

**URBAN CANAL PALCEMAKING AS A TOOL TO  
POLLUTION REDUCTION: A CASE STUDY OF THE  
KABUL RIVER CANAL, PESHAWAR**



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## THESIS ACCEPTANCE CERTIFICATE

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I certify that this research work titled “*Urban Canal Place making as a Tool to Pollution Reduction: A Case Study of the Kabul River Canal, Peshawar*” is my own effort. This research has not been submitted anywhere else for evaluation. The substance that has been utilized from other sources it has been properly referred.

Signature of Student

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MS URP, BATCH 2016

## DEDICATION

*To my beloved parents and family*

## ACKNOWLEDGEMENTS

I am thankful to my Allah Almighty to have guided me throughout this work at every step

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## LIST OF ABBREVIATIONS

KRC	Kabul River Canal
CBD	Central Buisness District
PDA	Peshawar Development Authority
KMO	Kaiser-Meyer-Olkin
COD	Chemical Oxygen Demand
BOD	Biological Oxygen Demand
OPDC	Old Oak and Park Royal Development Corporation
WHO	World health Organization
COD	Canal Oriented Development
NUST	National University of Sciences and Technology
IESE	Institute of Environmental Sciences and Engineering
NEQs	National Environmental Quality Standards
GCC	Gulf Cooperation Council
CFD	Computational Fluid Dynamics
LID	Low Impact Development
PPP	Public Private Partnership
CPS	Canal Placemaking Study
ASAB	Atta ur Rahman School for Applied Biosciences

## CHAPTER 1: INTRODUCTION

Canals are the main features of urban infrastructure and urban form in developed countries over the world. They serve the city economically, socially, and aesthetically. The waterfronts have a very major role to play in the development of a region. Pakistan being an agricultural country has one of the largest canal systems in the world which is spread throughout the country. There are two major types of canals based on their usage, i.e. Aqueducts, and waterways. These canals serve the purpose of irrigation in rural areas and help in maintaining the water table of the adjacent areas. Similarly, this canal system like other provinces exist in Khyber Pakhtunkhwa under the Provincial irrigation and drainage authority. There are two major canals in Peshawar i.e. the *Kabul river canal* and the *Joya shaikh* canal. The Kabul river canal is a gravity canal as the water flows on the principles of gravity in this canal. The Kabul river canal is the focus of study because it passes through the core of the city and different build up areas including commercial and residential. This research will mainly focus on two phases first it will highlight the pollutions of the Kabul river canal, how these are polluted, the water quality of these canals and the adverse effects of these polluted waters on the adjacent communities and in the second phase the research will focus on the solutions and recommendations for the reduction and prevention of these canal waters pollution in addition the second part will also include designing facilities and infrastructure.

## 1.1 PROBLEM STATEMENT

Peshawar is a beautiful city which is gifted with a beautiful geographical location and abundance of water. This water is channelized through different canals through the city. Talking about these canals and waterfronts which have the tendency to transport and carry abundance of water have not been addressed properly. So much so much so that by usurping their right of way, housing societies are constructed alongside these canals and their sewerage is channelized to these canals resulting in polluting agricultural water and producing unhealthy conditions in the areas dependent on these waters. Other than that, illegal encroachments have been made on the banks of these canals which affect them visually and environmentally. Moreover, these canals are mostly used for dumping garbage and trash which is again doing a lot harm to the environmental conditions of the city. No research has been made so far on the development of waterfronts and these canals in Peshawar.

## 1.2 RESEARCH QUESTIONS

After a thorough study the following research questions were set as a baseline for further study which are as follows

- ❖ How to identify the factors that are responsible for the pollution of Kabul river canal in Peshawar?
- ❖ What strategy should be adopted for assessing the existing pollution level and water quality of these canals?
- ❖ How to determine the effects of the polluted canals on the adjacent communities?
- ❖ Which type of designs and planning should be put in place to make the area around the Kabul river canal clean and conducive for living?

### 1.3 OBJECTIVES

Keeping in view the issues mentioned above in the problem statement, an initiative for the study will be taken which will be based on the following objectives

- ❖ To identify the factors causing pollution in the city canals.
- ❖ To assess the existing pollution level of the city canals
- ❖ To analyze the impacts of polluted canals on the adjacent communities.
- ❖ To suggest designing of such facilities and infrastructure which help in making the area around the canal clean and conducive for living

### 1.4 DELIMITATION

The focus of this research study was to explore the causes of pollution in Kabul river canal and suggesting facilities and infrastructure around it. It is a lengthy canal but for the purpose of this research only that part was considered which flows through the urban area of Peshawar

### 1.5 SIGNIFICANCE OF THE STUDY

This research work is innovative in many ways. Primarily it is an addition to the existing body of knowledge of this discipline. Both of its components i-e identifying causes of pollution and designing required infrastructure, are equally important to society, government, and policy makers in public and private sectors. Since no research has been conducted so far on this theme, therefore it could be a model which can be replicated in cities with canals flowing in their midst in Khyber Pakhtunkhwa and all over the country. In fact, no research work is a final word on a specific theme, rather it leaves ample room for further enquiry and investigation. As such this research may be a steppingstone for prospective researchers on a similar theme.

## CHAPTER 2: LITERATURE REVIEW

Canals from centuries have played a vital role in agriculture and are a source of water for agricultural land (Farrington 1980). Earlier the canals were only limited to agriculture but with the passage of time canals and its surrounding and adjacent areas were occupied and people started residing by the waterfront. The waterfronts changed with time with the demands of new users. The current pattern of waterfronts over the world is basically the continuation of this phenomenon (Wrenn 1983).

In the initial form of waterfront development started when different societies started using the waterborne forms of transit. This means that not more than 50 years ago, waterfront development in the urban scenario occurred where relief was favorable to harbor and shelter. Some examples of the waterfront settlements are as following, The Londinium roman settlement that later became London, UK. It was established as early as 50 AD on the river Thames. Similarly many more urban settlements were established on waterfronts that had the potential such as Bahia in Brazil , Falmouth in UK and Mumbai in India (Davidson 2009).

Urbanization occurred and many cities were built by water fronts and some became home to canals. The city of Amsterdam is a great example that has utilized the canal in such a way that it complements the city-built form, Canals were treated in such a way that they revolutionaries the city-built form by adding aesthetics to the environment. And since then canals and waterfronts in cities have had a huge impact on the cities.

When a waterfront development plan is initiated in any city it takes in to loop all the stakeholders and city developers to identify and develop the places that has the potential in such a way that they satisfy the shared community goals, By planning waterfront around public spaces we should

keep in mind that the new design should enhance the standard of the existing destinations which will result in the identity of the whole city rather than a part of it(Mustafa 2017).

The development of waterfront has always been different and unique from general urban development. In the past times many additional resources were provided by the waterfront , things such as the disposal of waste, energy and transit have always resulted in the process of development of waterfronts throughout the world and creating distinctive urban landscapes (Davidson 2009). Pollution is a potential threat to canals and water fronts. Experts are of the view that pollution of canals is mainly due to anthropogenic factors. These factors include urbanization, along with industrial and agricultural activities (Boskidis, Gikas et al. 2010).

Some cities have more than one canals flowing through them. One of them is the capital city of the Khyber Pakhtunkhwa province i-e Peshawar. Peshawar is a home to two major canals, *The Kabul River Canal*, and the *Joya Shaikh Canal*. This study focuses on the pollution along the Kabul river canal as due to rapid urbanization and increase in population the areas along the canal have polluted the canal to a great extent. Some articles were studied in the context of canal development that emphasized on canal development and how different structures can improve the status of the canal how public private partnerships can be established in promoting or developing the canal.

The main aim of this article is to distinguish the social effects of urban waterfront development. For this reason, four distinct measurements of social effects in urban waterfront development are displayed: assets and character, economic wellbeing, access and exercises and waterfront encounter. The four social measurements allude to the diverse methods for encountering and utilizing the edges of the ocean, lake, or waterway to make a comprehension of their

characteristics to the network. The substance of this typology is shown by dissecting some fundamental highlights of three distinctive recently assembled waterfront regions in Helsinki.

This study proposes to build a GCC structure over the canals of the city area to Tackle the surface runoff in the tropical season. two types of structures are proposed. one was fully covering the canal and the other was proposed semi covered in order to allow sunlight to incase the water quality is affected by the absence of sunlight. The study tells us that the LID technique can be put to work despite having limited availability of space. This study is of Phoenix Arizona a desert city that is being built for cars. But there is a great possibility of promoting walkability in the already built environment of the city. This can be done in the form of development of the canals which transverse the 181-mile built environment of the city. This development provides a unique opportunity for pedestrian nodal development and possible strategic locations. The study tells us that COD has a great importance in the development of a city.

This study emphasis on the importance of PPP in waterfront development projects its states that , “As of late, the pattern of urban turn of events and development is to coordinate the open private asset and capital so as to guarantee the attainability and congruity of venture execution. The huge, scaled waterfront recharging has been the primary attribute of world exhibitions and assumes a significant job in PPP advancement. In this research we have seen the how chance administration is associated with waterfront improvement. The hazard actuated and shared will rely upon how included the members are in the venture and on the money related plans used to subsidize any given undertaking”.



This study highlights on the impacts of water body on the warm atmosphere in the encompassing zone, it further includes that the water body improved the nearby warm atmosphere in the encompassing territory particularly on water fume dissemination and temperature. Consequently, this paper, producing the water results and factor examination as the exploration object, in view of the CFD technique, key components were investigated which impacting warm and moistness condition in the waterfront zones. The components for the most part talked about in this paper are building type, building floor territory proportion, dike tallness, good ways from water body, and finishing. Each factor incorporates five levels. The outcomes showed that the impact sizes of warm and stickiness condition were profoundly reliant on the calculation of ventilation display in the local locations of the waterfront. The outcomes additionally showed that the temperature in territory with the low plot proportion and huge ventilation exhibition was all the more effortlessly influenced by the waterbody.

## 2.1 CAUSES OF CANAL POLLUTION

The pollution of canals is mostly due to anthropogenic factors, such as urbanization, and industrial and agricultural activities (Boskidis, Gikas et al. 2010). The most important non-point source polluter is agriculture, which enriches these canals with nutrients (phosphorus and nitrogen), deposits and pesticide remains (Gikas 2014). In many developing cities pollution from sewerage is one of the main issues because it creates alt of health and environmental pollution issues. The quick growth and urbanization has resulted in the discharge of un treated waste water, adding to it the mass abstraction of irrigation waters , water for domestic and industrial use are the main causes of water quality degradation (Badhuka 2012).

Animal and industrial waste goes directly in the canal. The animal waste is not only a source of fertilizer but is also a convenient method of waste disposal. The disposal of animal waste is a more likely source of water degradation. Canal water pollution and human health are of great concern when we consider the fact that large quantities of animal waste are deposited (Hill, Owens et al. 2005). Discussing the sources and causes of pollution, solid waste and plastics are also the main source of pollution in the canal. The canals running between the midst of Peshawar have turned into garbage dumps They are a cause for concern given the environmental and health concerns. Canals in the city are brimming with organic and solid waste (Qayyum 2016).

## 2.2 EFFECTS OF CANAL POLLUTION

*Agriculture:* This in turn is affecting the agricultural lands that it irrigates after it leaves the city. Contaminated water used for irrigation is a source of pollution for agriculture lands. Most of the water we use comes from canals, ground water reservoirs and rains. And plenty of it is clean drinking water. And other is polluted with organic compounds and heavy metals. This is because the local bodies of water and canals are deposited with industrial and agricultural waste. Which results in the crops exposed to water are contaminated. Agriculture pollution becomes a hard nut to crack when it succeeds in poisoning livestock and causes crop failure (Rinkesh) (Ergas, Sengupta et al. 2010) (Naramngam and Tong 2013).

*Human Health* The disposal of sewage waste has a direct impact on people's immediate environment which leads to water borne diseases like diarrhea which alone kills 3-4 million kids every year other water borne diseases could kill 135 million people by 2020 (Gleick 2002). The primary intense infection hazard related with polluted drinking water in developing

nations is because of understood infections, microscopic organisms, and protozoa, which spread by means of the fecal oral route. As indicated by WHO records of infections due to water are at the top of the list, with cholera as the following most incessant illness, trailed by acute diarrhea, legionellosis, and typhoid fever. It is disturbing that, after a nonappearance of just about 100 years, cholera returned in Africa and represented 94% of the revealed worldwide cholera cases in this period. Notwithstanding cholera, the most waterborne cases were due to (para)typhoid fever. Additionally, many other diseases are regularly found related with lack of water supply and cleanliness (Schwarzenbach, Egli et al. 2010).

## 2.3 CASE STUDIES ON CANAL PLACEMAKING

### 2.3.1 Grand Union Canal London- Canal Placemaking Study

#### *Introduction & context*

The Grand Union Canal in Old Oak and Park Royal Development Corporation (OPDC) is one of the most important and underused properties in the OPDC area. It has all the features to be a wonderful place and a key element of the future achievement of the OPDC.

The Nearby Arrangement for the OPDC zone gives a progression of strategy snares for the Canal Placemaking Study (CPS), illustrating three key capacities for the channel which will be the core values to be created inside the CPS:

- A functional waterway, giving vehicle capacities and space to moorings over an assortment of employments, among others its potential for cargo transport uses.

- A recreation goal, with an attention on municipal uses, for example, open space, perpetual and transitory relaxation utilizes, private and network foundation, and a connector between various neighborhoods.
- A natural resource, as far as its incentive as ecologic passageway between bigger green spaces, its situation inside the Thames watershed, and as a major aspect of a system of biological system administrations.

*The Canal Placemaking study*

The CPS will as a matter of first importance unite and draw on the many existing methodologies, planning and design studies as of now set up inside OPDC, for example, the Neighborhood Plan, the Old Oak North and Park Imperial focal masterplans, the Open Domain procedure, and the Early Enactment Program. It will fill the holes where necessary, give extra work and detail where valuable and applicable, and give a vision to the grand union canal as a sustainable help for the redevelopment of the OPDC zone. It will concentrate on three key parts:

- The canal as a waterway: investigating open doors for private, visitors and business moorings, and in significant level terms, giving standards to recreational drifting and cargo.
- The towpath and nearby open domain: regarding its arranging, access and job as a person on foot and cycle course, and wayfinding.
- Advancement nearby the canal: best practice to guarantee that the plan of residential, blended use and industrial developments overseeing the canal react to and improve its setting

## 2.4 CHALLENGES IN PLACEMAKING PROJECTS

This is a basic human psychology to shape his surroundings according to his needs, Placemaking is often is hard to sell. It is surprising how you go through so many things to accomplish project goals. With public resources and community participation not being there its hard to convert public money and time to placemaking. The creation of new public spaces is often treated as a luxury in a time of scarcity, or a single issue in a crowded political environment.

It is highly unlikely around it: numerous placemaking endeavors require significant investment and loads of it. Indeed, even with the field's present grasp of the strategic and the brief, numerous ventures set aside some effort to gather the correct partners, to consider the unique circumstance, to carry networks to agreement, to fabricate political help, and to raise assets, and this occurs before the "scoops hit the ground." The procedure is regularly riotous and moderate—anyway this very untidiness that can be irritating and overwhelming likewise empowers network building.

Unease, and the desire for moment satisfaction, are extraordinary foes of numerous placemaking ventures. Media inclusion, which such a significant number of tasks urgently court, can regularly worsen the issue, as intricate ventures are diminished to a basic account that is then repeated until it is comprehended as reality while subtleties are disregarded. It takes effort to see and measure the genuine effect of spots and procedures on their networks. Repeatedly, a placemaking task will be immediately regarded a "triumph" or a "disappointment" rashly, and the long-term exercises will be unacknowledged.

## 2.5 PLACEMAKING IN AN ENVIRONMENTAL CONTEXT

Placemaking is the management of open spaces. In that capacity, it is one of the most noteworthy tools in exhibiting how environmental change impacts us all. This is on the grounds that our open spaces are the primary spot we see the immediate effect of natural issues on our lives. They are the places whose variances can be seen on a human and relatable scale. For example, when vehicles are prohibited from the street, we quickly observe the impact on our environmental factors and on individuals' mentalities to the space.

Placemaking works best when we believe our open spaces to be of equal importance as our homes and work environments. They are the spaces that keep us associated with nature, particularly in downtowns, and they are where we share encounters with others. So they should be appropriately managed to profit all partners.

Just as improving our day by day personal satisfaction, placemaking can be utilized as a groundbreaking instructive device to convey a message to the general population. For instance, workmanship establishments that attract swarms and pass on a more profound ecological importance can be both instructive and Instagram able, while workshops about the effect of our conduct on the earth can be utilized to teach nearby partners.

When seeing open spaces, numerous individuals either dismissal or neglect to see the effect they might be having on their lives. Whenever executed effectively, placemaking can expand the estimation of an open space by overseeing it in a naturally mindful manner. Subsequently, the open begin to see the space from an alternate perspective. It may invigorate individuals' inventive potential, making them watch or communicate with the space in another manner.

Overseen well, placemaking can change a urban no man's land into a profoundly valued space where we can interface with nature and with each other.

## 2.6 PLACE MAKING AS A SOLUTION

All of this is happening because no such efforts have been made to reclaim or develop the public spaces along the canals. The development of well-designed places alongside our rivers, canals and docks can make a significant contribution to the success of the waterways and their ability to deliver more active, socially engaged and healthy places (Gobster, Westphal et al. 2004).

No efforts have been made on any level to overcome the issue of pollution. This gap was identified and research was carried out on the value of placemaking in reduction of pollution and reclaiming the public spaces along the canal., Well planned and creative placemaking leads to lively public-facing spaces through the purposeful actions of people living in a built environment (Ryan Salzman 2018). Placemaking rose as a developing movement in which residents take an interest in making and changing the spaces they possess with the objective of "strengthening the association among individuals and the spots they share (Toolis 2017).

Along with rivers and harbors, canals have become important sites of waterfront development. canals represent an opportunity to introduce water-driven place-based development and create districts for leisure and recreation centered on dense, walkable environments as well as on economic growth and environmental stewardship (Ellin 2010).

There is a huge potential along the Kabul River Canal to be developed for recreational purposes. But the areas that have potential have either been occupied by encroachers or open spaces are turned to garbage dumps making the scenario worse. Successful places are a product of urban

design that equalizes comfort, sitting, safety, porosity, and walkability. While place-making vibrant urban places must address these issues, it must also attract people to stay at the location, and in doing so, designers must deliberately shape and create a place around images of a particular theme (Carmona, Tiesdell et al. 2010). Placemaking can not only help in creating a healthy environment but can also help in reducing the social and economic issues along the canal. Placemaking includes the enactment of an open space. In certain definitions, innovative placemaking brings nearby expressions and culture into the mix; in others, for placemaking to be inventive it must be artist driven. Still others portray placemaking as characteristically inventive in light of the fact that it includes people (Ryan Salzman 2018).

## 2.7 RESEARCH GAP

After going through the literature, it was observed that there was significant amount of data regarding placemaking and canal pollution. Many researchers have worked on these topics and there is an abundance of research material available. that being said , it was observed that no such research has been made on the identification of canal pollutants and in the same research it has been addressed with suitable solutions and design facilities along the canals that can contribute in the reduction of canal pollution and create a clean and conducive environment for the adjacent communities using placemaking techniques . This gap was identified as a food for thought and a basis for this research.



## CHAPTER 3: METHODOLOGY

This research study conducted is both exploratory and analytical. The tools for data collection for this research were interview schedule and questionnaire. Secondary data will be collected from books, journals, reports, internet, and other published materials

### 3.1 PRIMARY DATA COLLECTION

#### 3.1.1 Site Analysis

The first and foremost thing to start a research is to analyze the site one is working on. For this research, the area selected was Kabul river canal at Peshawar. KRC enters the urban part of Peshawar at *Palosay* area and after a passing through a distance of 14 KMs within the city it exits the urban area at ring road Peshawar near Afridi Garhay. The part of the canal flowing through the urban area will be the focus of study and will analyzed critically according to the research criteria.

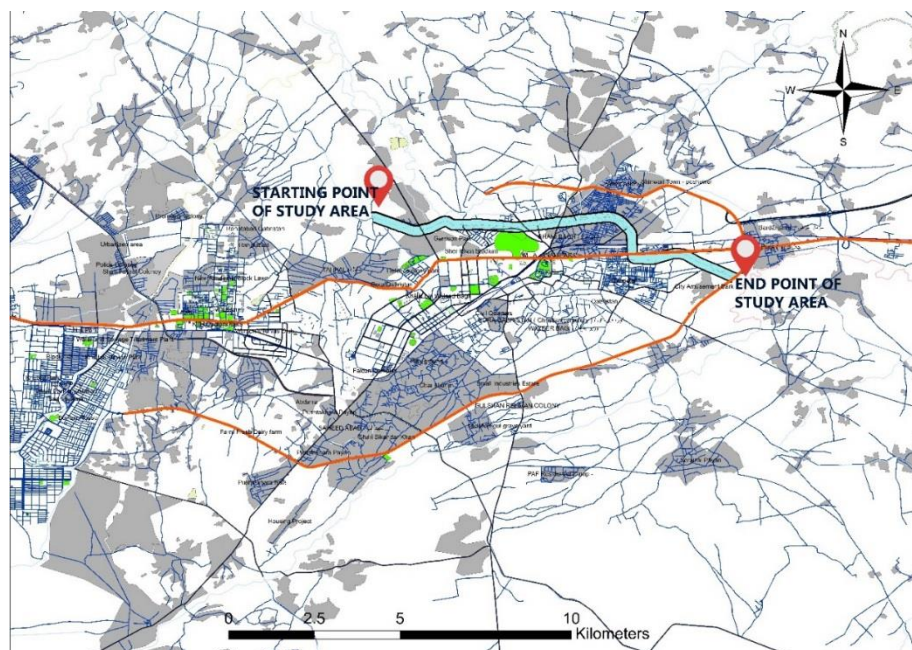


Figure 3. 1 Study Area

### 3.1.2 Water samples

To analyze the existing level of pollution and water quality samples were collected from different parts of the canal, A total of 5 collection points were identified on the basis of the level of pollution of the area, both the samples of ground water and canal water were collected. The first collection point was from the area where the water is free from pollutants and mixtures, after that the next collection point was from the location where it just enters the city. After that samples from the most populated area were collected. And in the last the samples were collected from the area where the canal exits the urban territory from each spot samples collected were from the canal and nearest ground water source. These samples were then taken to the laboratory of ASAB for testing and to compare them with the ground water samples. Through this, I ascertained whether it was affecting the community or not.

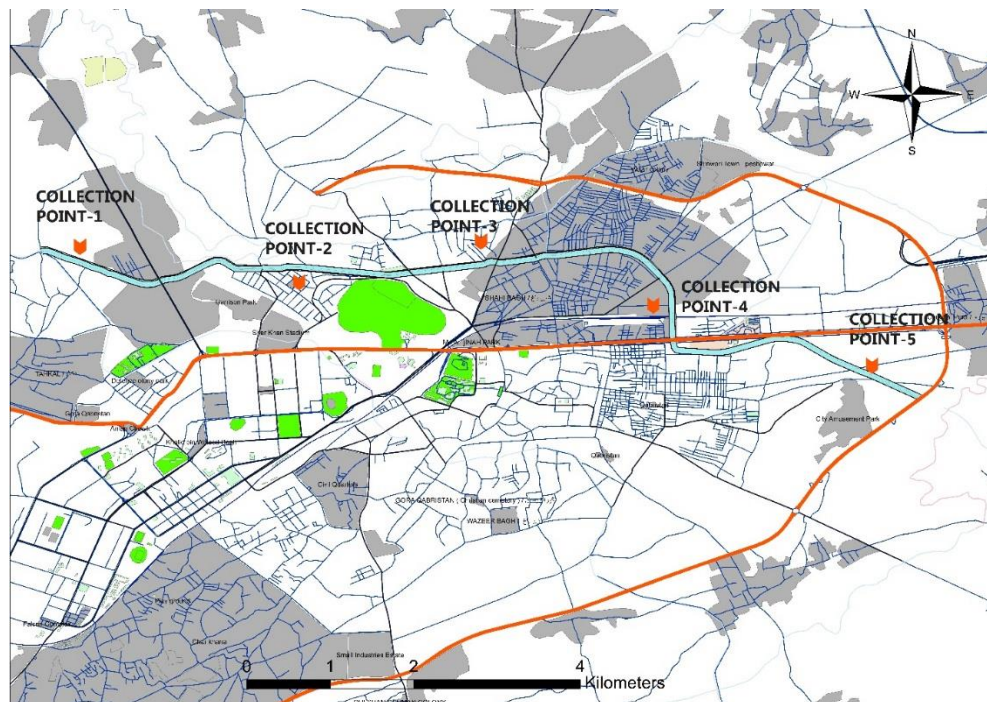


Figure 3. 2 Collection Points of Water Samples

### 3.1.3 Indicators

Several indicators were adopted for this study which are shown in table below. To identify the communities and areas that needed to be developed for placemaking. As all the areas along the Kabul river canal don't have the same features, so the attributes accountable for declining the existing situation of area of study were identified with the help of these indicators. These indicators were helpful in formulating design ideas in the designing stage. These indicators were selected based on literature review of different research articles, journals, and reports on canal placemaking and canal pollution. These indicators were helpful; in developing the questionnaire for the field survey.

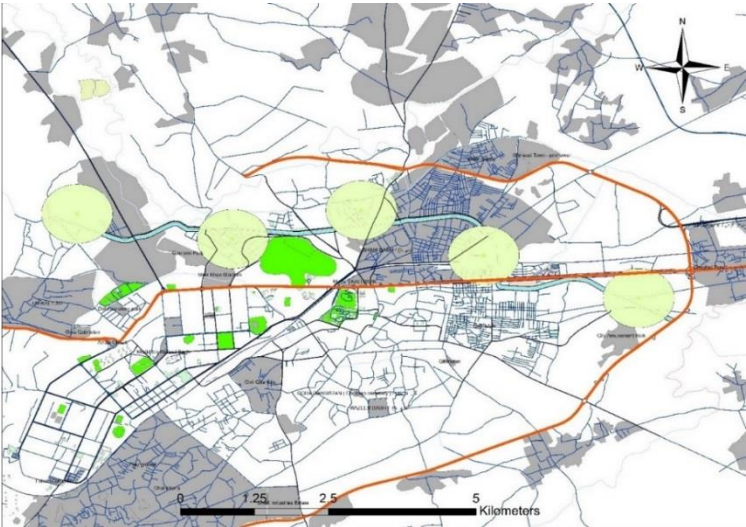
<b>Concepts</b>	<b>Indicators</b>
Land use	Development status of the area
	Type of infrastructure
Sewerage and Waste	Waste Composition of house
	Solid Waste Disposal
	Waste Collection Procedure
	Type of waste deposited in canal
	Sewerage waste Disposal
Ground Water Quality	Waste Contributing factors to Canal
	Canal cleaning procedure
	Availability of filtration plant
	Canal base paving
	Availability of ground water pumps.
Placemaking and development	Provision of clean drinking water to homes.
	Availability of parks and open spaces
	Encroachments on canal banks
	Commercial activity along canals
	Placemaking as a pollution reduction tool
Physical condition of the canal	Type of activities along the canal
	Side Paving
	Canal Road

	Safety Barrier
	Waste Bins
	Plantation
Role of Authorities	Problem solving
	Cleanliness drive
	Sewerage management
	Solid waste management
Recreational Facilities	Parks
	Sitting areas
	Water sports
	Fishing spots
	Boating
	Swimming spots
	Café and Eating spots

### 3.1.4 Questionnaire

A questionnaire containing both open and closed ended questions was designed on the basis of the above-mentioned indicators. It was distributed among the respondents who were end users, people directly associated to the canal and the concerned authorities who are responsible for the development and maintenance of the canal. The questionnaire was conducted within 500m radius of each collection point with a total of 50 respondents per collection point. The GIS map below shows the radius of the area where the questionnaire was conducted.

Figure 3. 3 Questionnaire Conduction Points



## 3.2 SECONDARY DATA COLLECTION

3.2.1 **Theses and Research Papers:** Many theses submitted to various institutions and papers published in different research journals, related to my topic were studied and reviewed. It helped in paving my way forward in research and guided me a great deal in understanding my topic and the complications and dimensions attached to it.

3.2.2 **Books:** Many books were also a part of study that were related to the research topic that included books on urban planning, placemaking environment etc.

3.2.3 **Internet Sources:** Data was also collected from online sources and repositories that included books in soft form related videos and pictures and online maps were also accessed for identifying the site of study.

## 3.3 DATA COLLECTION & RESPONDANT PROFILE

A study survey was conducted along the Kabul River canal in Peshawar through a questionnaire filled from respondents who were residents of the residential areas adjacent to the canals. The respondents age was not restricted but it was decided that only those persons will be interviewed who are aging above 20. The reason was that the questionnaire required opinions and public perceptions. The ranges of the respondents age are mentioned in (table 1) below. The survey conducted along the canal requires population data and that is directly dependent upon the marital status and the growth rate among the people. This data collected in the (table 1) shows that the majority of the respondents are married. Also number of kids is very essential to know as they are mostly the contributors to solid waste .The research that is being conducted regarding pollution in canals and the role of placemaking is directly related to the level of education and how the respondents react and give their opinions regarding the research study along the canal .

This following table also shows the highest level of qualification of the respondents. For a respondent to know the status of the area and the problems existing there, this was a very important question to be asked. The more the number of years spent in the study area by them, the more accurate was the information provided by the respondent.

Table 3.1 1 Respondents Profile

<i>Age</i>	Frequency	Percent
30 years and Below	78	31.2
31-40 years	105	42.0
41-50 years	34	13.6
above 50 Years	33	13.2
Total	250	100.0
<i>Gender</i>		
Male	247	98.8
Female	3	1.2
Total	250	100.0
<i>Marital status</i>		
Single	91	36.4
Married	159	63.6
Total	250	100.0
<i>Number of Kids</i>		
5 and below	223	89.2
6-10	22	8.8
10 and above	5	2.0
Total	250	100.0
<i>Qualification</i>		
Illiterate	22	8.8
Matric	47	18.8
Intermediate	62	24.8
Graduate	119	47.6

### 3.4 EXISTING SITUATION OF THE KABUL RIVER CANAL

During the survey it was observed that the canal is in a worse condition regarding the levels of pollution. Majority of the small garbage disposals were found right on the bank of the canal. That is because of being too close to the canal mostly fall into it. Moreover, many areas and spots were identified where the sewage waste was directly connecting the canal. Though during the survey, it was clear that the authorities had restricted further efforts to connect sewerage channels to the canal, so many areas are still practicing it. Many other factors were identified as the causes of pollution such as encroachment along the canal. Vendors selling poultry and meat products use the canal directly for disposing off their waste. Also, there are animal farms along the canal who also use the canals as a garbage dump.

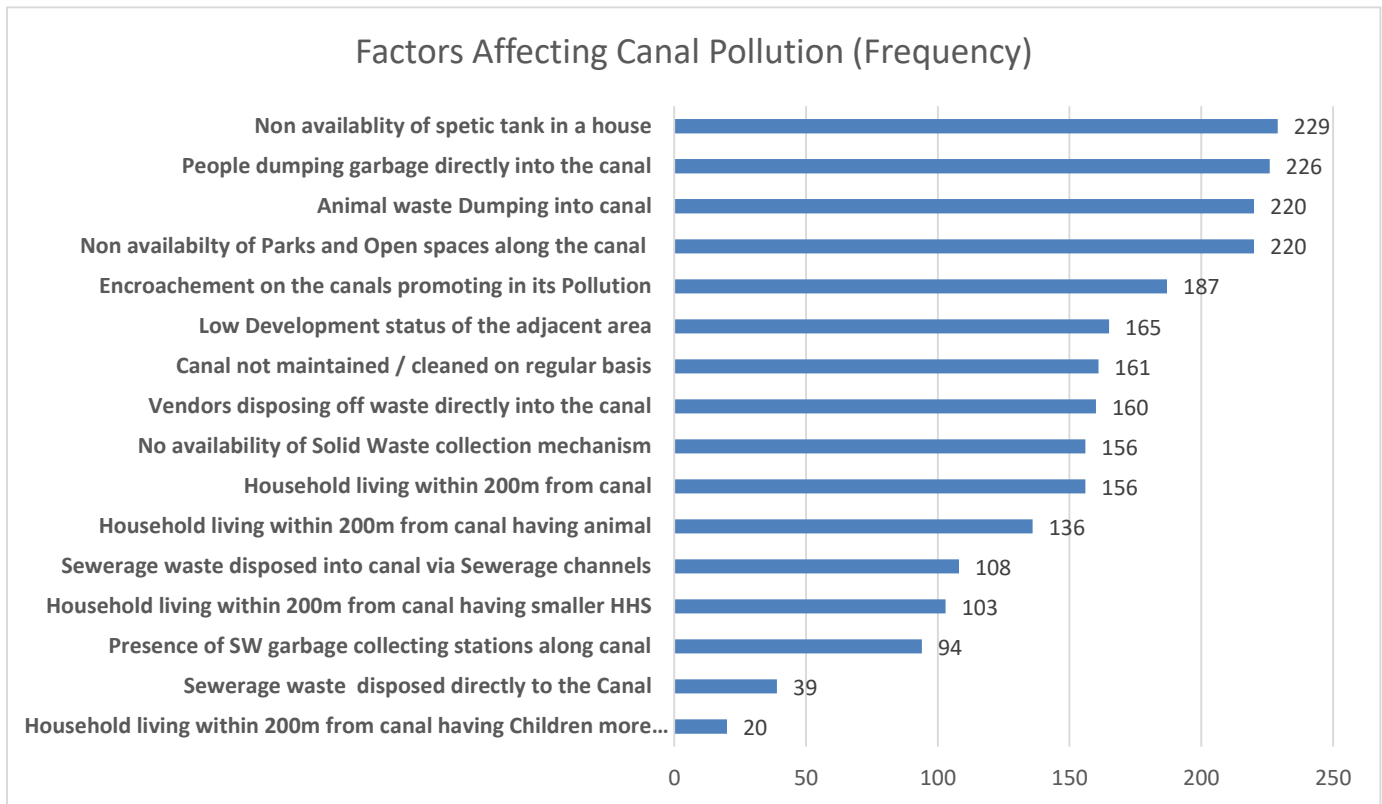
### 3.5 DATA COLLECTION THROUGH WATER SAMPLES AND QUESTIONNAIRE

A study was conducted to know the exact situation and the level of pollution of the canals. For this purpose, samples were collected from different points in the canal. Total of 5 samples were collected. These samples were tested in NUST IESE labs that showed tremendous amount of pollution levels that exceeded the National Environmental Quality Standards (NEQs) by a huge margin.

As mentioned earlier in the next phase a detailed questionnaire based on the indicators that were extracted out of the objectives was conducted from the respondents who were directly related to the canal. The survey lasted for a week and a total of 250 respondents were interviewed from different age groups. The survey had interesting results regarding public perception of how the canal should be and how it can be developed.

### 3.6 PERCIEVED FACTORS AFFECTING THE KABUL RIVER CANAL

Table 3.1 2 Factors Affecting canal Pollution



For the general perception of participants regarding the factors that are directly or indirectly affecting the canal the data was analyzed. a total of 16 factors were identified as the main contributing factors in canal pollution. Some of these factors are very closely linked to each other based on their relation. The values in the table are arranged on their frequency levels from highest to lowest. We see the top frequencies starting from Non availability of septic tanks at home. This clearly is a sign that the sewerage is channelized to the sewer channels which eventually leads to the canals and pollutes it. Out of 250 respondents 229 had no septic tank in their house which makes it 91.6 percent of the respondents having no septic tank at home. The second factor with the most frequency is people dumping garbage directly into the canal that is



of 250, 226 were dumping garbage directly into the canal which is a reason why solid waste has contributed so much and is clearly visible floating in the canal.

Following the solid waste, animal waste is the other big factor in the polluting of canal with a frequency of 220 that is a total of 88 percent animal waste goes directly into the canal. As the canals are not well looked upon, they are taken for granted and give an impression of dirty drainage lanes. There are garbage dumps along the bank of the canal which eventually end up in the canal. Non availability of parks and not utilizing the open spaces is also a reason that the spaces along the canal are underutilized and turned into dumps. Utilization of spaces also ends the problem of encroachment on the canal's vendors start to occupy the spaces. Encroachment leads to canal pollution in two ways, one is the visual pollution as it disrupts the aesthetic view of the canal while the other is the vendors who have encroached the canal bank dump their waste directly into the canal causing the pollution in the canal. Some factors that contribute to the canal pollution are related to poor infrastructure like low development status of the area, canal not maintained on regular basis and no availability of trash cans along the canal these factors also contribute in the pollution if not addressed properly. One major factor that can contribute to the canal pollution is the distance of residential units form the canal, it's a direct relation that is the closer the home the more it will contribute to pollution in the canal. These can be subdivided into sub factors such as described in the table which shows the closer limit of 200 metres from the canal, within this diameter the houses having small Household size, having animals, having more children will be the ones affecting the canal more as compared to the rest of the units.

### 3.7 TEST CONDUCTED FOR WATER SAMPLES

Though many people were of the view that solid waste is a major contributor in canal pollution this fact cannot be ignored that sewerage is also one of the major factors in canal pollution.

Following the commencement of the questionnaire's samples were collected from different sites of the canal under study. These samples were collected from different sites of the canal having more population density as compared to the rest. The samples were collected in autoclave bottles and were taken for test to NUST, Institute of Environmental Sciences and Engineering (IESE) Three tests were conducted i-e the Chemical oxygen demand (COD), Biological Oxygen Demand (BOD) and Ammonia Nitrogen. The results were to be compared with the National Environmental Quality Standards (NEQs). The standard limit for COD was **150 mg/L** and all the collection point values were exceeding the standard. Similarly, for the BOD test the allowed standard limits were **80 mg/L**, there too the values of collection point were almost double the value of the allowed standard value, almost all the points exceeded the acceptable limits. The table below shows the results obtained from the collected samples.

Table 3.1 3 Tests Conducted (COD.BOD, Ammonia nitrogen)

S. No	Parameters	Units	CP 1	CP 2	CP 3	CP 4	CP 5	NEQs
1.	Chemical Oxygen Demand (COD)	mg/L	275	198	252	206	166	150
2.	Biological Oxygen Demand (BOD)	mg/L	188	144	166	158	118	80
3.	Ammonia Nitrogen	mg/L	46	31	42	39	30	40

### 3.7.1 BOD Test Procedures

1. To ensure suitable biotic movement during the BOD test, a wastewater test:
  - o Must be liberated from chlorine. On the off chance that there is proof of chlorine in the example, at that point a dichlorination synthetic must be included before the testing.
  - o Needs to be in the pH go between 6.5-7.5 S.U. In the event that the example is out of this range, at that point corrosive or base must be included as required.
  - o Needs to have a current adequate microbiological populace. On the off chance that the microbial populace is deficient or obscure, a "seed" arrangement of microorganisms is included alongside a basic supplement support arrangement that guarantees microscopic organisms populace essentialness.
2. Specialized 300 mL BOD bottles intended to permit full occupying with no air space and give a water/air proof seal are utilized. The jugs are loaded up with the example to be tried or weakening (refined or deionized) water and different measures of the wastewater test are added to reflect various weakening. At any rate one container is filled distinctly with weakening water as a control or "clear."
3. A DO meter is utilized to gauge the underlying broke down oxygen focus (mg/L) in each jug, which ought to be a least 8.0 mg/L. Each jug in then positioned into a dull hatchery at 20°C for five days.
4. After five days ( $\pm$  3 hours) the DO meter is utilized again to gauge a last broke up oxygen fixation (mg/L), which in a perfect world will be a decrease of in any event 4.0 mg/L.

5. The last DO perusing is then deducted from the underlying DO perusing and the outcome is the BOD focus (mg/L). In the event that the wastewater test required weakening, the BOD fixation perusing is increased by the weakening variable.

### 3.7.2 COD Test Procedures

1. Before finishing the COD test, a progression of realized guidelines are readied utilizing potassium hydrogen phthalate. Most wastewater tests will fall in the high range, so principles of 100, 250, 500 and 1000 mg/L are normally arranged. COD norms can likewise be bought.

2. A COD reactor/warming (150°C) square and a colorimeter are turned on with the goal that the two instruments can settle.

3. Pre-arranged low-extend (3-50 ppm) or high-run (20-1500 ppm) vials are chosen for the COD test dependent on anticipated outcomes. The two territories can be utilized whenever expected outcomes are obscure.

4. One vial is set apart as a "clear," and three or four vials are set apart with known standard levels. Two vials are then set apart for the wastewater test to make a copy run. Note: If different wastewater tests are being run, at any rate 10% of tests are copied.

5. 2 mL of fluid are added to every vial. On account of the "clear," 2 mL of DI water are included. 2 mL of every standard are added to the comparing vials. On the off chance that the wastewater test is tried at full quality, at that point 2 mL is added to the comparing vial. In the

event that weakening is required, at that point sequential weakening are performed, and 2 mL of the weakened example are added to the comparing vial.

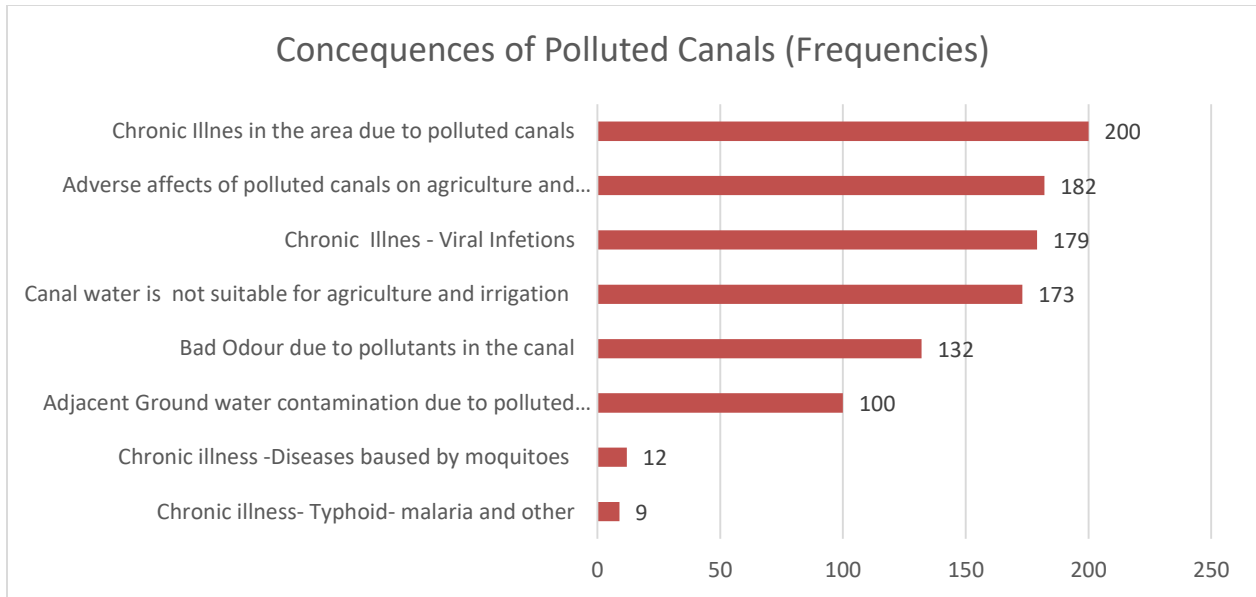
6. Each vial is blended well and set into the reactor obstruct for two hours. Following two hours, the vials are expelled from the square to a cooling rack for around 15 minutes.

7. The colorimeter is set and aligned per the particular directions for that unit (i.e., appropriate frequency, clear and norms) and every vial is put in the unit and the COD fixation read.

8. If the example was weakened, the relating augmentation is made.

### 3.8 PERCIEVED CONCEQUENCES OF THE POLLUTED CANALS

Table 3.1 4 Consequences of polluted canals



We discussed the factors and how they contribute to the pollution in the canal, now as these factors continuously contribute to the canals, they lead to certain consequences that arise due to the pollution of waters and canals. The above table is a post development after the identification of factors and a survey regarding the consequences of polluted canals. As we are of the view that canals in most of the areas are flowing along residential areas or residential areas are developed along the canal vice versa. The polluted water brings along a lot of water borne diseases. The table shows the greatest number of frequencies indicating the illness caused by polluted water and people's perception. 200 out of 250 were of the view that chronic illness in their areas is due to the polluted canals which is clearly an indication that the polluted canals are causing diseases in the adjacent communities. Diseases include viral infections, typhoid, malaria and other diseases related to water. The other adverse effect of polluted canal is the presence of bad odor

in the adjacent areas due to continues pollution of the canal. This also leads to contamination of ground water reservoirs as the canals in some areas are absorbed below by ground which meets with the ground water reservoirs nearby that leads to the diseases. Also, after leaving the city the polluted canal water irrigates agriculture lands which has a bad impact on the agricultural products as well.

## CHAPTER 4: RESULTS & ANALYSIS

After the completion of data analysis some factors that were contributing to canal pollution were identified. First and foremost, thing to do was to check whether the components identified have any significance to be analyzed further. First the Kaiser-Meyer-Olkin Measure (KMO) of sampling adequacy was checked. The value of which was .496 almost equal to .5, normally values between .5 and 1 are considered in this test but this value is close to .5 so it can be considered. If there is any ambiguity regarding this value, then we check the Bartlett's test of sphericity and that is significant when the value is less than 0.005 in this case the test value shoes  $.000 < .005$ . When these tests are proved significant in factor analysis then we proceed further. So, in the next step the total number of the 16 identified factors were reduced to 7 using the dimension reduction technique of factor analysis, the initial 16 factors were extracted based on principal component analysis techniques.

Table 4. 1 Kmo And Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling		
Adequacy.		.490
Bartlett's Test of	Approx. Chi-Square	873.640
Sphericity	df	120
	Sig.	.000



This is the first test conducted in the factor analysis. The results for our given data are highlighted which show that the components selected have significance in the research and can be further analyzed. The first value showing the KMO measure of sampling adequacy shows the value of .490, this shows that the value is almost equal to .5, usually in this case values above .5 and below 1 are considered. But to clear any ambiguities the significance value is checked and if its below .005 then the components are considered significant. Our tables show the Sig as .000. These values prove that the components analyzed are significant.

Table 4. 2 Total Variance Table

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
<b>1</b>	2.328	14.552	14.552	2.328	14.552	14.552	1.896
<b>2</b>	2.103	13.143	27.695	2.103	13.143	27.695	1.860
<b>3</b>	1.639	10.244	37.939	1.639	10.244	37.939	1.743
<b>4</b>	1.533	9.579	47.518	1.533	9.579	47.518	1.599
<b>5</b>	1.309	8.182	55.701	1.309	8.182	55.701	1.414
<b>6</b>	1.156	7.226	62.927	1.156	7.226	62.927	1.313
<b>7</b>	1.059	6.616	69.543	1.059	6.616	69.543	1.302
<b>8</b>	.887	5.542	75.085				
<b>9</b>	.850	5.312	80.397				
<b>10</b>	.748	4.676	85.072				
<b>11</b>	.665	4.158	89.230				
<b>12</b>	.534	3.337	92.567				
<b>13</b>	.407	2.544	95.111				
<b>14</b>	.311	1.946	97.057				
<b>15</b>	.262	1.635	98.691				
<b>16</b>	.209	1.309	100.000				

Extraction Method: Principal Component Analysis.

The principal component analysis technique was used to identify the factors. The factors having Eigen values greater than 1 will be retained. The above table shows the values sorted by size showing 7 of the values having Eigen >1, The table also tells us the collective variance of the 7 retained factors that is 69.5% which shows that the data is acceptable and gives us sufficient results.

Moreover, number of factors must be chosen so that, they can be easily understood. we performed factor analysis for two, three and four latent factors. To understand factor loadings, it is usual practice to rotate factor loadings until a simpler arrangement is attained. There are both graphical and analytical methods for factor rotation. We used the Varimax method which is a famous and accurate rotation method. Table below shows unrelated and rotated factor loadings, based on the varimax method. It segregated the factors into pairs having similarities, in this way 7 clusters were identified, under each cluster certain factors were compiled due to their similarities in their functions. It was observed that all the compiled factors were showing factor loading values greater than .4 all the values below were eliminated based on this criterion.

#### 4.4.1 Satisfaction regarding recreational facilities along the canal

During the data collection phase and conduction of questionnaire an index was designed to know the level of satisfaction of people regarding canal and its surrounding. Also the satisfaction level of people regarding the role of authorities was checked in this regard

Table 4. 3 Satisfaction Index

#### SATISFACTION REGARDING PARKS

---

	<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>	<b>Percent</b>
<b>very satisfied</b>	34	13.6	13.6	13.6
<b>satisfied</b>	9	3.6	3.6	17.2
<b>neutral</b>	13	5.2	5.2	22.4
<b>Un satisfied</b>	71	28.4	28.4	50.8
<b>very unsatisfied</b>	123	49.2	49.2	100.0
<b>Total</b>	250	100.0	100.0	

---

Parks and open spaces are a main element of a residential area , township or a colony and it enhances the living standard of any community , during this survey it was observed that the

study area has a lack of parks and open spaces and it was clearly seen that almost 50 percent of the respondents were not satisfied regarding the availability of parks and open spaces.

**SATISFACTION REGARDING SITTING AREAS**

Every community is based on certain elements and spaces . One of those spaces and the most important aspect are gathering spaces and sitting areas. As the study area was a canal bank so there need to be provision of sitting spaces along the canal. Respondents survey tells us that the people were very unsatisfied regarding the availability of sitting spaces.

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	<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>	<b>Cumulative Percent</b>
<b>very satisfied</b>	10	4.0	4.0	4.0
<b>satisfied</b>	24	9.6	9.6	13.6
<b>neutral</b>	24	9.6	9.6	23.2
<b>Un satisfied</b>	53	21.2	21.2	44.4
<b>very unsatisfied</b>	139	55.6	55.6	100.0
<b>Total</b>	250	100.0	100.0	

### SATISFACTION REGARDING CAFE /EATING SPOTS

Café and eating spots were present in abundance in the study area but it was observed that they were not hygienic and the spaces were not properly designed to serve the purpose. The satisfaction regarding the eating spots was again un satisfactory.

---

	<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>	<b>Cumulative Percent</b>
<b>satisfied</b>	31	12.4	12.4	12.4
<b>neutral</b>	31	12.4	12.4	24.8
<b>Un satisfied</b>	55	22.0	22.0	46.8
<b>very unsatisfied</b>	133	53.2	53.2	100.0
<b>Total</b>	250	100.0	100.0	

---

#### 4.4.2 Satisfaction regarding the physical condition of the canal

The physical condition of the canal has a huge impact on the aesthetics of the area. For this purpose, the satisfaction level of the concerned people was collected.

##### Satisfaction Regarding Side Paving of the Canal

Sides of the canal at some of the areas were not properly paved causing the water to seep through the soil and mixing with ground water. other than that people were satisfied with the canal paving.

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	<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>	<b>Cumulative Percent</b>
<b>Very satisfied</b>	115	46.0	46.0	46.0
<b>Satisfied</b>	83	33.2	33.2	79.2
<b>Neutral</b>	25	10.0	10.0	89.2
<b>Un satisfied</b>	16	6.4	6.4	95.6
<b>Very Unsatisfied</b>	11	4.4	4.4	100.0
<b>Total</b>	250	100.0	100.0	

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### Satisfaction Regarding Canal Road

Roads are of primary importance anywhere and similarly the roads along the canal are too. These roads need to be built according to the standards to avoid the damage of water. People in the study area were not satisfied with the condition of roads along the canal.

	<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>	<b>Cumulative Percent</b>
<b>Very satisfied</b>	56	22.4	22.4	22.4
<b>satisfied</b>	91	36.4	36.4	58.8
<b>neutral</b>	39	15.6	15.6	74.4
<b>unsatisfied</b>	44	17.6	17.6	92.0
<b>very unsatisfied</b>	20	8.0	8.0	100.0
<b>Total</b>	250	100.0	100.0	

### Satisfaction Regarding Waste Bins

The non-availability of waste bins along the canal is a major factor I contribution to canal pollution as people dump waste in the canals causing un hygienic conditions.

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	<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>	<b>Cumulative Percent</b>
<b>very satisfied</b>	31	12.4	12.4	12.4
<b>satisfied</b>	30	12.0	12.0	24.4
<b>Neutral</b>	21	8.4	8.4	32.8
<b>Un satisfied</b>	74	29.6	29.6	62.4
<b>very unsatisfied</b>	94	37.6	37.6	100.0
<b>Total</b>	250	100.0	100.0	

---



### Satisfaction Regarding Plantation Along the Canal

Plants and trees are very important to create a soothing environment in terms of the climate and aesthetics as well. This study area along the canal lacks plantation and people were un satisfied with the existing plantation along the canal.

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	<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>	<b>Cumulative Percent</b>
<b>very satisfied</b>	31	12.4	12.4	12.4
<b>satisfied</b>	14	5.6	5.6	18.0
<b>neutral</b>	40	16.0	16.0	34.0
<b>unsatisfied</b>	64	25.6	25.6	59.6
<b>very unsatisfied</b>	101	40.4	40.4	100.0
<b>Total</b>	250	100.0	100.0	

---

#### 4.4.3 Satisfaction index regarding the role of authorities

Authorities and their responsibility in every department is very important. The efficient role of authorities minimizes the problems in any area. A satisfaction level regarding the role of authorities was conducted under the following sub headings.

##### **Satisfaction Regarding Authorities Visit To The Area**

It was observed that majority of people were satisfied with the authorities visit to their area

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	<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>	<b>Cumulative Percent</b>
<b>very satisfied</b>	44	17.6	17.6	17.6
<b>satisfied</b>	90	36.0	36.0	53.6
<b>neutral</b>	33	13.2	13.2	66.8
<b>Un satisfied</b>	46	18.4	18.4	85.2
<b>very unsatisfied</b>	37	14.8	14.8	100.0
<b>Total</b>	250	100.0	100.0	

### Satisfaction Regarding Authorities Problem Solving

The problem solving of authorities is of great concern to the residents of these communities and majority of them were not satisfied with the role of authorities when in comes to problem solving

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	<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>	<b>Cumulative Percent</b>
<b>very satisfied</b>	30	12.0	12.0	12.0
<b>satisfied</b>	91	36.4	36.4	48.4
<b>neutral</b>	45	18.0	18.0	66.4
<b>Un satisfied</b>	54	21.6	21.6	88.0
<b>very unsatisfied</b>	30	12.0	12.0	100.0
<b>Total</b>	250	100.0	100.0	

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### Satisfaction Regarding Avoiding Encroachment

Encroachment is a very major issue these days and canal is also a target of encroachment due to which its being polluted due to constant trash and waste being dumped into the canal from the encroachers.

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	Frequency	Percent	Valid Percent	Cumulative Percent
<b>very satisfied</b>	58	23.2	23.2	23.2
<b>satisfied</b>	107	42.8	42.8	66.0
<b>neutral</b>	28	11.2	11.2	77.2
<b>Un satisfied</b>	42	16.8	16.8	94.0
<b>very unsatisfied</b>	15	6.0	6.0	100.0
<b>Total</b>	250	100.0	100.0	

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### Satisfaction Regarding Cleanliness Drive

Cleanliness drives on regular bases also minimizes the impacts of pollution, it was observed that most of the people were un satisfied with the cleanliness drive by the community authorities.

	<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>	<b>Cumulative Percent</b>
<b>very satisfied</b>	33	13.2	13.2	13.2
<b>satisfied</b>	97	38.8	38.8	52.0
<b>neutral</b>	28	11.2	11.2	63.2
<b>Un satisfied</b>	65	26.0	26.0	89.2
<b>very unsatisfied</b>	27	10.8	10.8	100.0
<b>Total</b>	250	100.0	100.0	

### Satisfaction Regarding Sewerage Management

Sewerage management is a very important aspect of any community and when this service is not proper it creates a lot of problems for the people there and also the adjacent water bodies and the study area had a major issue regarding sewerage management and people were very un satisfied with the efforts.

	Frequency	Percent	Valid Percent	Cumulative Percent
<b>very satisfied</b>	25	10.0	10.0	10.0
<b>satisfied</b>	99	39.6	39.6	49.6
<b>neutral</b>	35	14.0	14.0	63.6
<b>Un satisfied</b>	71	28.4	28.4	92.0
<b>very unsatisfied</b>	20	8.0	8.0	100.0
<b>Total</b>	250	100.0	100.0	

## Satisfaction Regarding Solid Waste Management

Waste management is also a very important aspect of any community and when this service is not proper it creates a lot of problems for the people there and also the adjacent water bodies and the study area had a major issue regarding sewerage management and people were very unsatisfied with the efforts.

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	Frequency	Percent	Valid Percent	Cumulative Percent
<b>very satisfied</b>	32	12.8	12.8	12.8
<b>satisfied</b>	55	22.0	22.0	34.8
<b>neutral</b>	59	23.6	23.6	58.4
<b>Un satisfied</b>	62	24.8	24.8	83.2
<b>very unsatisfied</b>	42	16.8	16.8	100.0
<b>Total</b>	250	100.0	100.0	

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## CHAPTER 5: SUGGESTED DESIGN FACILITIES ALONG THE CANAL

The Kabul river canal flows through the heart of Peshawar, a historical city famous for the name of city of flowers, but due to rapid and unplanned development the city once city of flowers turned to a cluster of slums and hap hazard development. This gave rise to so many social issues in this once beautiful city. That is the problem of pollution. From air pollution to noise and solid waste. This pollution is spread throughout the city urban centers and Center Business Districts, the authorities are planning and working to overcome this issue, but it seems out of hand now. The problem was identified that the canal that flows amidst the heart of the city is being polluted and it is affecting the adjacent communities. The research results showed significant amount of pollution and solid waste in the canal. The researcher proposed the idea of placemaking along the canal that will help in reduction of pollution levels as untreated spaces are being misused by the communities. The purpose of placemaking will be to encourage communities to contribute in making the canal a better place that will in turn help in creating a clean and conducive environment for their community. The canal has a potential to be developed through placemaking. Potential placemaking sites were identified for this purpose. Throughout the expanse of the study area, some spots were selected which could be replicated throughout the canal. The design facilities varied from place to place and were designed according to the site, keeping in mind the aesthetics and functionality of the proposed design. Focus was to design such facilities that look like a part of the canal and environment and enhancing the overall look of the canal which in turn will have an impact on the surrounding structures that can be renovated and newly built structures will complement the canal both aesthetically and respecting the right of way of the canal.



## 5.1 DESIGNING – RENOVATION OF AN OLD FLOUR MILL ROOF TOP

In Fig-1 we can see a flour mill located on the top of the canal in *Hasan Garhay* adjacent to *Shami road*. No activity was happening there. This researcher proposed a restaurant on the roof top of the flourmill with the canal sides developed as linear park creating a soothing environment for the users there and a new spot for recreation is proposed



Figure 5. 1 Design of the Flour Mill

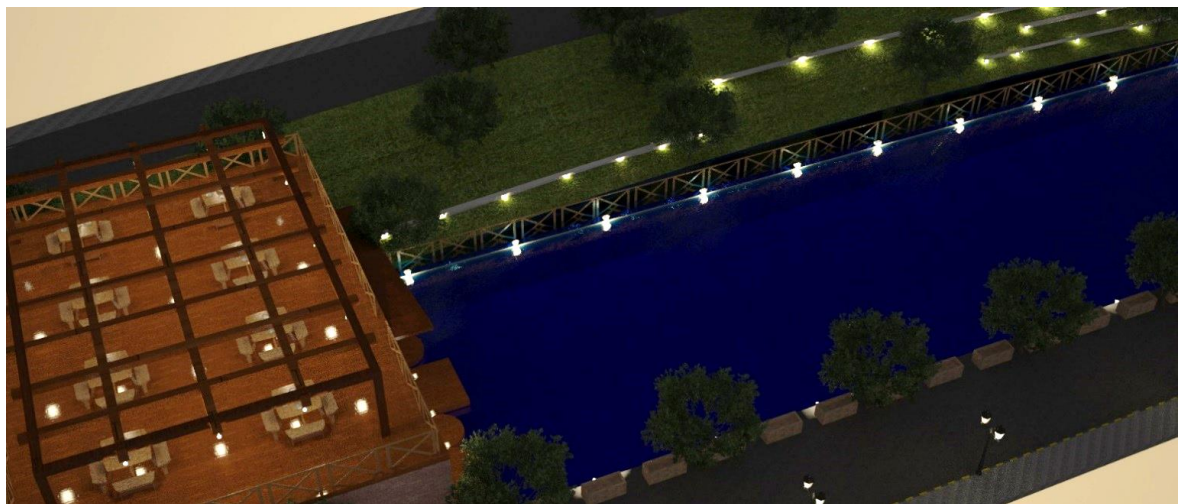


Figure 5. 2 View of the rooftop café on the flour mill

## 5.2 PEDESTRIAN BRIDGE NEAR TABLIGHI MARKAZ

Another Spot was identified near Tableeghi Markaz for placemaking where there was a need for a properly design pedestrian bridge that can serve for a sitting spot as well as a crossing. The side barriers of the canals can be converted to planters. Due to lack of plantation on the canal bank this idea was suggested that can serve dual purpose i-e barrier and a planter. Fig-2 shows the proposed idea.



Figure 5. 3 Pedestrain Bridge near Tablighi Markaz

### 5.3 FLOATING PLANTERS DESIGN

Moreover, due to lack of greenery and plantation along the canal banks in most of the areas some floating planters were proposed that help revive plantation and greenery in those sites in Fig-3 the floating planter can be seen



Figure 5. 4 Floating planter design

## 5.4 TREATING AND DESIGNING THE RAILWAY CROSSING OVER THE CANAL

There is another spot near Faqirabad locality of Peshawar city where railway track passes over the canal. A railway crossing along the canal was proposed to be developed as shown in Fig-4. The design concept complimented both the railway track and the canal at the same time showing connection between the two

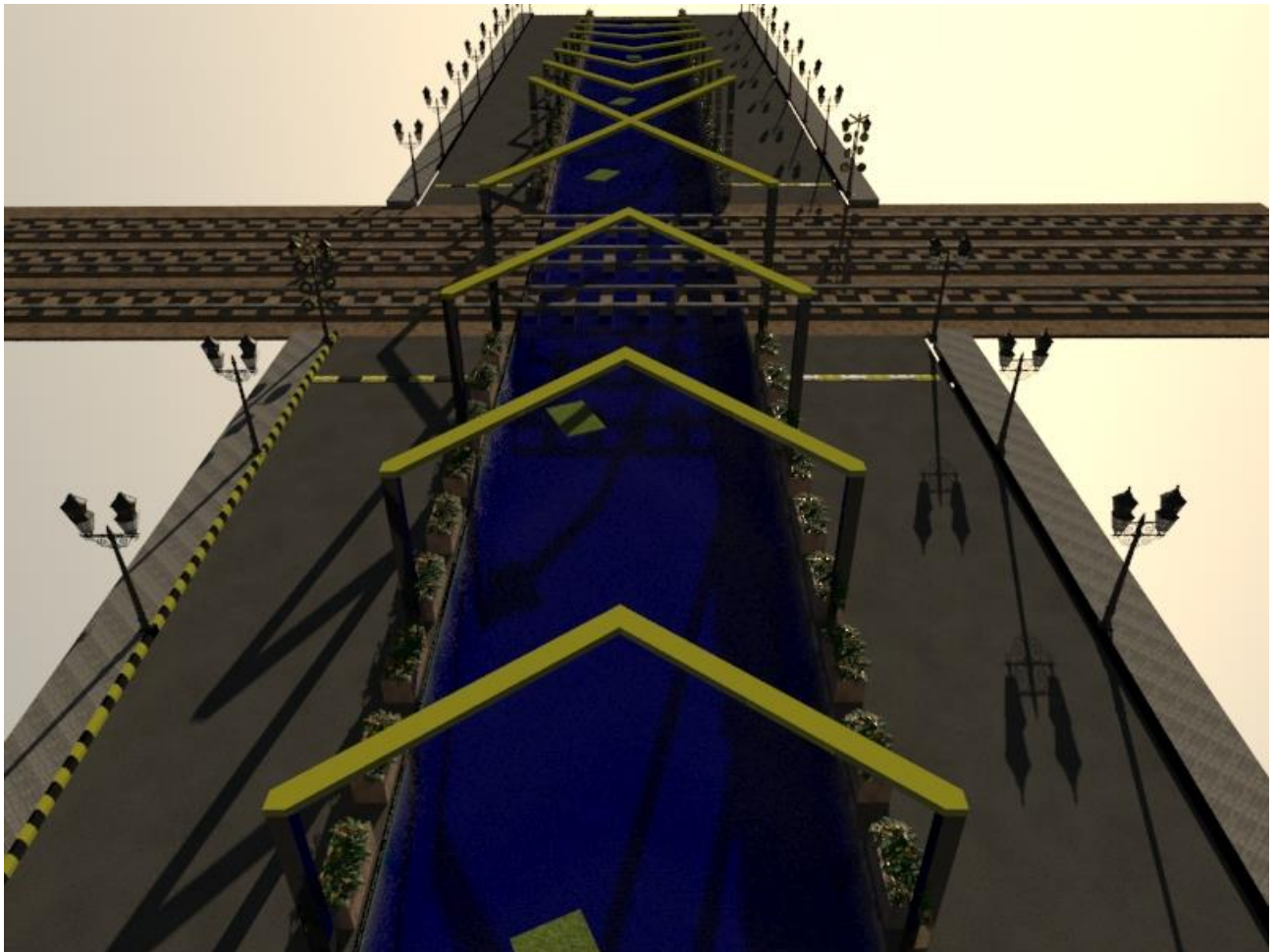


Figure 5. 5 Design of Railway Crossing

## 5.5 ROAD CROSSING

The road crossing was designed in such a way that shows an entrances or gateway giving a sense of place to people they are entering to. Figure 5 shows a crossroads over the canal designed like a gateway



Figure 5. 6 Road Crossing Design

## 5.6 SITTING AREAS

These sitting areas were design on the bank of canal in such a way that they will be supported from withing the canal and floating above it, therefore not usurping the right of way pf the canal; roads and yet contributing to the aesthetics. Some shaded benches were also proposed that can be replicated throughout the expanse of the canal due to lack of plantation and shade for sitting.

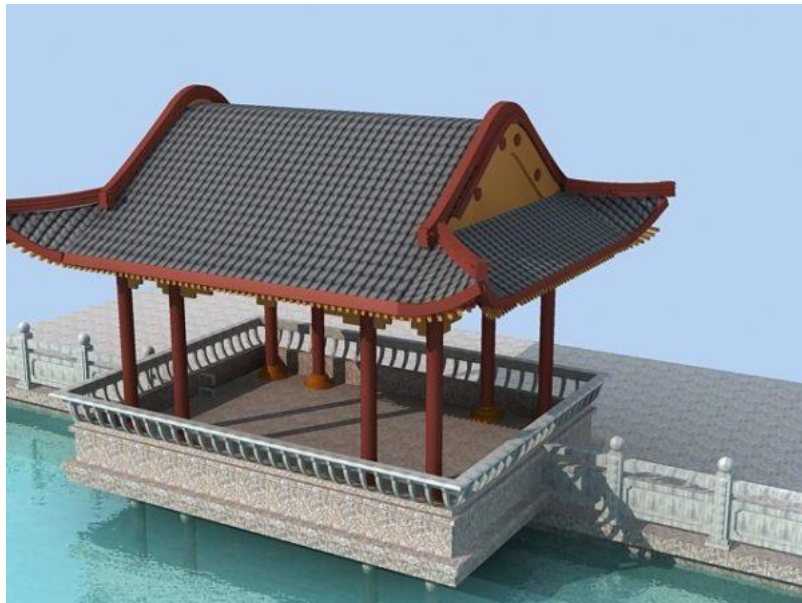


Figure 5. 7 Sittnng area above the canal

Figure 5. 8 Shaded Sitting benches



## CHAPTER 6: CONCLUSION & FINDINGS

It was observed that the Kabul River Canal in Peshawar is highly polluted in so many ways which include agriculture and animal waste and further when it reaches the urban environment, the solid waste and sewerage also join in the canal, making its condition even worse. Tests were conducted on water samples collected from the canal and it was observed that according to the National Environmental Quality Standards, in Kabul River Canal Peshawar water pollution levels have exceeded all limits. Different factors were identified in the survey that were directly contributing to the canal pollution and factor analysis test were applied which tell us that 7 factors of the selected 16 factors showed significant correlation values. Those factors were therefore, identified as the main contributing factors to the pollution in the canal.

It was clear from the conducted research that the Kabul River canal has been neglected as an urban treasure and this is the reason that its condition is worsening day by day. The canal and the adjacent areas have potential to be developed through place making techniques. This will help in reducing the pollution in the canal and reclaiming the lost urban treasure that is the canal.

The study tells us that the non-development of the canal and negligence has led to the pollution of the canal to unacceptable limits which is directly affecting the adjacent communities. Through detailed and well-planned place making techniques, not only the level of pollution may be reduced but it will add to beautification of the city.

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## ANNEXTURES

### ANNEXTURE-1- The Questionnaire

**Date:** \_\_\_\_\_

### **QUESTIONNAIRE**

Dear respondents, this questionnaire is prepared for academic purpose only. It will be helpful in completing my MS research thesis on “**Urban Canal development: Identifying pollution factors in Kabul River Canal Peshawar and providing counter strategies for its reduction**”. Therefore, any answers given shall be treated as confidential. Thank you in advance for your cooperation!

#### **Household**

1. What is your age? \_\_\_\_\_
2. Gender? Male  Female
3. Marital Status? Single  Married
4. Number of kids? \_\_\_\_\_
5. Highest level of qualification?  
Illiterate  Matric  Intermediate  Graduate

6. How long have you been living here? \_\_\_\_\_
7. How far is your residence from the canal? \_\_\_\_\_
8. What is your house situation / infrastructure like?  
Pakka  Kacha  Semi
9. Do you have any animals/pets at home?  
Yes  No
10. Number of animals / pets ? \_\_\_\_\_
11. Size of building? \_\_\_\_\_
12. What kind of amenities are provided to your house?  
Water  Gas  Electricity  Sewerage
13. Any chronic illness or disease your area is familiar with?
14. How much do you spend average on your medical bills?
15. What is development status of the area?  
Kachi abadi  Colony  Township

### **Sewerage and waste**

16. Your household waste composition?  
Paper  Plastic  Food
17. Is there a septic tank in your home?  
Yes  No
18. What is the location of the septic tank?
19. Where does the sewerage in your area go to?  
Canal  Sewerage plant  Septic tanks  Don't know
20. What is the solid waste collection procedure of your area?

Door to Door  collection from a common point  Not existing

21. How much are you charged for provided facilities regarding cleaning and maintenance?

22. What type of waste is deposited in the canal in your area?

Solid waste  sewerage waste  Industrial waste  Animal waste

23. How often do you see people using the canal for dumping garbage?

Sometimes  Regularly  Not use it at all

24. Is there bad odour in your area?

Yes  No

25. Are you familiar to bad odour due to water?

Yes  No

26. Is the canal water suitable for agriculture when it leaves the urban area?

27. Will the water have any impact on the agricultural products ?

28. What do you think are the factors that are contributing in the pollution of this canal?

### **Ground water quality**

29. Is the canal in your area cleaned on regular basis?

Yes  No

30. Do you use filtered water for drinking?

Yes  No

31. Is there any water filtration plant in your area?

Yes  No

32. Is there any availability of ground water pumping in your area ?

Yes  No

33. How much are you charged for clean drinking water provided to your house / area?

34. Do you use ground water directly?

Yes  No

35. Is the canal water being absorbed down below by the ground?

Yes  No

36. Do you think it has any impact on the ground water? How ?

Yes  No

### **Place making and development**

1. Are there any parks and open spaces in your area?

Yes  No

2. How many times do you visit a waterfront spot for recreation?

Once a week  Once a month  Not very often

3. How much average amount do you spend on a trip ?

4. Is there any encroachment on canal bank? how

Yes  No

5. Do you think the vendors along the canal bank dispose there waste properly?

Yes  No

6. Do you think the vendors and stalls should be allowed on the canal bank?

Yes  No  Reason: \_\_\_\_\_

7. Who do you think should take steps for the betterment of the canal?

Authorities  Public  Both in partnership  Individual

8. Do you think this canal has the potential to be developed for recreational purposes? How

Yes  No

9. What kind of activity would you suggest should be along this canal?

Linear parks  Sitting areas  Safe swimming areas  Fishing  Any other

10. Do you think placemaking can reduce the amount of pollution levels that exist in the canal now? How ?

Yes of course  Not exactly  Upto some extent

11. Would you contribute and volunteer with the development agencies if a development project is initiated along the canal? How :

Yes  No

12. Any commercial activity in your area along the canal?

13. If proper facilities are provided for cleanliness of canal are you willing to pay for the additional taxes applied on you?

Yes  No

## Satisfaction index

What is your satisfaction level with respect to the following?

Satisfaction level	Very Satisfied	Satisfied	Neutral	Un Satisfied	Very Unsatisfied
<b><u>Physical condition of canal</u></b>					
1	Side paving				
2	Canal Road				
3	Safety Barrier				
4	Waste Bins				
4	Plantation				
<b><u>Role of Authorities</u></b>					
1	Visit to the area				
2	Problem solving				
3	Avoiding encroachment				
4	Cleanliness drive				
5	Sewerage management				
6	Solid waste management				

<u><i>Recreational Facilities</i></u>						
1	Parks					
2	Siting areas					
3	Water Sports					
4	Swimming spots					
5	Fishing spots					
6	Boating					
7	Café / eating spots					

**Any other Problems in your area / canal:**

**Solutions:**

**Suggestions / Comments:**

Annexure -2 The Plagiarism Certificate





### **CERTIFICATE FOR PLAGIARISM**

It is certified that MS Thesis Titled **“Urban Canal Placemaking As A Tool To Pollution Reduction: A Case Study Of The Kabul River Canal ,Peshawar”** by **Regn No. 00000199399** by **Sohaib Fakhar** has been examined by us. We undertake the follows: -

- a. Thesis has significant new work/knowledge as compared already published or are under consideration to be published elsewhere. No sentence, Equation, table, paragraph or section has been copied verbatim from previous work unless it is placed under quotation marks and duly referenced.
- b. The work presented is original and own work of the author (i.e. there is no plagiarism). No ideas, processes, results, or words of others have been presented as author own work.
- c. There is no fabrication of data or results which have been compiled / analyzed.

- d. There is no fabrication by manipulating research materials, equipment, or processes, or changing or omitting data or results such that the research is not accurately represented in the research record.
  
- e. The thesis has been checked using TURNITIN (copy of originality report attached) and found within limits as per HEC Plagiarism Policy and instructions issued from time to time.

Signature: \_\_\_\_\_

Name of Supervisor: \_\_\_\_\_

\_\_\_\_\_