural qualities. Bringing green space to the Bagmati corridors can promote and inspire a better relationship with the environment while supporting important services. The research will help to give brief background about the urban river, know and analyze about the problem of River, City and People individually and how they are inter-related to each other for a sustainable riverfront development which will be helpful in planning and implementation of projects of riverfront development.

### 4. Research Objective

The main objective of the research was to explore the urban riverfronts along the Bagmati river banks from perspective of River-City-People for the development of sustainable urban city.

And to achieve this aim of the research, the specific objectives were as follows:

- To explore and analyze the existing condition of the river and its corridor of the chosen section

and also to explore means of proper riverfront development for the future sustainability of the river and open spaces along the Bagmati river corridor.

- To know the interrelationship and connection between River-City-People.
- To know about the values and activities that people associate themselves with river corridors.
- To identify the causes and the effects of deterioration and prepare the recommendation and suggestions for its improvement.

## 5. Case Area: Bagmati River

The case study area for the research has been chosen from SHANKAMUL bridge to TEKU (Kalopul bridge) with a distance of 3.4 km. The whole stretch that has been selected has been divided into three small segments for the research:

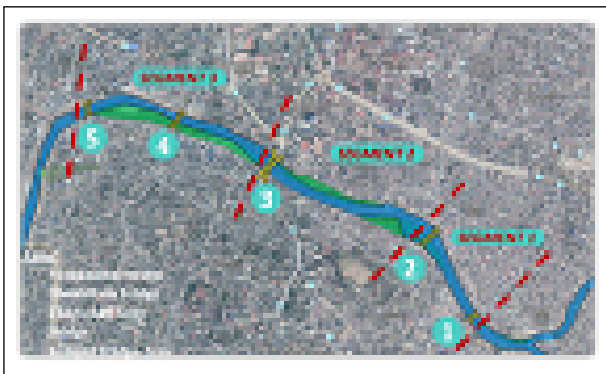


Figure 1: Study Area

1. Segment 1: Shankhamul to Dhobikhola Bridge
2. Segment 2: Dhobikhola Bridge to Thapathali
3. Segment 3: Thapathali to Teku (up to Kalopul Bridge of Teku)

## 6. Research Methodology

Methodology is the systematic, theoretical analysis of the methods applied to a field of study. It comprises the theoretical analysis of the body of methods and principles associated with a branch of knowledge. Typically, it encompasses concepts such as paradigm, theoretical model, phases and quantitative or qualitative techniques. [2]

### 6.1 Research Paradigm

The research paradigm adopted for the research study will be post positivist paradigm as it is used to

describe an approach to research where large amounts of qualitative data are categorized to produce quantitative data to be analyzed using statistical methods. Post positivist paradigm accepts the theories, background, knowledge and the values of the researcher that can influence what's being observed. Constructivism paradigm are the assumptions that are the reality which are socially constructed and based on perception. Constructivism paradigm will also be adopted for the research project.

#### 6.1.1 Ontology

The ontology of the study will be the current conditions of the Bagmati rivers and its impacts in the surrounding and local people living nearby. And it also includes the problems and challenges faced by the river.

#### 6.1.2 Epistemology

The Epistemology position of the research area has been found by the literature review, information's and data collected from different external sources, the local residents, and other involved organizations.

#### 6.1.3 Methodology

**Research type:** To achieve the objectives of the research, a qualitative research method will be used as this method is the best for the research. Main objective of the research was to explore the urban riverfronts along the Bagmati river banks and its connectivity between river, city and the people with different dimension of social, cultural and environmental factors of the Bagmati river corridors and for this objective, qualitative research fits the best. And to describe an approach to research where large amounts of qualitative data are categorized to produce quantitative data to be analyzed using statistical methods.

**Research strategy:** A case study is a research methodology commonly used in social sciences. As the research requires in-depth investigation of a single individual, group or event to explore the causes case study research is identified for it. A case study is a descriptive and exploratory analysis of a person, group or event. A case study research can be single or multiple case studies, includes quantitative evidence, relies on multiple sources of evidence and benefits from the prior development of theoretical propositions.

## 6.2 Research Design

### 6.2.1 Data collection

The primary data collections were collected through:

- Site surveys including site observations, personnel observations, knowing historical facts about the rivers, etc.
- Questionnaire survey including close end and open-ended questions
- Interviews with local residents, academics, practitioners-planners, architects, engineers, landscape architects, etc.
- It will also include discussion and meetings with concerned local authorities (Stakeholders)

Secondary data collections were collected through:

- Maps, policies and projects by the government, books, journals articles.
- Newspaper and magazine articles

### 6.2.2 Field Visit and Questionnaire Survey

Several field visits and observation of the case area to understand about existing condition, different problems and causes related to River, City and People.

### 6.2.3 Sample Selection for Questionnaire Survey

Random Sampling Method was used for the questionnaire survey on all the three segments to know about the perception of local people regarding the Bagmati river and its development and their concerns and preferences. Total 46 nos. of people were taken interviews in questionnaire survey in all the three segments of the case area from Shankhamul to Teku.

- Segment 1: 17 nos.
- Segment 2: 11 nos.
- Segment 3: 18 nos.

### 6.2.4 Data compile and analysis

Data compilation and analysis was one of the most important in finding out the result and draw out the conclusion of the research. Once the data was collected from all the sources and the questionnaire survey, certain data was analyzed entering in computer aid software (MS Excel) and other major finding was extracted analyzing the possibility of river front development in Bagmati River.

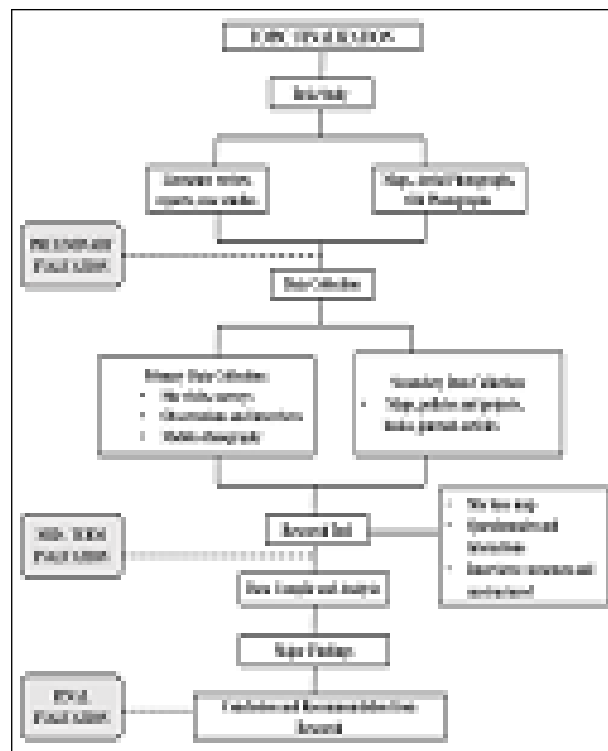


Figure 2: Graphical Representation of Research Methodology

## 7. Limitation

Certain stretch of the Bagmati river will be taken for the research. The study area will be taken from Shankhamul to Teku on both the sides of the river as this section is lies in the core urban area of the valley. Impact of Bagmati cannot be limited within the immediate periphery, then also for the ease of research maximum of 100 m distance has been considered and also in few areas of the study this limitation has been exceeded as per requirement. The research will not address all the issues and problems of all the tributaries of the Bagmati River because of time and resource limitations. However, the findings from this research, as well as the suggestions/recommendations obtained from this study, will definitely be replicable in other rivers and tributaries with similar problems.

## 8. Literature Review

### 8.1 Water and Waterfront

Water is a defining force that fundamentally shapes the character of each place it touches. It is a feature that should be honored and celebrated not to be treated simply as cosmetic or as just a commodity. Waterfront can be defined as a part of a town that is

next to an area of water such as a river or the sea [3]. In general, it is the zone of interaction between urban developments and the water (Nature). Moreover, waterfront is characterized as a place integrating land with water and having a natural attraction to people – Connecting river and people of the city.

### 8.2 Urban Waterfront

Urban waterfronts are interface between city and water bodies of sea, river and lake. Urban areas are the main economic base for the countries. They create jobs and services for its citizens and play a vital role in the development of the country. Urban wetland plays a significant role in the form of city and its pattern and affects the sustainability of urban development directly. According to The New York City Comprehensive Waterfront Plan that was prepared by the Department of City Planning’s Vision 2020: Public open spaces on the waterfront can transform neighborhoods, turning previously inaccessible lands into vibrant community gathering areas that foster economic growth.

### 8.3 Elements for Successful Waterfront Development

1. Beginning the project
2. Financial feasibility
3. Environmental Approvals
4. Public Perception of need
5. Function
6. Authenticity
7. Image
8. Construction Technology
9. Theme
10. Effective management

### 8.4 Principles for Developing Plans in Waterfront Areas

Bertsch (2008) recommended several principles that must be included while developing plans for waterfront areas, as follows [4]

1. Accessibility
2. Integrated
3. Sharing benefits
4. Stakeholder participation
5. Construction phase

### 8.5 Concept of River, City and People

Several articles and researches have mentioned about three-dimensional approach – RIVER-CITY-PEOPLE. This was inspired by the three Worlds of Habermas [5]. In this context, the river can be defined as the physical and biological world, the city can be viewed as the social and humanized world and the people can perform the place of individual emotions and perceptions.

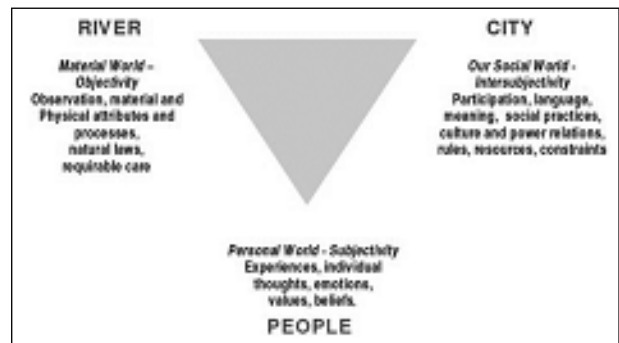


Figure 3: River, City and People Framework (Silva, Saraiva et al. 2005)

## 9. Findings

Each segment was explored with the River-City-people concept and different parameter were identified accordingly.

### 9.1 Existing Scenario

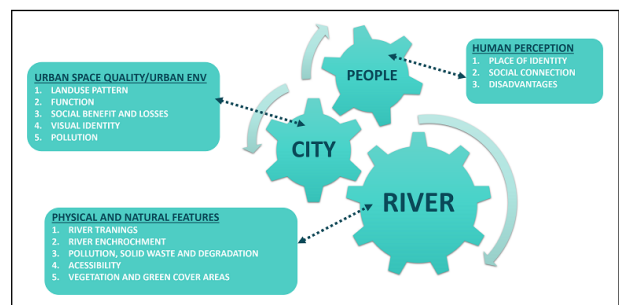


Figure 4: River-City-People Linkage

#### 9.1.1 River

##### a. Pollution and solid waste

Sewerage and drainage connection to river was the problem of all the three segments.

Segment 1: Cremation and funeral activities was the main reason for the waste collection and river being polluted. Waste from these activities were thrown into

the river and some of them are piled up at the same side where the ceremony has been carried out. Solid waste deposited on river and bank of rivers on different portions can be seen in this segment but not much as in the case of segment no.1 and 2.

Segment 2: Solid waste deposited on river and bank of rivers at several points. Construction materials: Found piled up haphazardly in different places of the road there-by causing inconvenience to the pedestrians and passersby. Informal Settlement: Large portion of land has been occupied by the illegal settlers giving bad aesthetic and also contributing a lot in the river pollution in this section.

Segment 3: Some portions of this segment mostly vacant lands were used for land fill purpose in the past without segregation and treatment, resulting in the river pollution River encroachment: Maximum open vacant land available. Huge percentage of the land has been used for farm land by locals, dumping site for the wastes.

### **b. Accessibility**

Segment 1: Presence of the cultural heritages and ghats so, several access points are found but on other parts proper access point are is absent.

Segment 2: River is accessible only from the UN park side and on other parts of the segment is inaccessible.

Segment 3: Inaccessible in most of the parts.

### **c. Public Utility**

Segment 1: Shankhamul Ghat has been used for cremation and funeral purpose. Shankhamul NRNA park and Shankhamul Yoga park for recreational purpose. Other public utility not much found.

Segment 2: UN park for different activities. Other public utility not much found. Recreational space or any other space not found

Segment 3: Agriculture, Dumping waste, Other activities, Recreational Space: near Kalopul Bridge. River encroachment high in this segment.

### **d. Vegetation and Green Cover**

There is no diversity in plantation found on all the three segments. Presence of the two parks in segment 1 somehow has contributed a little as a green cover area for this segment as compared to other two segments where there is huge lack of these kind of zones. Segment no. 3 having much potential in the case of open land which can be utilized to its

maximum level also, vegetation and green areas cannot be found. But in overall huge lack of vegetation in all the three segments but maximum in segment no. 3.

### **9.1.2 City**

#### **a. Land use pattern**

Residential, commercial and institutions, Cultural heritages, Informal settlements, Open spaces and parks.

#### **b. Function**

Role and the function of the river has been significantly decreasing day by day. Pollution and degraded river condition have disturbed the natural functional use and also affecting the aquatic habitat. Although of its functional potential, the river has not been sufficiently used. It could have been used as a waterway transport if the river was in good condition and water tourism developing recreational and commercial activities.

#### **c. Social Benefit and Losses**

Segment 1: Global trends reveal riverside as public, open spaces but in the case of Bagmati, no such spaces are found except in this segment i.e. Shankhamul NRNA park and Yoga park. Although design wise or its linkage with the cultural heritage it not much found in this park, still Shankhamul NRNA Park has much contributed to make the area as a social hub. People and the entire area were found to be much benefited due the presence of such park in this segment which is found to be absent in other two segments.

Segment 2: Presence of UN Park in the segment has not contributed much to make the water front area lively as Shankhamul park did. Also, the park is not in good condition as well.

Segment 3: No such public and open spaces present in this segment.

#### **d. Visual identity**

Segment 1: NRNA park has acted as a visual identity of the segment. It is visible from a distance giving a visual identity and people even from segment 2 and 3 are found to visit this park. The park has acted as a connecting factor – river connecting the city in the people. Segment 2 and Segment 3: No such particular visual identity in both the segments. Lack of connection to then river.

#### **e. Road and its infrastructures**

Another important criteria for any kind of riverfront development is the road and its infrastructures as it contributes a lot in connecting the river with the people. 8 m road on all the three segments but the condition of road on all the three segments not that satisfactory on both the sides of the river even lacking street light on some major parts. Some portions are in a very critical stage even causing inconvenience to the pedestrians and passersby and also leading to other problems like waste being collected, creating pollution etc.

**f. Pollution**

River and its landscape have been extremely displeased almost in all the three segment of the site area – unpleasant and disturbing the urban environment.

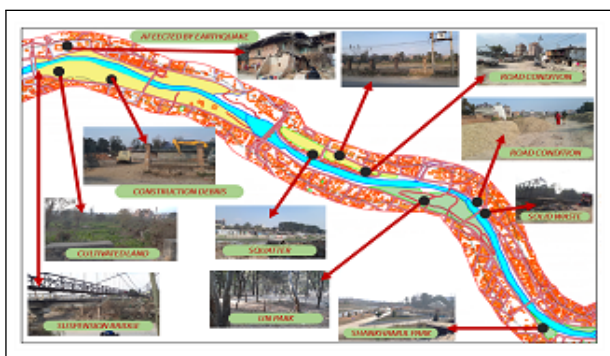


Figure 5: Existing Scenario

**9.1.3 People**

To obtain local people’s perceptions and their satisfaction of the waterfront and the river corridor landscape, some specific questions were prepared and taken into consideration. In this way, it was decided to have a conversation with local residents who were old enough to provide information about the past condition and history of the river which played a major role in this research for the understanding the context of the present as well as future. The questions included different sections related to Bagmati river and its corridor such as natural and physical elements related to the river and its landscape, socio-cultural aspects, economic aspects, changing scenario and its development. Figure 5 shows most of the people visit Shankhamul NRNA Park for their daily different activities rather than other places nearby. People of this segment and the entire segment has proven to be benefited and developed with its establishment.

In context of people in river-city and people, four things are important:

**1. Place of identity:** Relationship and connection between the site and its context. A place needs to be relevance in both individual and cultural level. In individual level, a place must satisfy the need. In cultural level, a place should be corresponding with norms and practice.

**2. Social connection:** Relationship and connection between the site and its context. A place needs to be relevance in both individual and cultural level. In individual level, a place must satisfy the need. In cultural level, a place should be corresponding with norms and practice.

**3. Place potential** Visual-artistic Quality (Visually pleasing, strong character) Social-usage Quality (Connections, functions, safety) Making Places Quality (Accessibility, inclusiveness, maintenance)

**4. Responsive characters:** Comfort, Relaxation and/or liveliness, Passive and active engagement, etc.



Figure 6: Segment 1: People Visiting Different Places

Comparing to all the three segments of the case area, presence of recreational parks (especially NRNA Park in Shankhamul ghat area) in segment no. 1 which was built recently is the only change in this segment but has contributed a lot in its development creating a place of identity and also has been proven that people from other segments also visit this park from the survey performed during the research work. This recent change has been successful in connecting the river with the people living in the city. It has given people an opportunity for various functions from social interacting space to numerous entertainments for the children in the park.

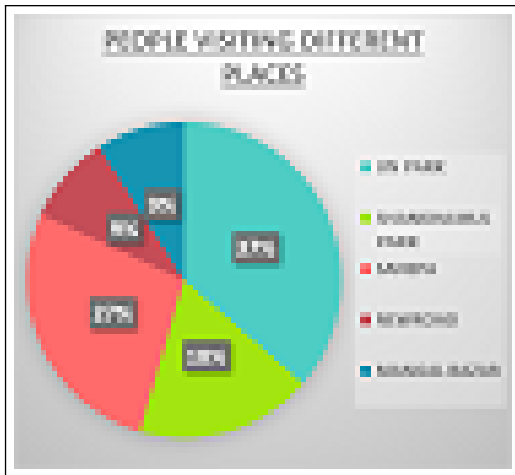


Figure 7: Segment 2: People Visiting Different Places

But the case is not similar in other segments i.e. segment 2 and 3. Despite of the potential especially in segment no. 3 having much vacant land the area has not been utilized properly and river encroachment level is also very high. There is a lack of disconnection between the river and people. If the open spaces were utilized properly these spaces could also have been lively as segment no. 1

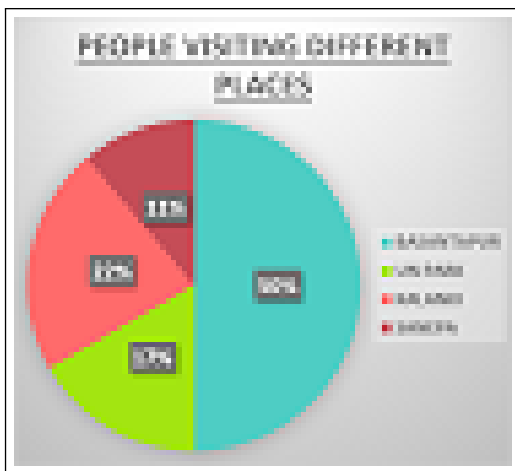


Figure 8: Segment 3: People Visiting Different Places

Comparing to all the three segments of the case area, presence of recreational parks (especially NRNA Park in Shankhamul ghat area) in segment no. 1 which was built recently is the only change in this segment but has contributed a lot in its development creating a place of identity and also has been proven that people from other segments also visit this park from the survey performed during the research work. This recent change has been successful in connecting the river with the people living in the city. It has given people an opportunity for various functions from

social interacting space to numerous entertainments for the children in the park.

But the case is not similar in other segments i.e. segment 2 and 3. Despite of the potential especially in segment no. 3 having much vacant land the area has not been utilized properly and river encroachment level is also very high. There is a lack of disconnection between the river and people. If the open spaces were utilized properly these spaces could also have been lively as segment no. 1

## 10. Analysis

### 10.1 Analysis of three Segments: Segment 1, Segment 2 and Segment 3

#### 10.1.1 Segment 1: Shankhamul to Dhobikhola Bridge

One of the major findings of the research was the establishment of Shankhamul NRNA park which was established only 6 months ago. And this recent change near the river or the riverfront development has made the entire area and the people living nearby benefited from it and made the area so lively than before. The one and only change which is clearly visible to all and hence making Segment no. 1 distinct and developed as compared to Segment no. 2 and 3. The NRNA park as a riverfront development has been acted as important bridge connecting people of that area as well as other area also and Bagmati river. Presence of the park gives a perfect example of the Riverfront development with a point of view of River - City – People linkage and also proper utilization of the open space of Bagmati corridor giving several benefits to the place, city, river and the people living nearby. Some of them are as follows:

1. A visual identity or visual connection from far and attracting people
2. River has been accessible to the people
3. To some extent pollution has also been reduced
4. It has been a place for social interaction making the place livelier than before.
5. A good connection can be observed between River – City – People with this park.

#### 10.1.2 Segment 2: Dhobikhola to Thapathali Bridge

UN Park is the only one green space area for the entire segment but not found much is use. Large



portion of land has been occupied by the illegal settlers (Squatters or Informal Settlement) since long time back occupying of such land has been increasing year after year which is uncontrolled. This is one of the very reason river being polluted in this area and giving bad aesthetic affecting the urban environment and the people. By ignoring this critical issue any kind of river front development is not possible in this segment. Government has also been totally ignoring on this very serious issue. Proper management and resettlement of these illegal settlers should be carried out without any further delay for the purpose of cleaning purifying and beautifying the river. Some of the major problems of the segment area as follows:

1. Lack of green space or recreational parks as present in Segment 1 (NRNA Park – Proper utilization of the river corridor as riverfront development)
2. River has been accessible to the people Absence of social gathering spaces
3. Solid waste deposits and construction debris haphazardly specially in the Dhobikhola Confluence.

Due to these reasons there is found a disconnection between the River – City – People. Some sort of connection and linkage was found in segment 1. But in this segment, there was absence of connection. People of this segment were also found to use the NRNA Park for their daily activities.

### 10.1.3 Segment 3: Thapathali Bridge to Teku

Some of the major problems of the segment area as follows:

1. Despite of the potential it has huge lack of green spaces. Maximum vacant plots can be found in this segment.
2. No social gathering space were people can interact and connect
3. And in this segment the problem of river encroachment is very high.
4. Condition of the road in this segment is one of the major reasons of river and its corridor being polluted was it has been used for land fill purpose.

Due to these reasons there is found a disconnection between the River – City – People. If there were

spaces such as park or recreational gardens in riverfront corridors where people can interact, spend some quality time, the riverfront spaces can be lively. The river and city and people could have been connected as it has done in Segment one. Thus, it can be understood that even a better space in the river corridor can provide benefits to the locals and help to create a connection with the river and the city.

## 10.2 Analysis of River, City and People connection in each Segment and its importance

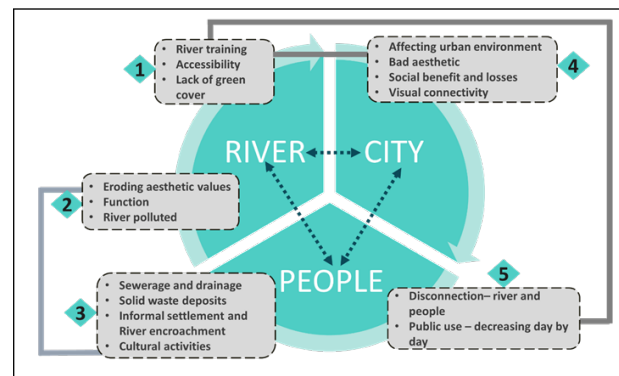


Figure 9: River-City-People Linkage

People are one of the main reasons that the river is being polluted day by day. Different activities of the human beings such as solid waste deposits from different sources, sewage and drainage connecting to river, ignorance, etc. are the main reasons that today the Bagmati river is eroding its aesthetic values, polluted and not functioning properly how it has to be. River is not able to function properly. Only a healthily functioning river can effectively combat pollution without compromising its quality.

On the other hand, river has other problems as well such as lack of river trainings in almost all the three segments. River cannot be properly accessible by the people in most of the segments, especially in segment no. 2 and 3. Due to which there has been disconnection between the people and river. And this disconnection is very unhealthy as it affects the urban environment of the city. Public use of the river and its corridor has been decreasing day by day. If proper attention and creation of spaces for riverbank beautification and its development is not given the condition of the river and its bank will be worst in the future. And for the development of all the three elements should be equally considered. The problem and the issues related to the river directly affects the

city affecting the whole urban environment of the place and ultimately affecting the people living in the city. These three are the vital components of the chain of life cycle. It is a cyclic chain. These three components equally important and with the absence of one other two cannot exist or developed. Therefore, these three elements in any kind of riverfront development plays a very vital role for its success.

## 11. Discussion

One of the major findings of the research was the establishment of Shankhamul NRNA park which was established only 6 months ago. And how this recent change near the river has made the entire area and the people living nearby benefited from it and made the area so lively than before. The one and only change which is clearly visible to all and hence making Segment 1 distinct and more developed than segment 2 and 3.

River-City-People are very closely interconnected with one another and playing a vital role in any kind of waterfront development of any place. By passing any one of them, the other two cannot be exist or developed. Problem of each dimension and each area should be solved simultaneously in order to achieve sustainable waterfront development. In this research, analysis of the Bagmati river from the perspective of River (natural and physical features), City and people locating in urban area has given a brief background about the site landscape giving the information about what exactly is happening in the Bagmati River and its corridors and the problem facing by the river, city and people.

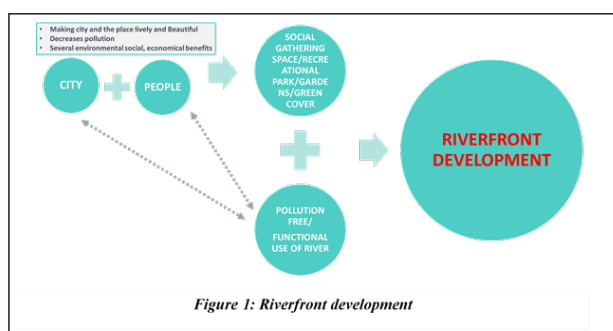


Figure 10: River Development

Although the condition or the problems or the issues of the river and its corridor seems to look similar from the top in each segment but each of them is different from one another. The problem or the issues of the river, city and people are very closely interconnected with

one another. The problem and the issues related to the river directly affects the city affecting the whole urban environment of the place and ultimately affecting the people living in the city. Acting as a cyclic chain. These three components equally important and with the absence of one other two cannot exist or developed.

Any kind of riverfront development projects consist of two things. They are:

1. Pollution free and functional river
2. Recreational riverfronts: social gathering space with greenery and multi-functional making the river and river front lively connecting people with it

Low quality of water in the Bagmati river has conveyed a negative feeling to the public. They do not want to spend their leisure time near the river or the riverbanks. In addition to it, there are not such kind of recreational space as well especially in two segments of the case area (Segment 2 and 3). People have no reason to go near the river and its corridor. And in this way day by day the connection between the nature and the people is decreasing. Segment no. 1 has set a very good example with the presence of Shankhamul NRNA park because the river is polluted in this segment also but still people are attracted to the park and they are found to spend time in the park. Also, the park has also contributed in the reduction of the environmental pollution than before.

These types of spaces should be established in other segments as they contribute a lot in connecting river with the people living in the city as well as beautifying the river and city and contributing in the urban development.

## 12. Conclusion

In the research it was found that the three segments: Segment 1, 2 and 3, the condition of the river was same and had different reasons behind the polluted river and the surrounding but also differed in the availability of the green/social gathering riverfront areas. The segment which had riverfront areas near the river had significant affect in that locality and creating a drastic change and making it different from the other two segments. Kind of connection could be noticed in segment number 1 but whereas in the other two segments, it was missing. These kind of riverfront spaces seems to be relevant in fostering the mental

health status of the people living there as well as connecting people with the nature. Sustainable and green river front provide natural corridors and environments in urban areas, along with recreational areas for social interactions and environmental benefits, transportation and nature education opportunities for urban residents. Vegetation or the green cover area near the river can controls entering the dissolved substances as well as make the river function properly and also making the surrounding atmosphere fresh and healthy benefiting the local residents. But despite of the high potential in terms of the open spaces in most of the segment the area has not been utilized.

River-City-People are very closely interconnected with one another and playing a vital role in any kind of waterfront development of any place. Research of this particular section of the Bagmati river, has tried to draw the attention about the importance of human-social dimension related to the river projects. Solving the problem of the river and its bed and its surrounding landscape with no care of the residents' dimension will lead to decreasing and disturbing the place identity, valuable sense of belongingness, and the meaning and unique memories related to the rivers. Each and every dimension river-city-people should be studied and explored properly for the proper and sustainable waterfront projects. The main objective of the research was to explore the urban riverfronts along the Bagmati river banks from perspective of River-City-People for the development of sustainable urban city. Different dimensions and indicator have been studied and analyzed to know about existing scenario, problems according to each perspective and cause and affects has also been studied. The research gave a conclusion how River-City-People are very closely interconnected with one another and how each of them the problem should be solved side by side to achieve the goal of sustainable waterfront in case of Bagmati River.

### 13. Recommendation

#### 13.1 RIVER: Restoring river natural appearance

**1. River as A Mode of Transportation** Rivers can also provide a form of transportation as well as recreation. Bagmati river flows through many core important cities of the valley. It can be used as the most efficient spot to provide access to multiple

places of the valley. Our urban transportation routes Kathmandu valley today are experiencing more and more demand every day. Problem of traffic is increasing day by day. People who live in or near cities depend on public transportation to get to work and around the city. Using Bagmati river as a mode of transportation can be advantageous move people and decrease road congestion as well. Having multiple transportation options is always a good way to decrease congestion. Considering future plans for water transportation as opportunities to make connections to water landings.

#### 2. Environment

**Solid waste management:** Identification of strict Solid waste management plan for river corridor especially and should be implemented as soon as possible in order to control the riverside dumping activities.

**Squatter Rehabilitation:** All the Squatter along the riverside should be resettled especially in segment no 3. As Informal settlement of segment 2 (Thapathali Area) are contributing a lot in degrading the river and making it polluted day by day.

#### 3. Sewage and drainage management

Sewage and drainage should be managed so that it does not mix in direct to the river. The sewer running through the river should be diverted to different treatment plants to increase the quality of the water.

#### 4. Others

Construction works should be carried out rapidly as in many areas especially in segment 2 (Dhobikhola to Thapathali) causing inconvenience to the pedestrians and passersby. Reconstruction of the cultural heritages near the river corridor should be carried out rapidly.

### 13.2 City: River and Riverbank Beautification and Development

#### 1. Open Space Planning and Design as Urban Green Public Space

**a. Recreational public green parks** Public access (Accessibility): Waterfront walkway, wooded trails, trailheads, community gathering places, public access corridors, streetscapes, view areas/viewpoints, and many more. Facilities and infrastructure: Children's play areas, site furnishings, benches, lighting, bollards, drinking fountains, picnic tables, bike racks, surfacing materials, fences, signs, logos, educational / interpretive, parking and staging areas, many more.

Most feasible in Segment no. 3 as it has large area of vacant land available which can be utilized for the riverfront development.

**b. Urban Green forestry maximum** Enhancing more vegetation in the form of urban forestry. Natural forestry can be developed with different plant species. These spaces or the garden can come with a mediation area which will provide urban citizens an escape into vast greenery in the heart of a sprawling metropolis.

**c. Organic Farm or Gardens** Green space can be in the form of organic farmland and gardens also. Managed and planned organic farm can be created especially in segment no. 3 where we can observe huge portion of land on the Lalitpur side of the segment, occupied for cultivation purpose by the local people by encroaching the river. If a planned organic farming can be introduced, the problems and the issues created by the river encroachment issues from the farming will reduce as well as it will be educational creating business innovation and new opportunities.

**d. Visual identity or Place identity or Visual Connectivity** Maintain and enhance local character and history Local identity, elements should be in the form of architectural details, sculptures etc. Locating landmarks at strategic and focal points where required that they may be noticed by people from near and far to suit different scales. Development of the natural environment and revitalization of waterfront and making them visitable and attractive special places. It will attract many people to the River.

### 2. Promoting Public Activities and Events

Sidewalk cafes, street fairs, informal markets and vendors enliven connections – these activities and event will make the river front areas livelier and entertaining as well. Development of different events and activities throughout the year in the waterfront of public and private initiatives. People will able to connect with the river and the area along the river side. Creation of high-quality public spaces in which people can spend more time and interact and shop. The problem regarding haphazardly kept footpath markets in the Kathmandu valley such as Newroad, Ratnapark, etc. will be diverted to the Bagmati corridor area, creating fixed job opportunities to people and also will help the local bodies to manage the footpath area of the valley.

### 3. Removal of Encroachments, And Restriction /

### Banning of Undesirable Activities

All public land on the riverbank needs to be cleared from encroachments and constant watch must be kept to ensure that it is not re-encroached. And these spaces should be used and made available for riverbank beautification and development projects. This is most feasible in segment no. 3 as the river encroachment is a very high as well as it much vacant land. After the removal of these space only assignment of land for riverfront beautification and development projects can be carried out smoothly and rapidly.

Certain undesirable activities like, open defecation, disposal of solid waste, dhobi ghats, etc. can also be found in and is the problem of each segment and these should eventually be banned in both public and private lands on the riverbank. Certain undesirable activities like washing of clothes, wallowing of cattle, throwing of floral offerings, etc. must be discouraged.

### 13.3 People: Community based development

Awareness programs regarding the importance of river, solid waste management, etc should be done in the community level with participation of maximum number of people. Public participation: Timely surveys should be carried out by the government in order to know about the public's reactions regarding the proposed actions or policies [6].

## References

- [1] Maria EI Shrestha, Junun Sartohadi, Mohammad Kholid Ridwan, and Dyah R Hizbaron. Urban energy scenario: the case of kathmandu valley. *Journal of Engineering and Technological Sciences*, 49(2):210–224, 2017.
- [2] Irny Suzila Ishak and Rose Alinda Alias. *Designing a strategic information system planning methodology For Malaysian institutes of higher learning (ISP-IPTA)*. Universiti Teknologi Malaysia, 2005.
- [3] G Amola. Contribution of waterborne public transport to sustainable waterfronts. *Stockholm: Department of Urban Planning and Environment*, page 6, 2009.
- [4] H Bertsch. The key elements to successful waterfront design. *Real Estate Weekly*, 54, 2008.
- [5] John Mingers. *Multimethodology: Mixing and matching methods*. 2001.
- [6] Azlina Binti Md. Yassin, Sandy Bond, and John McDonagh. Developing guidelines for riverfront developments for malaysia. *Pacific Rim Property Research Journal*, 17(4):511–530, 2011.