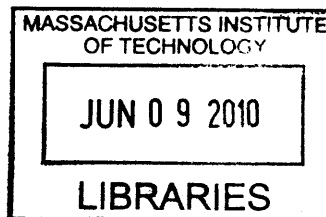


# ANIMATING THE ADI GANGA

by

Priyanka Kapoor  
Bachelor of Architecture  
School of Planning and Architecture, 2006



SUBMITTED TO THE DEPARTMENT OF ARCHITECTURE IN PARTIAL FULFILLMENT OF THE REQUIREMENTS  
FOR THE DEGREE OF

MASTER OF SCIENCE IN ARCHITECTURE STUDIES  
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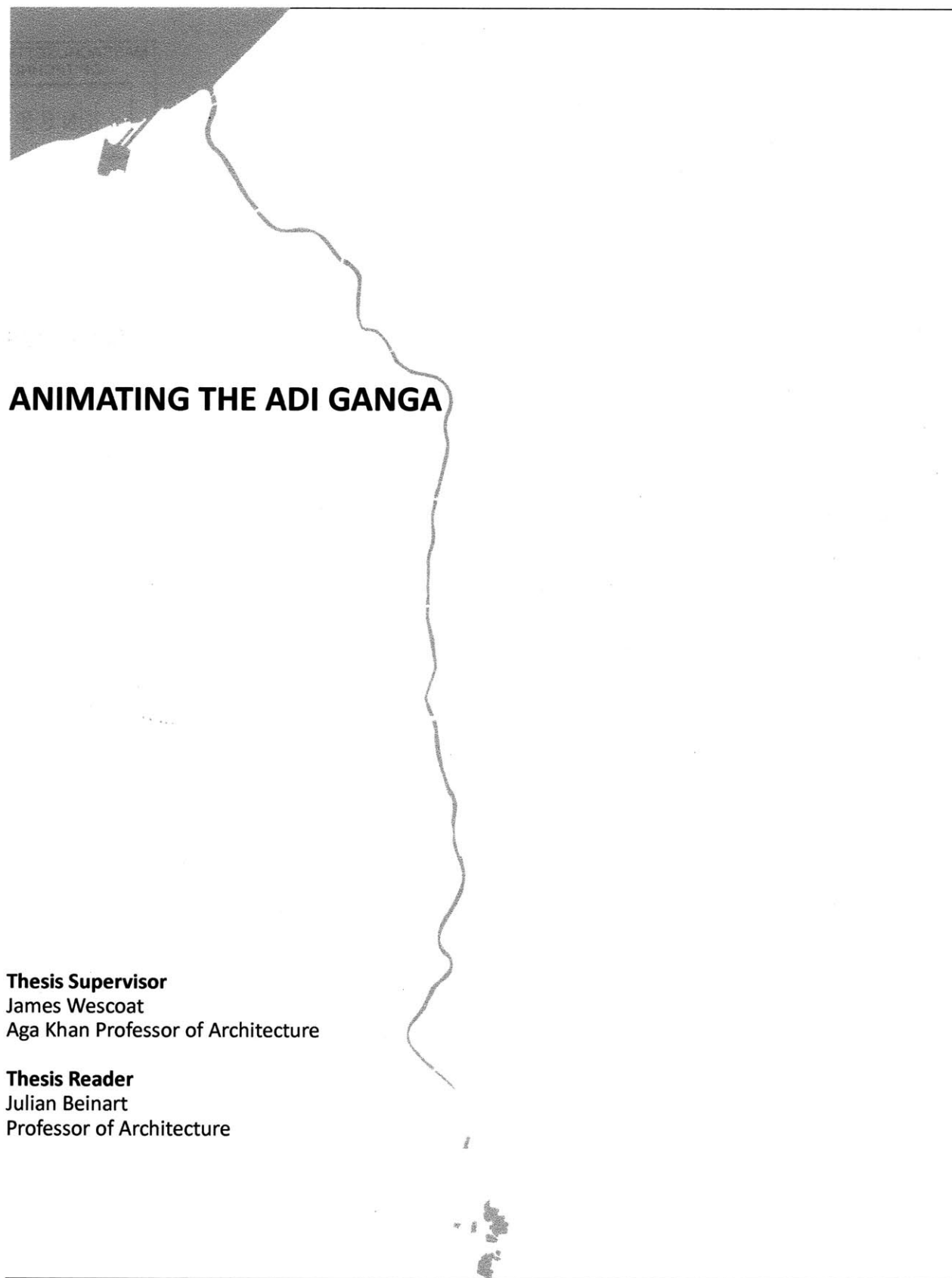
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# **ANIMATING THE ADI GANGA**

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# ANIMATING THE ADI GANGA

by

Priyanka Kapoor

Submitted to the Department of Architecture  
on May 21, 2010, in Partial Fulfillment of the  
Requirements for the Degree of Master of Science in  
Architecture Studies

## ABSTRACT

The thesis is about a fascinating channel flowing in southern Kolkata. The channel is heavily polluted inspite of being considered sacred in the City's memory. The thesis tries to understand and interrogate the residual memory of this channel to propose strategies for its rehabilitation. The study uses a three-fold approach: the historical analysis, to understand the causes of the present situation; the geographical analysis, to discern the extant physical conditions and spatial scales; followed by an integrative design proposal.

In the contemporary debate of river restorations in India, where holy rivers have turned into polluted drains, Urban streams and channels are being considered as a viable means of interventions. Realizing this, the thesis shows possibilities on how the rehabilitation of a polluted urban channel can be approached.

**Thesis Supervisor:** James Wescoat

**Title:** Aga Khan Professor of Architecture

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*The Negro Speaks of Rivers*  
- Langston Hughes

*I've known rivers:  
I've known rivers ancient as the world and older than the flow  
of human blood in human veins.*

*My soul has grown deep like the rivers.*

*I bathed in the Euphrates when dawns were young.  
I built my hut near the Congo and it lulled me to sleep.*

*I looked upon the Nile and raised the pyramids above it.  
I heard the singing of the Mississippi when Abe Lincoln went  
down to New Orleans, and I've seen its muddy bosom turn  
all golden in the sunset.*

---

## ACKNOWLEDGEMENTS

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My Thesis reader, Julian Beinart, who introduced me to the complexities of cities. He has consistently pushed me to reach further and higher. The conversations that we have had, have made me look for larger goals, the bigger picture and the underlying issue rather than the superficial symptom.

Michael Dennis for teaching us the code to unravelling cities. I have learnt an immense amount from him and have enjoyed every moment of our interaction.

Rahul Mehrotra for his insights on the Indian landscape have made this thesis and my stay in MIT more meaningful.

Thanks to everyone who helped me in Calcutta. My impression of the city has been transformed after meeting them and learning from them.

Thanks to Claudia, Debbie, Yessika, Azra, Jay and Sagarika - for being my closest allies and dearest friends.

Thankyou to my family- parents, my brother, Roshni, Neena masi - for being there through thick and thin. The last two years would not have been possible without you.

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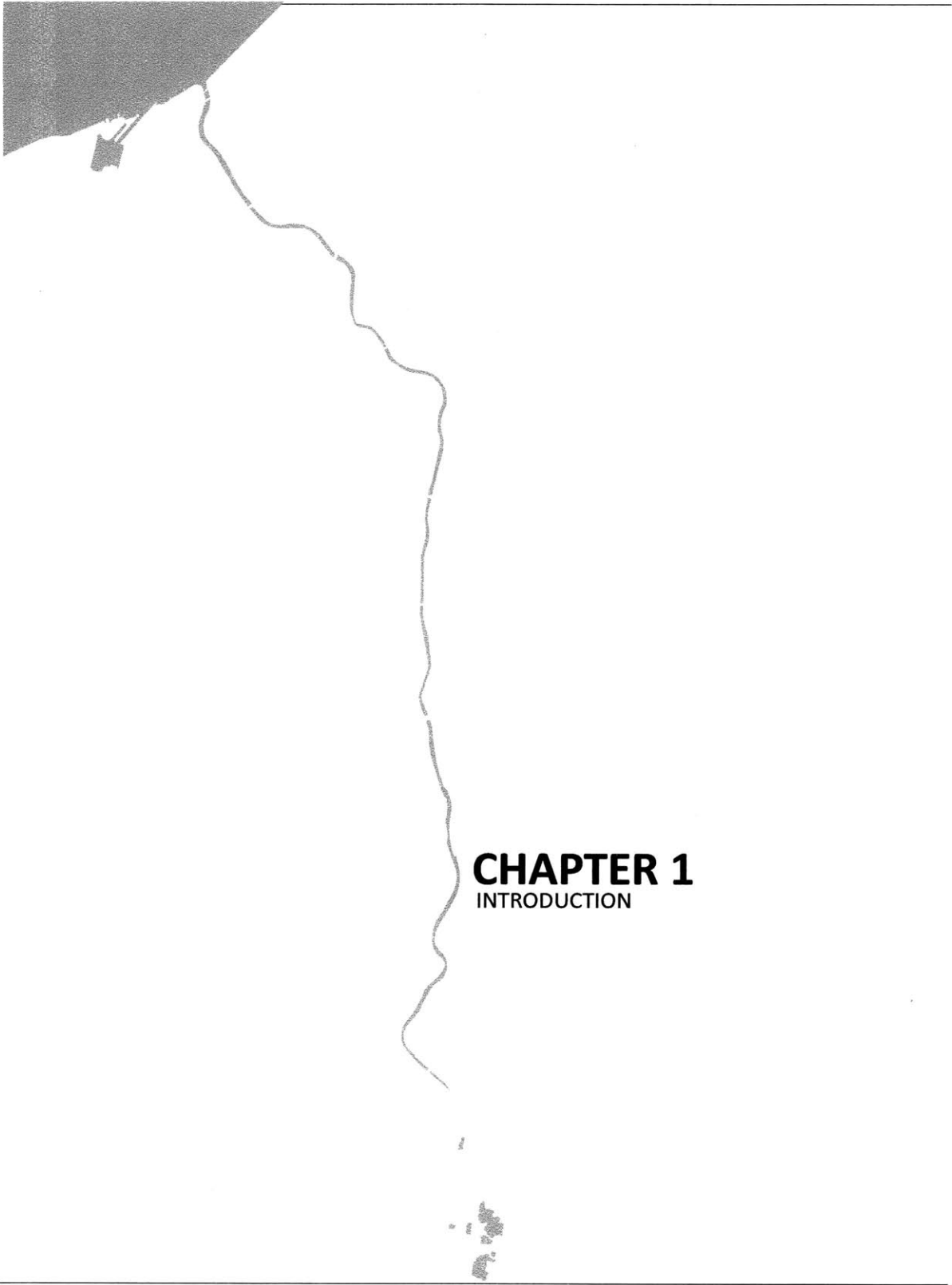
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**CHAPTER 1**  
INTRODUCTION

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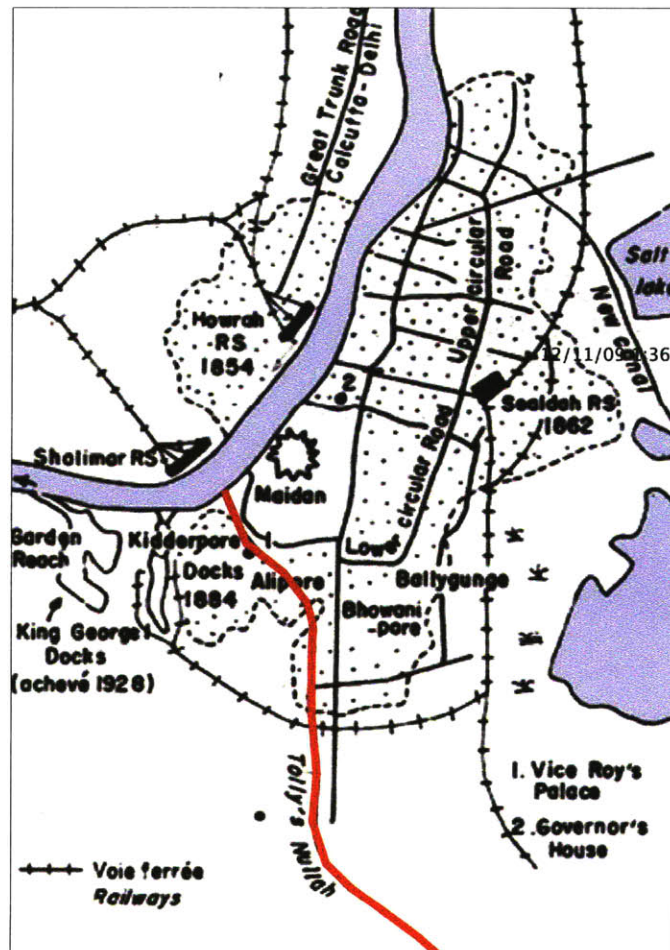
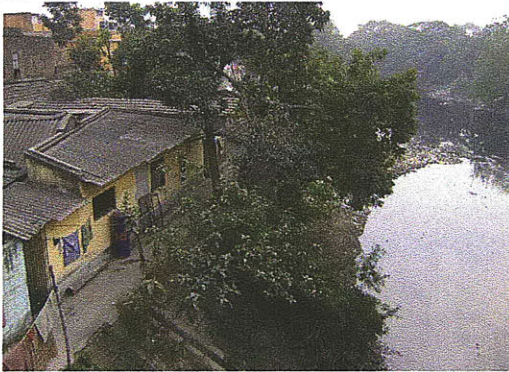


Fig 1.1: Location of Adi Ganga

Source: Sukanta Chaudhuri, *Calcutta: the Living City* (Calcutta; New York: Oxford University Press, 1990), p.12



**Fig 1.2: The informal settlements on the edge**  
Source: The author



**Fig 1.3: Metro columns**  
Source: The author



**Fig 1.4: The Adi Ganga at Kalighat**  
Source: The author



**Fig 1.4: "Dying Channel"**  
Source: The author

This thesis deals with the Adi Ganga or Tolly's Nullah, a channel that flows along the southern boundary of Kolkata (Fig 1.1)

At first glance, the channel is ordinary. It has a quiet, quotidian existence in the everyday city. (Fig 1.2)

It resembles any stream in contemporary India - with shanty towns hugging the water's edge, the water itself, polluted with sewage and effluents, carrying the city's excrement. It flows hidden, behind the walls, accessible from very few points along its course.

Downstream the channel dwindles, its waters dark, heavy and stagnant. Here, large concrete columns pierce its still waters. These columns support the city's metro system, the pride of contemporary Kolkata.(Fig 1.3)

Further south, the channel disappears – in the battle between the pillars concrete, dirt, pollution, it succumbs. The bed remains, a silent reminder of a dying channel.(Fig 1.4)

However, this channel is not an ordinary drain. The Adi Ganga, as it is called by the public (though the official name is Tolly's Nullah), evokes similar emotions as the Ganges, in terms of its spiritual, cultural and historical resonance. (Fig 1.5) The channel branches out from the Hugli River, the present course of the Ganga flowing on the western side of the city of Calcutta. The presence of Kalighat, one of the most revered pilgrimage sites in the country, on the bank of this channel greatly adds to its significance. The stream, important in the spiritual imagination in the city, has not been spared the sporadic change in river courses. Before 1772, when a British Major, William Tolly, canalized it, the stream scale had reduced considerably. Tolly excavated the course to open the river route connection. The channel then acted as a major navigation route for the next hundred and fifty years. However, it has succumbed to the pressures of the past century and has turned into a sewer channel for the southwestern part of Calcutta. The channel, which once had a number of bathing ghats, temples, and sacred cremation grounds on its banks, has transformed from a holy river to an unholy drain.

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In the August 1995 report of the *Environmental Problems In Metropolitan Calcutta Municipalities*, V. Ramaswamy states, "The Tolly Nullah (The Adi Ganga is called Tolly Nullah in official parlance) carries Calcutta's rubbish into our municipality. The entire stretch of the Nullah from Tollygunge to beyond Garia is stagnant and foul and on both sides of this are shanty settlements."<sup>1</sup> At that point in time, the polluted Adi Ganga had become the subject of a great deal of public attention.

In response to the situation, the March 1997 report of the Calcutta Environmental Management Strategy Action plan (CEMSAP) outlined a proposal for the renewal of the East Kolkata Wetlands and Canal systems. In the report, there was considerable emphasis on the revitalization of the Tolly Nullah (by joining it to the Piali river). Another plan suggested the extension of the canal by 11 kms to join it to the Bhargal Kata Khal that would provide easy transportation and allow for eco-tourism. In December the same year, a report was published by the Urban Development Department of West Bengal that stated that the 15.5 km stretch of water between Hastings and Garia would be renovated and made suitable for transportation.<sup>2</sup>

These plans never materialized. By the end of 1999, however, the Railway Authority had made plans to allow the metro railway extension from Tollygunge to Garia that would dissect the Adi Ganga with 300 pillars constructed at a distance of 20 meters on center.<sup>3</sup> In July 1999, Rebati Ranjan Bhattacharya, an environmental activist, wrote a letter against the scheme proposed by the Railway Authorities. This letter was followed in April 2000 by an article in the *Statesmen* by Mohit Ray, who received support from several citizens and prominent literati (from poets, historians, environmental activists to the former Chief Engineer of the Irrigation and Waterways in West Bengal). The letter describes the Nullah as a "Heritage river" and the need to examine the detrimental effect that the Metro Expansion Plan would have on it. In the mean time, an October 2000 *India Today* article referred to the Adi Ganga as: "a 15km toilet dispenser, an unbroken river of sludge, stink and toxins."<sup>4</sup>

The issue of the metro extension over the channel even raised concern in the National River Conservation Directorate.<sup>5</sup> This was followed by more efforts from more environmentalists and historians, such as the initiative of Subhas Dutta who filed a case in the High Court in March 2001.

---

The High Court judgment that followed this slew of activism disregarded the petition. Clause 11 of the Railways Act from 1989 was used to redirect the legal provisions under the Environmental Protection Act of 1986, which was enacted in accordance with Article 253 of the constitution of India to implement the decisions of the Stockholm conference of 1972.<sup>6</sup> In the case of the Metro extension over the Adi Ganga channel, the Railway authorities sought no environmental clearance. The Clause 11 of the Railways Act, 1989 gives the Railways the power to “make or construct in or upon, across, under or over any lands, or any streets, hills, valleys, roads, railway, tramways, or any rivers, canals, brooks, streams or other waters, or any drains, water-pipes, gas-pipes, oil-pipes, sewers, electric supply lines, or telegraph lines, such temporary or permanent inclined-planes, bridges, tunnels, culverts, embankments, aqueducts, roads, lines of railways, passages, conduits, drains, piers, cuttings and fences, in-take wells, tube wells, dams, river training and protection works as it thinks proper’<sup>7</sup>

Apart from evidence of Indian bureaucratic complacency (of Development organizations in this case), a few important questions surface in light of the recent developments.

1. What prompted the activism and advocacy in relation to saving “an unbroken river of sludge, stink and toxins”? Essentially, what latent significance of the polluted drain/’Nullah’ prompted the involvement of citizens of the state (in the absence of the state) to react?

2. In recognizing the significance, what has lead up-to the decay of the Adi Ganga?

3. Why did the Railway Act get precedence over the Environmental Act in this context?

The questions will help in defining the problem statement, to gain a larger understanding of this fascinating channel, and point towards potential solutions for its rehabilitation.

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## PROBLEM STATEMENT

This “sewer,” paradoxically, is still considered a sacred space in the city’s memory and holy for the countless pilgrims who visit Kalighat, testifying to the residual significance in the contemporary city.

However, the channel has several problems, the most significant being its level of pollution and misuse. It is considered to be a largely “dead” channel and a bane in the government’s imposition of new infrastructure.

The inherent tensions between the channel’s residual yet intangible significance and its material problems trigger several intriguing questions. Most important of these questions is: *how has this sacred space turned into an artifact of pollution?* I argue that the problem lies in the separation between the tangible and intangible. Although the space of Adi Ganga still has intangible meaning, it lacks a more tangible or physical identity, structure and more importantly a living relationship with the city.

The thesis seeks to understand and interrogate this intangible significance and its actual and potential reconnection with the tangible urban landscape. It begins with the question of how this landscape has become fractured through the years, and concludes with a provocation of how this space might be rehabilitated or re-imagined, and thereby reconnected, in the context of Kolkata’s present. The intent of the thesis proposal is to re-ignite a living relationship between the channel and the city.

Moreover, in the larger debate of river restoration in India, these canals and streams that release pollutants into rivers are now being targeted as a viable means of urban ecological design intervention. Realizing the importance of these debates, this thesis analyzes the Adi Ganga infrastructures both in their historic and geographic context and proposes interventions that address the complexities that they engender.

---



## **METHODOLOGY**

The thesis uses a three-fold approach: the historical analysis, to understand the causes of the present situation; the geographical analysis, to discern the extant physical conditions and spatial scales; followed by an integrative design proposal.

The thesis collates the historical and geographical data to establish a temporal and spatial understanding of the Adi Ganga channel and to show how the dichotomies of Sacred and Profane, Continuous and Fragmented, Natural and Artificial developed.

The methodology involves the integration of the historical and geographical analysis and their potential design implications in a matrix (attached in Appendix). Used at the end of each section, the matrix collates and filters the information into two types of significance that have implications for design: the physical landscape (tangible) and cultural meanings (intangible). The physical and cultural significances are represented visually on a regional, zonal, canal scale, depending on the scales they address. For instance, the sacred, an intangible significance, is associated with a temple and its ghats located on immediate bank of the channel. The temple site is physically local while being culturally regional in scale.

The proposal, in the final part of the thesis, seeks to address the join intangible and tangible significance of the Adi Ganga at the different spatial scales.

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## CHAPTER OUTLINE

**-CHAPTER 1-** Introduction – This initial chapter has introduced the Adi Ganga channel, defined the problems and the methods that will be used to address it.

**-CHAPTER 2-** This chapter tells the story of how the channel of Adi Ganga came to be what it is today. Although there is some mention of this in the published literature, it has not been analyzed to form an overall argument towards the understanding of the Adi Ganga channel. The task of this part is to collect, collate and codify the literature to form a better understanding of the inherent complexities.

**1a: Adi Ganga in Pre- Colonial Calcutta-** This part focuses on the channel before colonization(Pre-1690). Here I will use mainly secondary literature on the subject (Bengali literature), travel accounts (Portuguese, Greek), maps (not-to-scale maps from the Portuguese travel accounts) and modern photo interpretation based studies (Babu, 1796; Das, 1985) – to show the importance of the channel for constructing a larger argument towards its rehabilitation.

**1b: Adi Ganga in Colonial Calcutta (1690-1947)-** Although Calcutta had a bustling economy before Job Charnock landed on her shores in 1690- Calcutta or the representation of Calcutta can be classified as between before and after colonization.

Through the analysis of British accounts and policies (using the Imperial Gazetteers), maps (and other visual methods of representation), secondary literature, and the rich literature on the analysis of the British occupation of Bengal- I will argue that the Adi Ganga fell into the pitfalls of development from the time of colonization- an identity that it has succumbed to since then.

**1c: Adi Ganga in Post Independent Bengal:** Here, using policies (developmental policies including property laws, the crucial role of the automobile lobby and colonial laws that have not been adapted to contemporary times), maps, and secondary literature I will try to show the position of Adi Ganga in the growing concept of the modern State of India. Here, I will argue that in the process of nation building and political flux key policies required for the safeguarding of ecology were ignored. Although this is popular knowledge, it is crucial to analyze this with respect to its direct implication on the Adi Ganga.

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These chronological layers are broken down into the physical and social issues and significance that are relevant to the channel today. Through the analysis I argue that although the physical issues have featured in the present developmental strategies (albeit on a superficial level), there is very little analysis of the intangible layers and significance associated with the Adi Ganga.

### **CHAPTER 3: Spatializing Significance& Mapping Possibility**

The physical and social significance of the Adi Ganga are then visually represented and analyzed on the following scales:

- i. Regional Scale: With reference to the region/ city- looking at policies and other channels/canal/water systems
- ii. Reach scale: With reference to urban neighborhoods adjacent to the channel, analyzed in terms of land use/demographics
- iii. The channel scale: Looking at the implications on the immediate banks of the channel
- iv. Sectional Scale: Looking at typical and atypical sections

Moreover, I will analyze the socio-cultural dimensions of the Adi Ganga- through a description of the stakeholders and their stake in issues relevant to the stream.

This chapter provides the platform to analyze the dichotomies that exist – between pollution and religion, between urban and ecological, between state and community, and others that are still buried in the complexity of this fractured landscape. Essentially, through this section, I will try to identify the course of action for the rehabilitation of the canal and revealing design questions- of what constitutes rehabilitation in a fractured landscape like this? Is it restoration or articulating a new ideation?

The primary data for this section will be from the field study (using photographs and observations made on the field), contemporary articles, reports and published articles.

**-CHAPTER 4:** deals with the actual process of rehabilitation through design. In proposing a way to rehabilitate the channel, I will try to provide design strategies that take into consideration both the tangible as well as intangible issues at stake. These ideas will also encompass the range of stakeholders operating at the three different scales and related site conditions. The final chapter makes inferences and conclusions towards the rehabilitation of the canal over time.

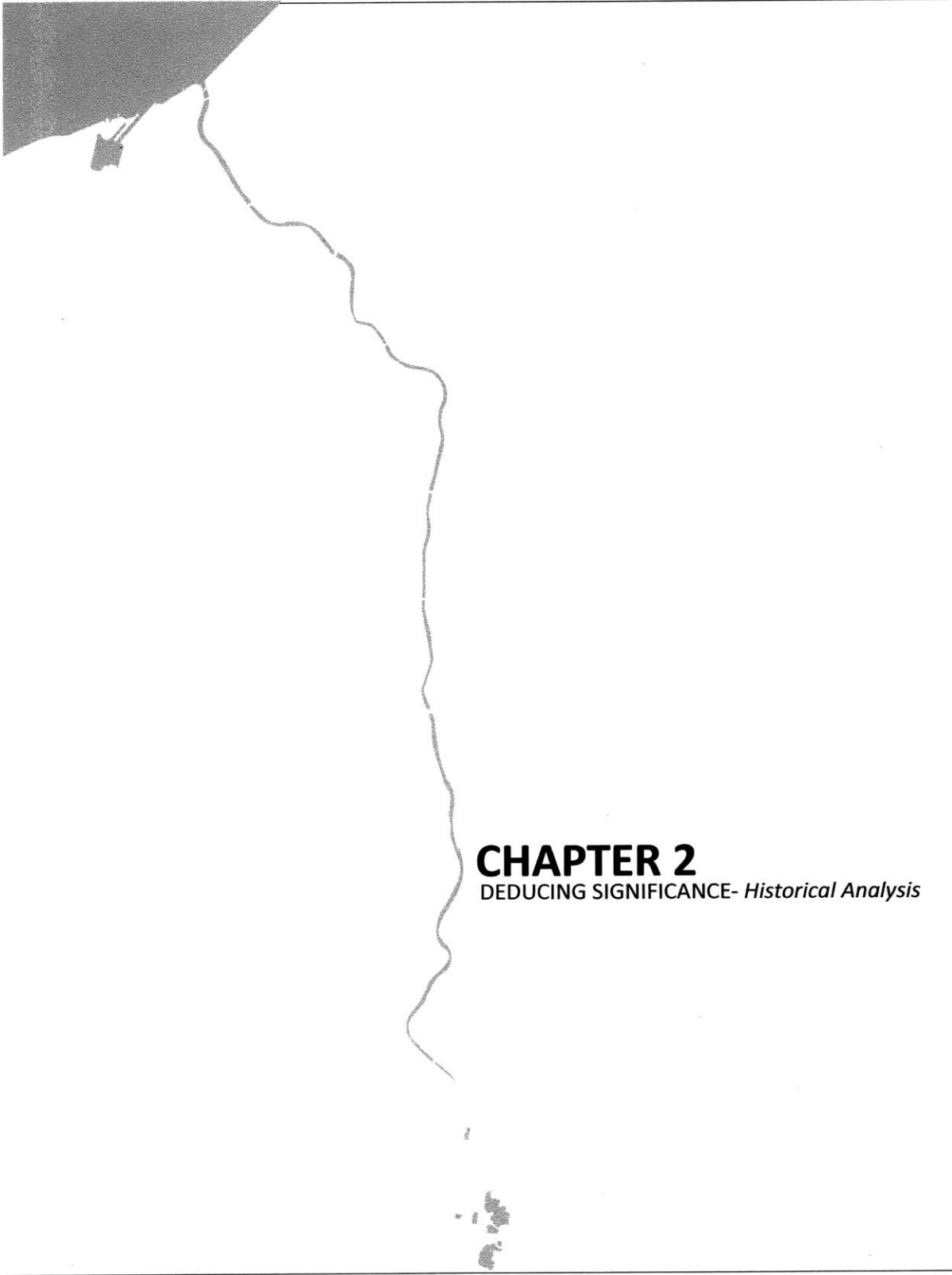
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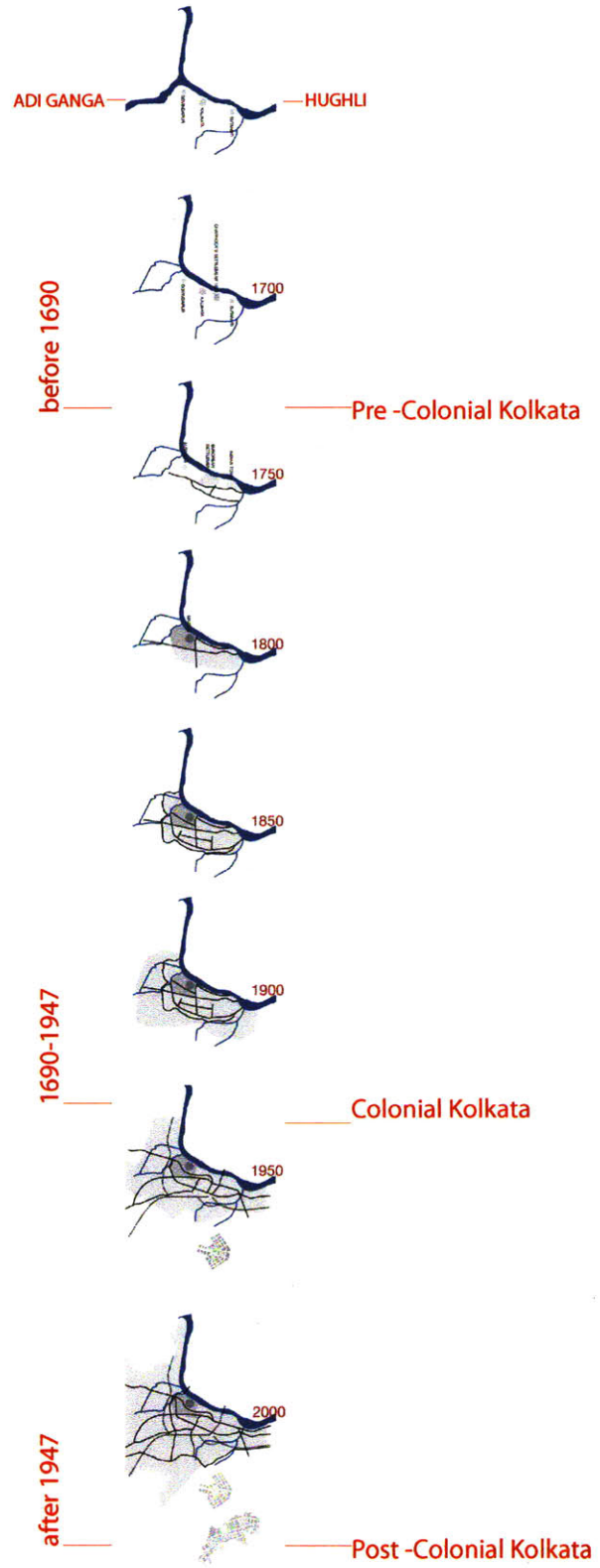
**ENDNOTES**

- 1 In August 1995, at a meeting organized by the Dept. of Environment, Govt. of West Bengal, representatives from the various municipalities in the Calcutta Metropolitan Area spoke about the principal environmental problems in their towns- this was reported by V Ramaswamy. V Ramaswamy, "Environmental Problems In Metropolitan Calcutta Municipalitie, September 18, 2005, <http://mail.sarai.net/pipermail/test1/2005-September/006265.html> (accessed January 20, 2010).
  - 2 Mohit Ray, "Citizens Voice for Adi Ganga," *VASUNDHARA FOUNDATION CONCERN FOR ENVIRONMENTAL RIGHTS*, January 2, 2010, <http://vasundhara.webnode.com/news/citizens-voice-for-adi-ganga1/> (accessed January 20, 2010).
  - 3 Jenia Mukherjee, "How a Canal Changed a City and how a City Changed a Canal: Erie Canal and Tolly's Nullah in Comparative Light," *Nature's Sake!*, November 27, 2008, <http://justjenia.blogspot.com/2008/11/how-canal-changed-city-and-how-city.html> (accessed December 20, 2009).
  - 4 The India Today article that chronicled this was before the Metro extension was built- which led to further decay. Labonita Ghosh, "Much Battle," *India Today*, October 30, 2000.
  - 5 The series of letters were essentially private initiatives. For a more detailed look at the letter consult: Mohit Ray, "Citizens Voice for Adi Ganga," *VASUNDHARA FOUNDATION CONCERN FOR ENVIRONMENTAL RIGHTS*, January 2, 2010, <http://vasundhara.webnode.com/news/citizens-voice-for-adi-ganga1/> (accessed January 20, 2010).
  - 6 For the High court judgment look at: Mohit ray, "High Court's Judgement and After..," *VASUNDHARA FOUNDATION CONCERN FOR ENVIRONMENTAL RIGHTS*, January 2, 2010, <http://vasundhara.webnode.com/news/high-courts-judgement-and-after-/> (accessed January 20, 2010). (accessed January 12, 2010).
  - 7 CommonLII, *Indian Legislation*, [http://www.commonlii.org/in/legis/num\\_act/ra1989121/](http://www.commonlii.org/in/legis/num_act/ra1989121/) (accessed February 6, 2010).
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**CHAPTER 2**  
DEDUCING SIGNIFICANCE- *Historical Analysis*



**Fig 2.1: HISTORICAL GROWTH:**  
Diagram to show the 3 Time Periods studied.



In addressing the question of how this space has developed into a *sacred sewer*, I traced the channel through 300 years of its recorded history. This also allowed me to understand the terrain more comprehensively.

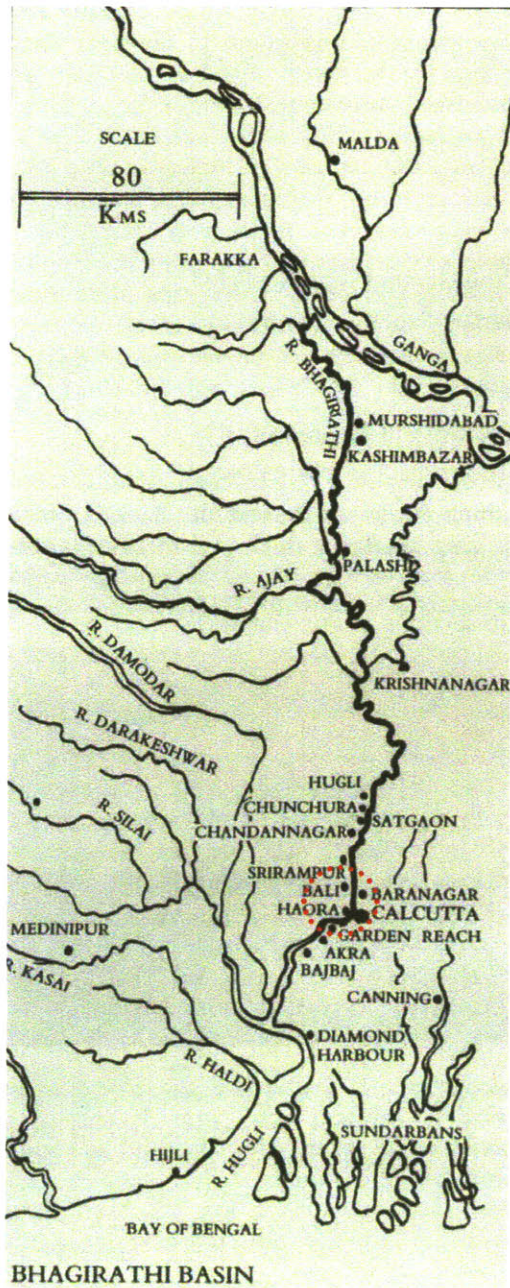
This chapter analyzes the channel through its history.

The historical analysis aims to reveal the different facets of the channel. The facets fall within the polarities of **Natural versus Artificial, Sacred versus Profane, Continuous versus Fragmented**.

These are terms to render a broad understanding of the landscape. The analysis situates the Adi Ganga within broader historical, ecological and cultural domains. The methodology has been used to analyze relevant chronological data for implications on the extant landscape, in order to gain a better understanding of the present condition.

The analysis is carried out using 3 time periods (also the sub-sections of this chapter). They are:

- A. The Pre- Colonial
  - B. Colonial
  - C. Post Independence
-



**Fig 2.1: PHYSICAL SETTING OF KOLKATA**

Source: Sukanta Chaudhuri, Calcutta: the Living City (Calcutta;New York: Oxford University Press, 1990), p.3



**Fig 2.2: ADI GANGA as Thransport**

Source: <http://sankalpa.tripod.com/roots/image/tollynullah.jpg>



**Fig 2.3: KALIGHAT**

Source: commons.wikimedia.org/wiki/File:Kalighat\_Temp



**Fig 2.4: KALIGHAT TODAY**

Source: [http://www.indiamike.com/photopost/data/501/outside\\_of\\_kalighat.jpg](http://www.indiamike.com/photopost/data/501/outside_of_kalighat.jpg)

## A. PRE-COLONIAL (pre-1690)

This section outlines the significance of the Adi Ganga from the 15<sup>th</sup> to 17<sup>th</sup> Centuries, where it functioned as an important navigational route, drainage basin as well as a revered pilgrimage site.

### The Physical Setting

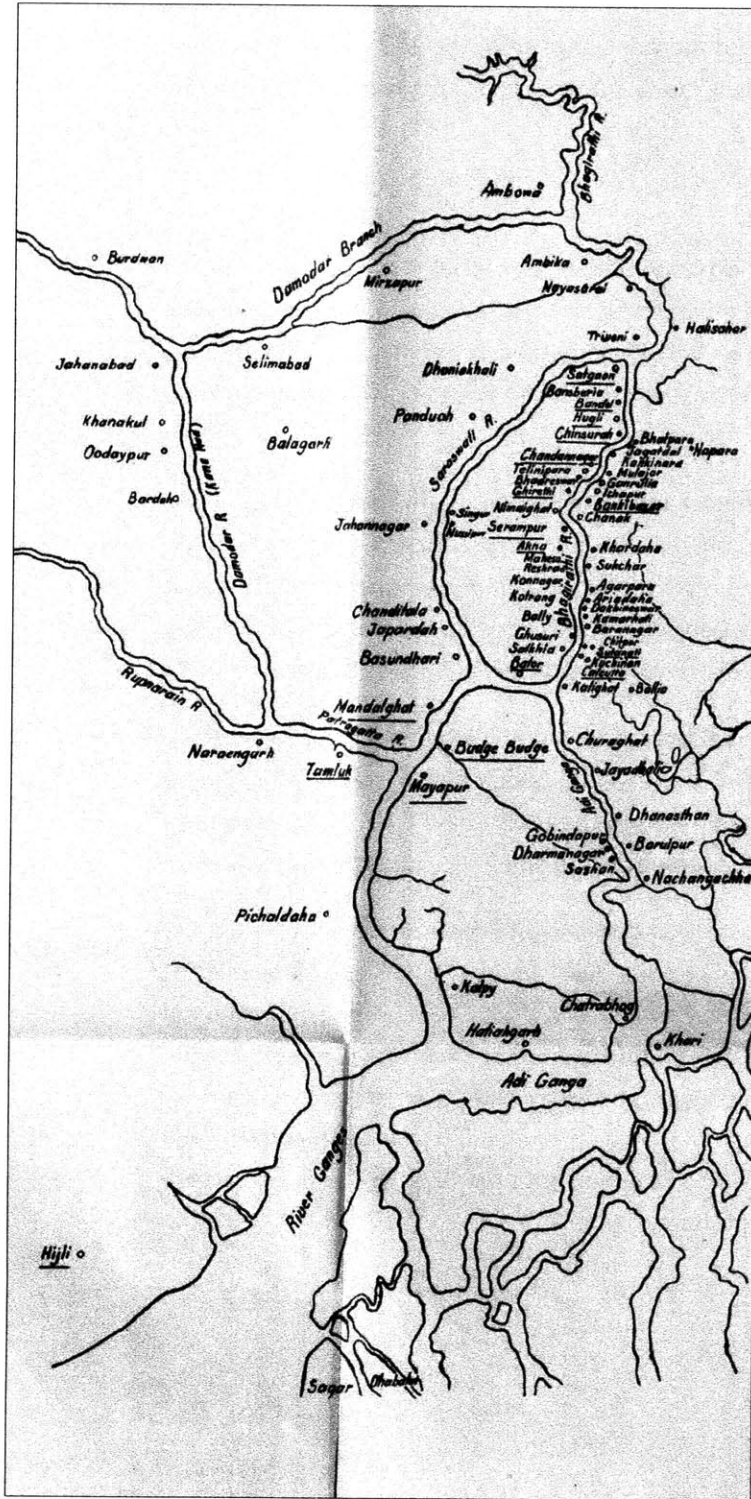
The physiographic setting of Calcutta, from the time of its 'official'<sup>1</sup> foundation in 1690 to the present day, is dominated by the meandering river Hugli (Ganga). Hugging the east bank of the river there stretches a narrow belt of comparatively high natural embankment, some 2 or 3 kilometers wide. The embankment gradually slopes down to the low-lying alluvial plains on the east. (Fig 2.2)

The Hugli forms the westernmost limit of the Gangetic delta- the largest delta in the world, built up by the slow deposition of river silts into the sea. Hence, Calcutta is a typical riverine city surrounded by marshes, tidal creeks, mangrove swamps and wetlands. At the head of the delta near Farakka, the Ganga bifurcates into two major distributaries, the Padma and the Bhagirathi-Ganga, which is known in official parlance as the Hugli.<sup>2</sup>

The common phenomenon of sequential activation and abandonment of deltaic distributaries has played out in the course of the Ganges/ Ganga deltaic region as well. The Bhagirathi-Ganga course carried the main flow of the Ganga till the end of the sixteenth century, when the main stream was suddenly diverted along the course of the Padma.

During the 15<sup>th</sup>-17<sup>th</sup> century, the Bhagirathi was divided into three branches at the vicinity of Tribeni ('Tribeni' refers to three branches of a river) about 175 kms downstream of its off take from the Ganga. These are: (a) Saraswati to the west, which used to drain into the sea through the present course of the Hugli downstream of Sankrail; (b) the Bhagirathi-proper at the centre, which followed the present Hugli course up to Garden Reach (in south Calcutta) and then occupied the Adi Ganga channel and (c) the comparatively less significant Jamuna Bidyadhari to the east. However, both the Saraswati and Jamuna like the Adi Ganga have become inactive at the present.<sup>3</sup>

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**Fig 2.5: ADI GANGA IN THE 16TH AND 17TH CENTURY**  
 Source: Radhakamal Mukherjee, *The changing face of Bengal, a study in riverine economy* (Calcutta: University of Calcutta, 1938)

### The Mythological Origins of Calcutta and the Adi Ganga

Holwell <sup>4</sup> notes that a small brook (Adi Ganga) near Kalighat<sup>5</sup> was “deemed to be the original course of the Ganges by the local Brahmins.”<sup>6</sup> In addition to this documented observation, there have been several references to the myth surrounding Kalighat, situated on the banks of Adi Ganga. (2.3)

C.R. Wilson of the Bengal Education Service recognized that Calcutta had a history that spanned centuries. He shows how Charnock made his mark on the landscape of Calcutta only in the third phase of its early growth and documented the myth surrounding Kalighat in his treatise, *The Early Annals of the English in Bengal*. He writes:

Like other cities Calcutta has its legend. Long ago, in the ‘age of truth’ Daksha, one of the Hindu patriarchs made a sacrifice to obtain a son, but he omitted to invite the god Civa (Shiva) to come to it. Now Sati, the daughter of Daksha was married to Civa, and she was indignant that so great an insult should be offered to her divine husband. In vain did she expostulate with her father. On asking the reason for her husband being ignored, Daksha replies, ‘Thy husband wears a necklace of skulls; how can he be invited to a sacrifice?’ Then, in grief and indignation, and shrieking out- ‘This father of mine is a villain; what profit have I then in this carcase sprung upon him?’ she put an end to her life; and Civa, ‘drunk with loss,’ transfixed her dead body on the point of his trident and rushed like a madman through the realms of creation. The whole world was threatened with destruction; but Vishnu, the preserver, came to the rescue. He flung his discus at the body of Sati, and broke it into pieces, which fell scattered on the earth. Every place where any of these pieces or ornaments fell, became a sanctuary, a sacred spot full of the divine spirit of Sati. The names of these spots are preserved in the garlands of sanctuaries. Some of them are well known places of pilgrimage; others are obscure and forgotten; but to-day the most celebrated of them all is Calcutta, or rather Kalighat, the spot which received the toes of the right foot of Sati, that is of Kali. <sup>7</sup>

The myth surrounding Kalighat continues to live today with thousands of devotees praying each day. Kalighat continues to remain a powerful site for the worship of Kali in the present day.<sup>8</sup> (Fig 2.4)

The mythical origins of Calcutta and Kalighat are inseparable from the life of Calcutta: it is considered by some to be a source of the city’s name. Moreover, while most textbooks on Calcutta still regard its inception to be a purely colonial venture (a process that began in August 1690, when Job Charnock was looking for a good place to land on the banks of the Hugli to set up the outpost of the East India Company), there is evidence to show the existence of a complex economy at work before Job Charnock, where the temple at Kalighat was situated. The pilgrimage path to the sacred site formed a catalyst for economic and cultural activity in the region.

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According to Wilson's account, the English capital of India had grown out of the union of a cluster of riverside places. The three hitherto recognized members of this cluster are Calcutta, Sutanuti and Govindpur; but besides these, Chitpur and Salkhia, the sanctuary of Kalighat, and the original focus of trade, Betor on the west bank of the river were among the elementary constituents of the city. The villages of Sutanati and Govindpur had well established trade communities. The villages of Salkhia, Chitpur, Calcutta and Betor are all mentioned by the fifteenth and sixteenth century Bengali poets. Moreover, the mention of the pargana of "Kalkata" is found in the earliest survey of the country.

Regarding the origin of Kalighat, Wilson states:

we can state nothing definitely, but we have a tradition which may as well be given here, for what it is worth. According to this the founder of Kalighat was an ascetic, named Jangal Gir (in the 15th Century). In those days the fashionable quarter of Calcutta, now known as Chowringee (still referred to, with the same name) was covered with forest and tropical vegetation, and Jangal Gir was living there as a hermit in the woods. One evening whilst performing his devotions by the bank of the Adi Ganga, which was then a great stream flowing south of Calcutta, when suddenly a bright light shone around him, and that same night, when he had gone to sleep, the goddess Kali appeared to him in a dream, and told him that the spot was one of those holy places which had once received a portion of her severed body. The next day he dug up the ground, and proved the truth of his vision. The sacred emblems thus miraculously found were set up for worship in a small wooden house on the bank of the Adi Ganga. <sup>9</sup>

The mythical meaning of the place has continued to the present day. Wilson's accounts testify to the anecdotal manner in which mythical narratives were passed on. Even today, the stories associated with the Adi Ganga are narrated in the same colloquial manner.

### **Adi Ganga: a paleodistributary of the Bhagirathi**

In Bengali literature (from the 15<sup>th</sup>-17<sup>th</sup> Centuries), the channel features extensively. The works described the Adi Ganga course of the Bhagirathi as a principal navigation channel to the Bay of Bengal. <sup>10</sup> (2.5)

These works are now collectively referred to as *Mangala* poems or *Mangalkavyas*- a class of various cult-related narrative themes that flourished in the 13<sup>th</sup>-18<sup>th</sup> century. Voyages to the ocean by their central characters, mostly merchants, was a common theme. Bandhyopadhyay in his article, *Location of the Adi Ganga Paleochannel*, documents the standline villages of the Adi Ganga and other relevant localities mentioned in the *Mangalkavyas*. <sup>11</sup> Its representation has been used to substantiate the claim of the Adi Ganga being an important paleochannel in the past.

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Apart from its mention in Bengali literature, there is historical evidence to prove that the Adi Ganga was an important navigation channel. When Portuguese traders commenced operations in Bengal in the 16<sup>th</sup> century, the two great centers were Chittagong (Porte Grande or the 'Great Harbor') and Saptagram or Satgaon (Port Piqueno or the 'Little Harbor'), the Portuguese traders would use the Adi Ganga as far upstream as Betore on the West bank and the site of today's Garden Reach on the East bank. From there the cargo was transferred to country boats. The support for the observation that the Adi Ganga constituted a major mediaeval outlet of the Bhagirathi mainly comes from the contemporaneous not-to-scale maps prepared by Jao de Barros in 1552 and Van den Brouke in 1660, where the channel is portrayed prominently.<sup>12</sup>

### **The Significance of the Adi Ganga**

Collectively, these facts indicate the importance of the channel between the 15<sup>th</sup>- 17<sup>th</sup> centuries. Moreover, modern photo-interpretation based studies also detect that an approximately 5-km wide and 50-km long levee zone "representing an ancient channel" extends from the south of Calcutta to the area around khari which can closely be correlated with the course of the Adi Ganga.<sup>13</sup>

Apart from the Portuguese source, there is little cartographic evidence to show the 15<sup>th</sup>- 17<sup>th</sup> century state of the channel. The earliest scaled map representing the Adi-Ganga was in the Bengal Atlas produced by James Rennell in 1778. The map shows the channel to be draining into the Bidyadhari below Baruipur. The initial written accounts of the channel described in the early maps as Govindpur Creek, Gunga Nullah, Sharman's Nullah etc., were provided by the *Calcutta Review* in 1852. Subsequently, Hunter, in 1875, identified it as the Adi Ganga and observed how "the Hindus still consider the route of this channel sacred, and burn their dead on the sides of the tanks dug in the bed."<sup>14</sup>

During 1775-77, a connection was made by Major William Tolly between the Hugli and Bidyadhari by means of a 27km long canal which mostly followed the Adi Ganga in its western section upto Gariya. Tolly's nullah, the subject of this study is still there, but the Adi Ganga is no longer an active distributary.

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By the early 20s, topographical maps show the course of the Adi ganga in a completely decayed condition between Gariya and Surjyapur and then, as an active stretch between Chitraganja and Khari creeks, below Bishnupur. In later 1:50,000 scale version of these maps, resurveyed in 1959-60 and 1968-69 respectively no trace of the paleochannel between Gariya and Surjyapur was represented although the name Adi Ganga was retained for the lower section of the still active discontinuous stretch. Bandyopadhyay further goes onto analyze the reason behind the establishment of the present course of the Bhagirathi-Hugli at the expense of the Ganges. Citing *The Calcutta Review* report in 1852, which states: "the traveller never sees any funeral pyres smoking near the Hugli south of Calcutta, as natives have a notion that this is Khata Ganga (khata=kata=excavated), or a modern channel- only the ancient channel is accounted sacred by them" and Reeks in 1919 report that elaborates a connection between the former Bhagirathi, that used to flow through the Adi Ganga, and the lower Saraswati was at established by an artificial cut (from Garden Reach to Sankrail), he documents the different explanations that have been sought for the of both Adi- Ganga and upper Saraswati. This is substantiated using field Investigations confirming the absence of any crematorium or temple along this supposedly excavated stretch and accounts by several authors<sup>15</sup>, presumably following prevailing legends, that suggest the modification of the artificial channel being executed during the times of Nawab Aliwardi Khan (the ruler of Bengal between 1739 and 1756), carried out to resuscitate the lower Saraswati and Rupnarayan; probably involving cutting and deepening of an already existing connection with the help from Dutch engineers.<sup>16</sup>

However, the low probability of a large scale intervention (the length of the supposedly excavated hugli is 10km) in the 18<sup>th</sup> century-of which no proper records existed have been acknowledged, attributing the event to natural processes.

While the decay in the channel has been attributed to the natural transformation of rivers, the urban expansion in the last 300 years have adversely affected the Adi-Ganga, and have virtually destroyed the channel.

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**Summary:**

The significance of the Adi Ganga has been deduced primarily from secondary literature- Bengali folk poetry and Portuguese travel accounts. The picture painted is unlike the one that exists today. In contrast to the sewage drain that the Adi Ganga has been reduced to, the 15<sup>th</sup> to 17<sup>th</sup> Century version resonates significance at an intangible level as well as a material level, that of transport , trade and pilgrimage.

The programmatic implication of the precolonial Adi Ganga would be to use a strategy that increases the significance of the channel, within the tangible and intangible domains of the city.

The character of the channel can be classified as:

**SACRED- Sacred Identity due to its association with the Ganges and Kalighat.**

**NATURAL- It was an open channel, not yet canalized.**

**CONTINUOUS- It was used as a transport linkage and provided a natural drainage basin.**

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**Fig 2.6: CALCUTTA IN UPJOHNS SURVEY- 1892-93**  
 Source: Sukanta Chaudhuri, *Calcutta: the Living City* (Calcutta;New York: Oxford University Press, 1990), p.22



**Fig 2.7: CARTESIAN LAYOUTS**  
 Source:Harvard Map Collection

## **B. COLONIAL (1690-1947)**

The purpose of this section is to analyze the impact of colonization on the ecological systems in Bengal. It reveals what led to the compartmentalization and degradation of the physical landscape and the division in the social landscape. This section shows how the Adi Ganga underwent a transformation: from *Natural* to *Artificial* and from *Continuous* to *Fragmented*.

The first part is an analysis of The Permanent Settlement Act, Land Reform acts and the Riparian Acts, which show the systematic breakdown of the land-water relationships. The study of these reforms provide important clues in understanding the policy that underscores the present condition.

In the second part, situating the Adi Ganga within the fabric of Calcutta exposes its marginal status and provides an insight into its physical condition. Lastly, the analyses of the social and religious codification during colonization provide a more dynamic lens through which to view the Adi Ganga.

This section shows how the relationships that connected the channel to the city were severed during colonization.

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### The English conquest of Bengal

By 1690, Job Charnock had set up an outpost of the East India Company at the present site of Calcutta. The site was appropriate for strong fortifications and on account of being 130 kms from the sea, it was a safe and commodious harbor for the large sea-going vessels of those days. Moreover, the presence of rivers and canals, which connected it to the interior hinterland, provided a perfect setting for trade and the transportation of goods.

As Robert Travers' analyzes in *Ideology and Empire in Eighteenth Century India*, The East India Company's conquests in India had been swift and chaotic. Since its foundation in 1600, the East India Company had exercised its monopoly rights to trade with India through small forts and factories perched on its coasts. During this period, the company was militarily weak and dependent on the Mughal rulers. However, towards the middle of the eighteenth century, there was a shift in the power equation. Travers writes:

(The fragmentation of the Mughal Empire), beset by factionalism, rebellion and new threats from beyond its frontiers coincided with mobilization of the British traders with, unprecedented naval and military resource in response to the globalizing dynamics of European warfare, but also in an effort to exert power and influence over Indian territories, these transformations in India signaled an epochal shift in world power, as militarizing European Nation States cut into the great agrarian empires of Asia, establishing the foundations of modern Colonial Empires.<sup>17</sup>

The Mughal province of Bengal proved to be the first major conquest for the East India Company. Bengal was a notable example of the regionalization of power following the death of Aurungzeb in 1707. Shia Muslim rulers or *nawabs* (provincial governors) built a semi-independent regional state, fighting off incursions by Maratha invaders from western India. Within Bengal, these nawabs achieved significant innovations and raised taxes confining to the commercialization and expanding foreign trade of the time. However, not having any political backing from the north, they were vulnerable to the other powerful interest groups, these being: bankers, who financed their regimes, big land holders (*zamindars*), and the European trading companies clustered on the coast.<sup>18</sup>

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In 1756, on being provoked by an inexperienced, young nawab, Siraj-ud-Daula, the East India Company retorted by deploying the formidable naval and infantry force that had been assembled in Madras to combat the French.<sup>19</sup>

As Travers describes, the commander of the Company's forces, Robert Clive, swiftly re-annexed Calcutta and within a year had struck deals with big financial and political stakeholders within Bengal. Following the Battle of Plassey in 1757, where Clive routed Siraj-ud-Daula's army, a new nawab was installed in the provincial capital of Murshidabad and new territories (and their tax revenues) were secured. The consequence of this was the monopolization of revenue and the beginning of the Company's reign in India. Traver's writes:

The allure of more territorial revenue proved too enticing for the British to resist, and Bengal swiftly collapsed under the weight of British demands. In 1765, Clive, on his second stint as the Company's governor in Calcutta, engineered the appointment of the East India Company as *diwan* (roughly translated as the treasurer or chief revenue collector) of Bengal, by the captive Mughal emperor, Shah Alam II. The grant of the *diwani* was used to extend the controlling power of the British over the breadth of the territorial administration of Bengal. By the 1770s, the East India Company's 250 civil servants backed by an army of a few hundred British army officers and 20,000 soldiers had become the rulers of Bengal.<sup>20</sup>

Thereafter, Bengal was used as a launching pad by the British for territorial expansions and as a laboratory for testing new conceptions of "Empire". Several scholars in the post-colonial discourse have shown how the largely "Enlightened" ideas of Western modernity were deployed by the British in Bengal and India. For the purpose of this thesis, it is sufficient to say that the 18<sup>th</sup> century represented the main phase of transition, where the East India Company was being transformed from being an essentially commercial enterprise to an "Asiatic State", where new paradigms and ideas were tested as "Reforms". Moreover, within this context, the Adi Ganga and others water systems were being transformed as well as these "Reforms" ultimately had direct implications on the ecological balance, as shown further on in this section.

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### Law, Property and “Improvement”

Metcalfe in *Ideologies of the Raj* writes:

During the last quarter of the eighteenth century, the British occupiers were geared towards devising a strategy that would sustain their rule over Bengal and consequently the Indian subcontinent. They had to set in place principles that would enable them to justify to themselves their rule over India. By the end of Lord Cornwallis's years as Governor General (1786-93), the British had put together a fundamental set of governing principles. These were essentially drawn from their own society and the debates that were ensuing in Britain; they included the security of private property, the rule of law, and the idea of “Improvement”. However, these ideas differed greatly from the ones at home- they were in India used to establish the British Empire.<sup>21</sup>

By the 1780s, following the passing of the Pitts Act in 1784, the Company had been transformed into a governing body, with its servants. They were no longer traders, but magistrates and judges. The Company's directors retained control of the daily administration in India, supervised by a board of Control, subordinate to the parliament. As Metcalfe analyzes, “This so called ‘double government, which found expression with Cornwallis's India in the separation of powers of district judge and collector, embodied many of the central elements of eighteenth century Whig political philosophy.”<sup>22</sup> In the Whig political philosophy <sup>23</sup>, the main organs of government, executive, legislative and judicial exercised separate powers so that each would check and counterbalance the other and in turn maintain and secure the rights of the individual and keep at bay those who aimed to gain profit unfairly.

Many of the English thinkers at the time believed that, private property in land lay at the heart of safeguarding social order. Hence, to bring about a justly ruled India, property, above all else had to be made secure. From this point ensued the formulation of Cornwallis's Permanent Settlement Act in 1793, which ordered Bengal rural society until the end of the British rule.<sup>24</sup>

In today's context, it is interesting to note how the system of checks and balances is still prevalent in the governing structures. The predominant “Whig” mode of governance raises important questions in relation to effective policy and administration.

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### **Fixed Boundaries in Fluid Landscapes 'The Permanent Settlement Act' (1793)**

In 1793, Lord Cornwallis introduced the Permanent Settlement Act, where the zamindar was made the owner of the land and he could sell, pledge or divide land between his family members. In return, he was to give a fixed amount of revenue to the government every year and in case of inability to pay the revenue, the right would be revoked and given to someone else. To start with every farmer was given land on a 10-year lease and the zamindars, that paid regular revenues, were made the ultimate owners of the land.<sup>25</sup>

Despina Ilopoulou's argument in *The Uncertainty of Private Property: Indigenous versus Colonial Law in Restructuring of Social relations in British India* is that the incorporation of the permanent settlement act played an important role in organizing and structuring property relations in a way that benefitted the interests of the Colonial state. As stated, "the colonial legislation could override the sanctity of private property, regulate individual access to property, and place limitations over the exercise of free alienation of land."<sup>26</sup>

More specifically, Despina argues that there were two sets of changes within the social framework: between the peasant and the zamindar and more importantly, between the state and the zamindar. Essentially, the change of the zamindar from revenue collector to land owner was primarily to subject the zamindar to state regulation so the revenue claims could be protected. Private property, gave the State regulatory control over the zamindar, the farmer and the land.<sup>27</sup>

The zamindar thus assumed the role of the buffer class or the Indian equivalent of the English yeoman-farmer, whose dependency on large private estates (provided by the colonial government) would ensure his loyalty to the Empire. As Eric Stokes has pointed out:

(The Permanent Settlement Act) was a frank attempt to apply the English Whig philosophy of the government. Cornwallis sought to reduce the function of government to the bare task of ensuring the security of person and property. He believed this could be achieved by permanently limiting the State revenue demand on the land; for he was convinced that the executive arm of the Government would always abuse its power so long as the state demand was variable from year to year.

<sup>28</sup>

The Permanent Settlement Act, thus, reduced the relationship between state and citizen to a purely fiscal level, i.e. Revenue. This was done by creating a class, who maintained fixed revenue, to safeguard their own property.

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Rohan D Souza meticulously analyzes on the transformation of property rights in eastern India, from the Pre- Colonial to Colonial, specifically in Orissa in the late Eighteenth and Nineteenth century. He argues:

The Mughal and Marathas rulers were relatively more efficient in dispensing taqqavi<sup>29</sup> and granting remissions in the Orissa Delta was premised in large parts on a dense rootedness with rural society and by extracting a negotiated surplus, which, in turn, was calibrated and hedged by a system of social and political alliances. For the East India Company, however, rule was anchored in bourgeois landed property based on a rigid realization of a non-negotiable rent and on sustaining exclusive ownership.<sup>30</sup>

It is this notion of fixed, non-negotiable rent when applied to the shifting landscape of Bengal that created the transformation from natural to artificial.

Gunnel Cederlöf explores the tense relationship between a fluid, continuously, changing landscape and the fixed notions of boundaries (to delineate private property) held by the British. The notion of fixed boundaries was intimately linked to the notion of fixed revenue. According to Cederlof:

A major obstacle for any advance into northern east Bengal was caused by nature—by climate, ecology and the physical landscape. The rhythm of the monsoon annually turned marshes into fields, fallows or lakes one year could have turned into shrub or dense forest in the next few years. Acting on orders from the Company government at Calcutta to establish correct and permanent boundaries for cultivation, ownership and neighboring kingdoms, the officers mostly faced insurmountable problems resulting in negotiation, compromise and the enforcement of regulations without recourse to social and natural realities.<sup>31</sup>

In essence, the concept of the Permanent Settlement Act was alien in the fluid landscape of Bengal. The basis of its imposition was extremely “Imperial” and led to the codification of the landscape.

While this section showed where the “Reforms” had their roots, the next section shows how the codification actually affected the landscape.

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### **Reform in the shifting terrain**

In Radhakamal Mukherjee's poetic and vivid treatise on the deltaic regions, he charts the changes in the river systems and their impact on different types of geophysical regions within the Bengal Delta.

Mukherjee emphasizes how the premature decline and death of old rivers or sudden rise and violence of new ones are natural features of the landscape, intersected by the maze of rivers, spill channels and sub channels. As he explains:

Flood discharge in the area of deposition gradually raises the margins of active streams until these serve as ridges or low flood embankments, confining them to their permanent channels and excluding overflow. As the riverbeds consequently rise higher, the river loses connection with the headwater and languishes or dies along with some of the spill channels. On the other hand, the river may erode one of its banks in a curve or over-step or breach the flow embankment. As the country slopes away from the river, a new and active is formed and rapidly develops, ultimately diverting the main river into it. A deltaic river also periodically oscillates between its permanent banks, and this also governs the activity of the off takes of the river on its two banks. On the one side then, we have extinct or moribund channels and on the other, active land building ones. Delta- building consequently goes on indefinitely in this manner through the deterioration of old rivers, characteristic of tracts where anabolism of delta building has been completed and katabolism has set in, and the improvement of old rivers and emergence of new ones in tracts which have yet to be built up and raised above the level of periodical inundation by the river system.<sup>32</sup>

A river and drainage system is thus an integrated whole. There exists a fine balance, albeit a shifting one, between the components of the system: namely the distributaries, channels and the little watercourses, which connect the rivers with swamps or drainage reservoirs in the interior. The silting up of the bed of a particular river or change in its course, and alteration in the level of drainage reservoir or of the tides have far reaching effects on topography, agriculture and the river system on the whole.

These river systems, particularly in Bengal, which have changed significantly over the centuries, have determined the natural preconditions for production.<sup>33</sup> The landscape transformations intensified from the sixteenth century onwards, resulting in increased agricultural productivity and population growth in the Mughal period and contributing to making Bengal a global economic hub for raw silk and cotton.<sup>34</sup>

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In the pre-colonial agrarian society, there was an emphasis on working with the natural cycle, where sudden flooding and drying up of the bank was understood. As noted by Lieutenant Colonel Hag, while reviewing the infamous Orissa Canal Scheme in 1873:

His (the Oriya Cultivator) whole system of cultivation has been adapted to an uncertain and precarious rainfall and periodic inundation. He is a gambler; he has one field on the high ground, another in the hollow and another half way between, so that if he loses one crop by either flood or drought he is pretty sure to save the other.<sup>35</sup>

Many cultivators in the delta attempted to harness floods rather than shut them out from their fields.<sup>36</sup> Consequently, the pre-colonial system of property and taxation appears to have been sensitive to the fluctuations inherent in such a context.

### **Increased embankments and ecological decline**

The equation that the riparian or cultivator shared with the water system changed considerably in the Eighteenth Century. As Rohan D'Souza analyzes, there was a shift, a radical break from the previous accounting procedures. Instead of adjusting the tax claim to seasonal veribility, the Company officials worked towards arriving at an *average* for production for each plot and then settled on a rate for a specified period of years. With the previous flexibility thus abandoned, *inundation* the colonial administration vocabulary was equated with a loss in revenue rather than viewed as part of a natural cycle in which the damage of one season was usually compensated by abundance in the next. As D'Souza explains:

Deltaic inundation was increasingly treated as an aberration on the production landscape rather than as a phenomenon integral to the fluvial regime. In effect, landed property produced a new perception that deltaic inundations were calamitous events rather than geomorphologic processes. The colonial administration consequently developed the idea of flood control to buttress attempts to secure its property regime and its revenue collection strategies. Embankment structures designed to insulate lands from inundation were the first flood control works deployed by the British. An Embankment Committee was instituted and military engineers carried out the general administration and construction of the structures in the initial period. The embankments system had in a matter of fifty years converted a flood dependent agrarian regime to a flood vulnerable landscape, with an altered drainage system.<sup>37</sup>

The entire landscape was being turned from the natural to the artificial, with embankments blocking natural cycles. By the middle of the Nineteenth century, the embankments had their foundations peppered across the landscape.

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### **The Revolt of 1857 and the construction of Railways**

The 1850's witnessed the introduction of three engines of "social improvement" that heightened the British illusion of permanence in India. They were the railroad, the telegraph and the uniform postal service, inaugurated during Dalhousie's tenure as governor general.

Situating this within the larger context of the Nineteenth century ideology of "Establishment of Empire", the increased communication and the opening of railways and highways accelerated the movement of troops, the transportation of raw materials and goods from the interior and the exchange of commercial information. The sepoy mutiny of 1857, which led to the fall of the territories under the East India Company to the direct governance under the Crown in the new British Raj, also led to the further acceleration in the building of railways.

Essentially, the implications of the railways on the water system on Bengal is two-fold-

1. In propagating the railways, the government and the railway authorities failed to appreciate the relative importance of inland waterways. The waterway system, extensively used in the pre-colonial times, became an irrigational resource-commoditized and codified. (Fragmented identity as opposed to a continuous one)<sup>38</sup>
2. The extension of railways in the Bengal Delta also meant equal degree of extension of embankment amidst a highly fluid landscape. Thus, the 3500 miles of railways that traversed the Ganges-Brahmaputra watersheds also represented almost similar length of embankments.

The colonial technological feat in the form of railway not only helped to maximize the collection of raw materials, but it also substantially threatened the water systems of the region. In addition to the embankments created for irrigation, to maximize revenue, the railway embankments further emaciated an already fragile water system.

Given the circumstances, it was no wonder that as early as the 1920s C.A. Bentley, Director of Public Health, Bengal, pointed out that due to the blind way of building roads and railway embankments without adequate culverts, the country became divided into innumerable compartments and it was extremely difficult for rainwater to flow from one compartment to another. Every year, Dr Bentley added, the floods increased in severity and he warned that unless remedial measures were adopted.<sup>39</sup>

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Interestingly enough, bringing the conversation to the present, Kolkata faces massive problems due to floods.<sup>40</sup> Every year countless people are left homeless, with water reaching waist high.

Essentially, these Reforms had changed the natural pattern of drainage in the city. The effects of which, are noticeable even today, as in the case of the floods in Kolkata.

This raises the question: In this context of Colonial "Reform" and its implication on the ecological systems of Bengal, how has the Adi Ganga been affected? The effects, of these Reforms can be calibrated along the following strains:

**A- Drainage:** Drainage is a crucial problem in the city of Kolkata. Since the establishment of the Fewer committee, in 1803, drainage in Calcutta followed similar ignorance of the natural systems at work. The Cartesian division of land ensued in the urban context as well. As the city was laid out, wetlands, ponds were filled and natural streams were canalized and embanked. Moreover in Calcutta, the sewage lines were laid out in the north- south direction in a heavy-handed manner, in contrast to the natural drainage that occurs East-West. These factors led to the breakdown of the natural drainage pattern. This pattern continued in "Modern", independent India with the Salt Lake City, where the entire western marshland was filled up to construct a township.

**B-Governance and policy:** In Philippe Cullet's analysis of present day water policy, He states: "the existing framework in India is characterized by the co-existence of a number of different principles, rules and acts adopted over decades. These include common law principles and irrigation acts from the colonial period."<sup>41</sup> By analyzing the water laws in India, he shows how the colonial riparian policies are still an inherent part of the Water Laws that operate in India. He goes on further to show how Acts like the Madhya Pradesh Irrigation Act, 1931 and recent Bihar Irrigation Act, 1997 have increased the power of the state in regulating water systems.

In his paper Cullet writes about the Environmental impact assessment, the Environmental Impact Assessment Notification that provides a framework for assessing the environmental impacts of planned hydropower and irrigation projects. With regard to displacement, the main act that applies is still the Land Acquisition Act, 1894. He writes: "This colonial act, which was enacted with the interests of the colonial government rather than the interests of displaced people in mind, gives the government significant control over the process of eviction and ousted very few rights".<sup>42</sup>

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A direct correlation can be made between his analysis and the conditions surrounding the Adi Ganga channel. In the construction of the metro extension, the state government under the directive of the high court cited the Clause 11 of the Railways Act, 1989 gave the Railways the power to “make or construct in or upon, across, under or over any lands, or any streets, hills, valleys, roads, railway, tramways, or any rivers, canals, brooks, streams or other waters, or any drains, water-pipes, gas-pipes, oil-pipes, sewers, electric supply lines, or telegraph lines, such temporary or permanent inclined-planes, bridges, tunnels, culverts, embankments, aqueducts, roads, lines of railways, passages, conduits, drains, piers, cuttings and fences, in-take wells, tube wells, dams, river training and protection works as it thinks proper’<sup>43</sup> Moreover, there was no compensation paid to the displaced. The effective “State control” along with the antiquated colonial policy put into action is evident from this case.

Moreover, as analyzed in the next chapter, the channel (like other channels in Calcutta) is controlled by several governing agencies. The consequence being, no comprehensive policy can be established. In a case of uncanny, the Adi Ganga still comes under the control of the Irrigation department. The scope of the thesis does not allow an in-depth analysis of the historical implications of Colonial Riparian policy. However, certain glaring question surface do surface. They being:

1. Why is the channel still a part of the Irrigation department, considering it is situated in an urban setting and no longer functions as an irrigational resource?
2. How can an effective policy be formulated for urban channels- like the Adi Ganga?

**C-The degradation of Waterways:** Although it can be argued that the abandonment of the Adi Ganga channel as a navigational route was due to certain natural processes, the building of railways is coincidental with its abandonment. In the larger scheme, where waterways had become peripheral, historic waterways were abandoned. Faster, more efficient forms of transport replaced these older channels.

What is evident here is that the ambiguous terrain when classified and cordoned off lead to the degradation of the ecological systems. In the case of Adi Ganga, this led to the significance of the channels as a navigational route and a drainage basin to be atrophied,

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**Fig 2.8: Black town and White town**

Source : Keya dasgupta, Mapping Calcutta, Archive Series (Calcutta: Centre for Studies in Social sciences, 2009), p.12

## **CALCUTTA AND NINETEENTH CENTURY COLONIAL RULE**

This section concentrates on the scale of the city of Calcutta. It shows how the position of the Adi Ganga, beyond the confines of the black and white town, affected its physical condition. Moreover, this section also traces how the channel ceased to be a transportation linkage.

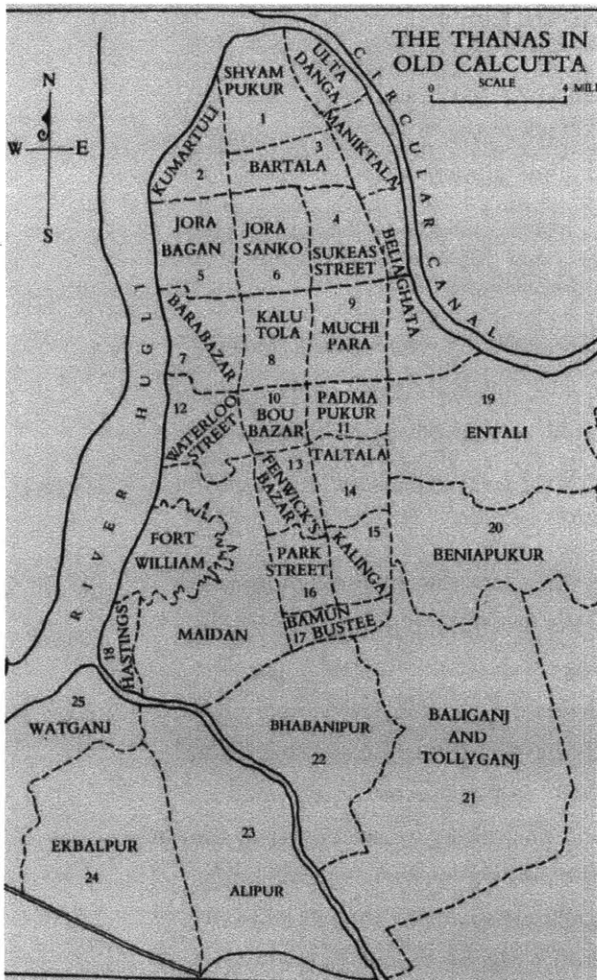
### **Beyond the Black and White town**

Taking off from the Land reform acts, during the nineteenth century, Reforms formed the centre of state activity and the new policies that were introduced decisively shaped the new modernity in India.<sup>44</sup> This caused a codification, in the physical landscape (as discussed earlier) as well as the social landscape. Nowhere was this codification more visible than in the clear physical demarcations of Calcutta.

Calcutta had, since the eighteenth century, performed a key role in the commercial growth of the East India Company and consequently the British Empire. It also supplied the essential resources necessary to sustain the growing colonial state. By mid nineteenth century Bengal contributed 44% of the total British Indian revenue (26% more than Bombay). Bengal represented the most important, but at the same time, the most exploited region in the colonial state, with Calcutta as a nodal point in this process of exploitation. It grew as a typical colonial city, linking the hinterland of primary production with the plantation and mining enclaves, and exporting the entire product (as well as providing the services involved) in the interests of an imperial economy. (The canals connected the city to the hinterland)-. The city was of importance within the regime as long as there were resources to tap into. Once this ceased to be the case, as in the early twentieth century its development was interrupted, at a vital point of growth.<sup>45</sup>

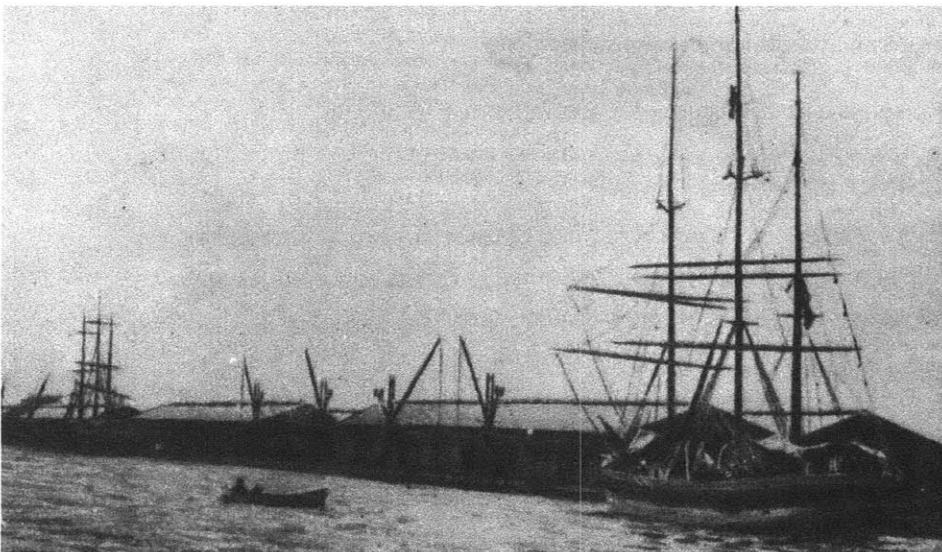
As shown by the popular renditions of Calcutta, the urban fabric had two distinct parts : the European and an Indian town were the physical manifestation of the two processes, sometimes contradictory to each other. The European or white town tended to specialize in relatively narrow, highly capital-intensive sector that formed a part of the global network. It represented planning ideals with broad well laid out streets and avenues and a high level of real estate. It was an artifact of colonial settlement.<sup>46</sup>

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**Fig 2.9: Calcutta: Neighborhoods**

Source: Sukanta Chaudhuri, *Calcutta: the Living City* (Calcutta; New York: Oxford University Press, 1990), p.16



**Fig 2.10: The first vessel entering the Kidderpore Docks-1892h**

Source: Sukanta Chaudhuri, *Calcutta: the Living City* (Calcutta; New York: Oxford University Press, 1990), p.124



The Indian or black town, on the other hand was a space teeming with massive, mixed crowds, many of whom were only marginally connected with the main channels of economic activity in the zone. It was, by the nineteenth century, the place where the new middle class, comprising of the Bengali business class and the expanding group of urban landlords, accommodated themselves. (The coalescence of British and Indian culture had resulted in the emergence of a new *Babu* class of urbane Indians — whose members were often bureaucrats, professionals, read newspapers, were Anglophiles, and usually belonged to upper-caste hindu communities.)

In the latter part of the nineteenth century, the city underwent rapid industrial growth, especially in the textile and jute sectors, abetted by the massive investment in infrastructure. As a result, the port of Calcutta called for further improvements, and docks were built. It must be noted that up to 1860 the port of Calcutta had a very small hinterland comprising only Howrah, Hugli, 24 *Parganas*, and a small part of Eastern Bengal. The establishment of jute and cotton factories in Calcutta and its suburbs and the opening of the new lines of communication expanded this hinterland. By 1900 Calcutta's port supplied the whole of Bengal and Bihar, Assam and a portion of the North-Western Provinces with salt and other goods from Britain. With the advent of heavy machinery, European manufactured goods were distributed throughout Northern India from Calcutta, while the principal articles of export from the region were opium, indigo and cotton, with opium and indigo accounting for more than half of the total value of all exports. The opening of the Suez Canal gave a tremendous impetus to India's foreign trade which in the five years from 1869, was running at an average annual value of exports and imports of US\$ 19 m.<sup>47</sup> The Growth of industries in the nineteenth century changed the face of the region. Calcutta was the location of the jute textile industry and finally the rapid development of a coal industry from 1895, added a new dimension to the port. The growth of the port and commerce attracted the rural poor to Calcutta in search of jobs. Since the transport system did not allow them to commute daily they had to live in the city itself in unsanitary and sub-human conditions that gave birth to the so-called slums. Part of the slums consisted of the areas where the British population's servants lived without basic facilities. The first slums to come up thus were for the service of the white town. However with increased urbanization, they inhabited the industrial landscape.

The Kidderpore docks attracted a number of migrants by the late nineteenth century.<sup>48</sup> As visible in the map, the settlement around Kidderpore grew within the boundaries set by the fort in the north- the southern boundary of the white town and the Kidderpore docks in the south, representing the industrial landscape. This industrial landscape formed itself around the Adi Ganga.

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In the spatial sense, this division between the Black and White town has been the focus of majority of the analysis pertaining to the physical fabric of Calcutta. The Adi Ganga, within the physical boundaries of the city, lay outside, on the margins of the white town, forming a distant boundary to the European town. In the usual patterning of colonial city space, the landscape of the Adi Ganga was peripheral, not central in the delineations of the colonial administrators. This area did not fit the usual dichotomy of the black and white town, but developed independently, forming a dispersed landscape. The channel, by then excavated and converted to a canal formed a boundary, an interface between the hinterland and the city. Except from enclaves of old neighborhoods like Bhabanipore, the British neighborhoods of Alipore, Hastings and the industrial landscape of Kidderpore, the remaining area retreated to a no-mans land. The Adi Ganga had by then become Tolly's Nullah and reduced to a resource-retrieving infrastructure.

#### **ADI GANGA TO "TOLLY' S NULLAH"**

In the official colonial parlance, the first mention of Tolly's Nullah is dated the 6<sup>th</sup> of July 1775, when Major Tolly applied for permission to excavate a canal between the Hooghly and the salt lakes at his own expense. His proposal was approved by the government in 1775, with a lease of the tolls at 1% on the invoice price of all goods carried by boats through the canal granted for a term of 12 years.<sup>49</sup>The canal followed the old bed of the Ganges, or Adi Ganga. Tolly excavated the course to open up the river route connection of Calcutta with the districts of East Bengal. He therefore excavated the old channel towards the east to connect it with the Bidydhari-Matla river system.

Major Tolly's lease was extended to his widow and prolonged for another 15 years. The nullah was taken over by the government eventually. Records reveal that there was constant trouble in maintenance of the channel on account of the tides meeting between Russa and Garia (where the flow of the channel reverses). The heavy boat traffic led to congestion. In 1823, there was a proposal to rebuild the bridges on the nullah, and by the following year a suspension bridge was built at Kalighat and Kidderpore. The addition of more bridges across Alipore and Tollygunge affected the water level.

In 1882, proposals were made to canalize Tolly's Nullah completely, by building locks at Hastings and Samukpotta. The project was not undertaken. However, a boat canal at Chetla connecting to the Kidderpore Dock was constructed. The canal does not appear to

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have been used by boats and was converted to a silt trap in which the silt from the water fed in from the nullah is allowed to settle before the water is pumped into the docks. The draining of a large supply of water from the nullah has resulted in an increase the silting between Tollygunge and Garia. In 1903 there was another proposal by Mr. OC Lees to canalize the nullah for boats and inland streamers and flats. However due to financial costs, the proposal was abandoned.<sup>50</sup>

In the context of embankments, and policies of drainage that affected the larger landscape of Bengal, and the lack of maintenance (desilting), through successive canalizations, the Adi Ganga became largely divorced from the natural drainage map.

### **SITUATING THE ADI GANGA WITHIN THE COLONIAL RHETORIC, CODIFICATION OF RELIGION.**

The neighborhoods that surround Adi Ganga, do not surface in the colonial literature on the Nullah. These neighborhoods provide a different, unique lens to understand the taxonomy of social relations that existed, and still exist in isolated cases.

Bhabanipur, lying on the northern bank of the Adi Ganga, developed unlike the British cartographic portioning system of corridors and blocks, but resembled a capillary system penetrating a dense and complex fabric. This fabric had been formed along occupational and caste lines from the seventeenth century along the Adi Ganga (for ease of trade and transport). Kalighat formed the nucleus of the settlement, on account of its associated reverence. As Keya Dasgupta writes, "Historic maps reveal a distinct commercial belt along the banks of the Adi Ganga, the remnants of streets buildings and the large number of temples all testify to the importance of Adi Ganga in the urban scheme of the indigenous population of Bhabanipore." The presence of religious ghats (landing points on the riverfront), temples and cremation grounds reinforces this importance.<sup>51</sup>

The other neighborhoods that abutted the Adi Ganga have Mughal lineages. In the instance of Alipore- named after Ali Naqi Khan who had a ghat on the Adi Ganga. Or the naming of Kidderpore- Khidirpore bridge alluding to Khidir or the "patron saint of river crossings" in Islam. These allude to certain fluid communal relationships. The artifact thus absolved of its all-Hindu identity.

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The landscape of the Adi Ganga thus forms a composition of religious nuances. In the context of Bengal, where religion has been perceived, historically, as fluid as the landscape, it forms an interesting underpinning to the cultural landscape of the Adi Ganga and expands its significance. (In Bengal for instance, the Goddess of the Sunder bans is Banbibi, or “the lady of the forest”, also Bandevi, Bandurga and Byaghradevi is a guardian deity of the forests worshipped by both the Hindu and the Muslim residents of the Sunderbans.)<sup>52</sup>

Metcalf in the concise history of India alludes to the rather fluid relationship to religion in the pre-colonial subcontinent. This changed during colonization, where the “acceptance of Orientalists notions of India’s ‘decline’ from a glorious past, and the singling out of the medieval Muslim rulers as the prime agents of that decline led to the theory of India’s past inevitably exacerbated the emerging divide between Hindu and Muslim.”<sup>53</sup> The creation of horizontal identities of “Hindus” and “Muslims” was a “colonial characterization to a pre- colonial past.”<sup>54</sup>

The “artificial” differentiation brings forth the question of social restoration, rather the scope of it. As designers, can a new geography that seeks to invert a 300 year codification of our religious landscape be implemented? If so, how?

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## SUMMARY

At the time of British occupation in India, the relationships between the water systems and the city atrophied. Reduced to resources, their presence became peripheral in the grand scheme of things.

This section analyzed the break in the physical connection between the water systems and the city in the following ways:

- Notion of fixed boundary on a fluid landscape for revenue.
- Drainage in Calcutta- The construction of roads along the north south axis, using Cartesian notions created compartments in the land, disturbed the equilibrium of drainage leading to stagnant water, which were the filled up. Thus the ecological balance was disturbed.
- Due to the preference given to railways, the water systems were ignored and eventually degraded. In the colonial paradigm, it was cheaper and faster to have land-based transport. In the context, the Adi Ganga too, degraded and silted further and ceased to be a transport route for the city.
- Moreover, due to the presence of docks, the area surrounding the Adi Ganga has always been home to the poor, the peripheral in the schema of the *black and white city*

However, outside the formation of the duality of black town and white town was the industrial landscape (near the Adi Ganga). This landscape had a different character. It can be argued that beyond the confines of the black and white towns developed a third landscape that had a more complex identity, where the British, Indian- Hindu and Muslim identities developed in conjunction (an aspect that can be studied in the future).

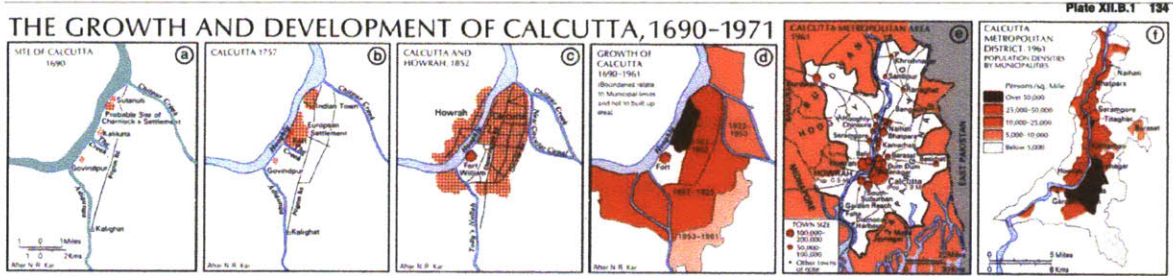
The character of the channel was transformed to:

**Natural to Artificial:** Land water relationships changed due to the enforcement of boundaries, rent and revenue. There was a separation and codification of the fluid landscape. Moreover, the identity of the Adi Ganga too changed from being natural to artificial, on being canalized by William Tolly in 1775. The natural balance was disturbed.

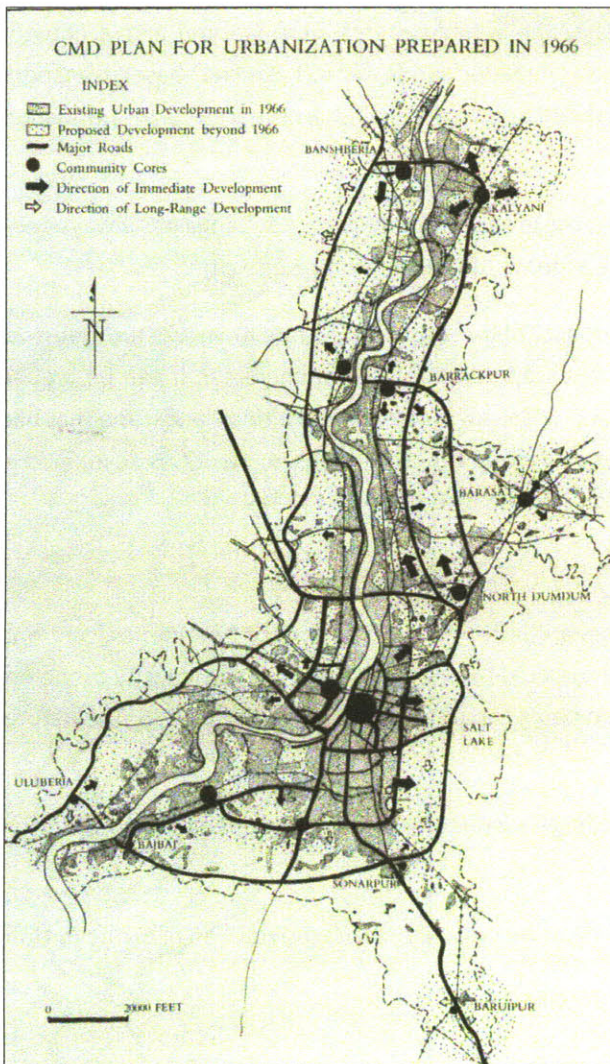
**Sacred and Profane:** The use of channels as drainage systems and the subsequent juxtaposition of pollution on a religious artifact.

**Fragmentation-** creation of embankments/the treatment of railways/ makes the Adi Ganga divorced from the natural scheme of things.

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**Fig 2.11:Calcutta: Growth in the 20th Century**  
 Source: <http://dsal.uchicago.edu/reference/schwartzberg/fullscreen.html?object=171>



**Fig 2.12:plan for Urbanization in1966-**  
 Source: Sukanta Chaudhuri, *Calcutta: the Living City* (Calcutta;New York: Oxford University Press, 1990), p.145

### **C. POST INDEPENDENCE**

The primary focus of this section is to draw parallels between a colonial and post-Independence era that share a sensibility of "Improvement." This has been analyzed based on the treatment of the migrants who inhabit the canal banks and the socio-political pressures working against them, played out by the governing institutions. Moreover, to reveal the rather flawed nature of the regulatory landscape that still follows the language of its past rules, a top-down approach that further degrades the already poor environmental condition. The question then is: Is trusting the public sector a mistake, when it comes to improving the condition on the ground?

### **INDEPENDENCE, PARTITION AND RISING COMMUNALISM**

In the aftermath of the Second World War and the emancipation of British forces, the Empire finally crumbled. On the 15<sup>th</sup> of August 1947, Jawaharlal I Nehru in a dramatic gesture announced the independence of India. In an eloquent and poetic message he addressed the assembly:

Long years ago we made a tryst with destiny, and now the time comes when we shall redeem our pledge, not wholly or in full measure, but very substantially. At the stroke of the midnight hour, when the world sleeps, India will awake to life and freedom. A moment comes, which comes but rarely in history, when we step out from the old to the new, when an age ends, and when the soul of a nation, long suppressed, finds utterance. It is fitting that at this solemn moment we take the pledge of dedication to the service of India and her people and to the still larger cause of humanity.<sup>55</sup>

Independence was however marred by the horrors of riots and massacre. Bengal that had assumed a great deal of importance during the freedom struggle bore a brunt of this communal violence. The partition of India into Pakistan involved the division of the state of Bengal.

The two nation states of India and Pakistan were essentially formed on communal basis. In Calcutta, symptomatic of the rest of the country, the wave of immigrations had been preceded by wrath of massacre and riots. In the Great Calcutta Killing from the 16<sup>th</sup> to the 20<sup>th</sup> of August, 1946, as mobs roamed the city, some 4000 people of both, Hindu and Muslim communities, were killed and thousands more wounded or made homeless. The killing of some 7000 Muslims in Bihar, and a lesser number of Hindus in the Bengal district

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of Noakhali, promptly followed. The violence that erupted in the rest of the country had a marked influence on the landscape of Calcutta-communalism had taken precedence, solidified into crystals and marked itself in community clusters. Present day neighborhood boundaries ensue from these stark lines of communalism.

In terms of the logistics of partition, the minority communities of both these states crossed borders in search of political security- or so they believed. Thousands of 'displaced persons' or refugees made their way to the cities of Calcutta and Delhi. The two 'capital cities' of the empire held the promise of being able to support the large refugee flow. However, the municipal government in both the cities was not adequately prepared for the massive influx. The refugees came in waves and sought out shelters according to their means and opportunities. Whilst the rich could afford new property, the poor, simply encroached on vacant land and built houses of all sorts on their own, the poorest setting up squatter colonies on public land.

### **THE STORY OF URBAN MIGRATION IN CALCUTTA**

The migrants from East Bengal or present day Bangladesh can be historically situated in the three hundred year old history of Calcutta, as sustainers of its cultural and economic life. The origins of slums in Calcutta can be traced to the pre-industrial colonial city, where they served the imperial rulers. The second group resulted from the industrialization process. The large flow of British capital led to the development of jute and engineering industries in and around the city. Railways, postal facilities, banks and dock facilities also led to the diffusion of the population over forty miles on the bank of the Hugli river. The post Independence squatter settlements (locally called jhopri), created base, adjacent to infrastructural lines.

The 1951 census found that only 33% of the population of Calcutta was born in the city. After Partition, 2,58,000 migrants sought shelter in West Bengal. This number increased to 5,90,000 in 1948 and 1,82,000 in 1949. The stories of the East Bengal refugees diverges at the economic fork, the refugees who had means bought property or exchanged it with evacuee Muslims, creating new 'private enclaves'. A considerable number rented houses, in middle class localities or slums. But it was the squatters who made East Bengali refugees famous. Squatting ranged from the occupation of barracks in the Dhakuria Lake area and New Alipore by individual families to the collective take over of private, government and wastelands. <sup>56</sup>

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The statistics continued to pile up. The fragmented, differentiated unequal Indian society has fuelled urban migration from the hinterland to the urban center in search of *equal* opportunity. The 1966 survey showed non- Bengali workers made up 71% of the labor force in the jute mills, 58% in the textile mills and 73% in the iron and steel plants. In the state industries on the whole, the proportion was 60%. The industrial and rapid urbanization of Calcutta, led to the migration of cheap labor from the hinterland, looking for cheap accommodation, settling in mud and bamboo constructed houses by middle-men, on leased land from land-lords.<sup>57</sup>

The labor numbers have declined recently owing to the decline in industry.<sup>58</sup> The influx of migrants however, has not paralleled provision of infrastructure needed to service these new communities. Housing statistics show the steep increase in the slum population of the city. The 2001 Census reports that out of a total population of 4,580,544, 1,490,811 live in slums. One third of the population within the Calcutta Metropolitan Area lives in slums. There are, approximately, 2000 registered and 3500 unregistered informal settlements in the city.<sup>59</sup> The urban Slum Report on Kolkata (name changed after 2001), those that are officially authorized are called *bustees*. The bustee, in contrast to a 'slum settlement' is defined by the physical nature of its structures. According to the Calcutta Municipal Act of 1951, '*Bustee* means an area containing land occupied by, or for the purpose of collection of huts standing on a plot of land not less than seven hundred meters in area. A hut in turn is defined "as any building, no substantial part of which....is constructed of masonry, reinforced concrete, steel, iron or other metal."<sup>60</sup>

The squatter settlements that are not authorized have grown by the side of canals, large drains, garbage dumps, railway tracks and roads. They are defined by The West Bengal Slum Areas (Improvement and Clearance) Act of 1972 as 'injurious to public health or safety or to the health, hygiene or morals of the inhabitants of such area'. The living conditions of the people living in these shanties are the worst. They do not have any amenities, such as sanitation or water.<sup>61</sup>

The unauthorized slums are known by their own local names: the ones near roadside are called *jhupri*, alongside canals are called *khaldars* and those that establish themselves in any vacant space are called *udbastu*. Their structures are either *pukka*, semi-*pukka* or *kutchra* (crude or imperfect). The 1981 census revealed that about 3 million people live in 5000 slums strewn through the city. The *khaldars* or settlements along canals come under the Irrigation department of the Government of West Bengal. With no services provided in terms of drainage, sanitation, waste management or water supply, the environmental

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conditions of these settlements are appalling. The canals are used for the disposal of sewage. The canals also receive effluent discharge from industries as well as untreated sewage from sewer lines.<sup>62</sup>

### **MIGRATION AND EVICTIONS ON TOLLY'S NULLAH**

In 1983-84, Unnayan, a social service organization specially concerned with housing and shelter made a survey of the shanty dwellers at eight points along the city's canals and open arterial sewers. The land adjacent to the Tolly's Nullah had 1240 households with an estimated population of 6200. The population along the banks has escalated in recent years.<sup>63</sup>

It was in this context of "urban squalor" that the government initiative to clean, desilt and upgrade the canal was welcomed. Under the GoI funded Mega City Project, The West Bengal government received a loan from HUDCO to desilt and excavate city canals, implemented jointly by the Calcutta Municipal Corporation and the Irrigation Department. In similar vain, Tolly's Nullah was the site of two State Government projects- The Government of India's Ganga Action Plan and the second being the Calcutta Metro Rail Extension.

On the 22<sup>nd</sup> of September 2002, 15000 residents were evicted from the squatter settlements along the Tolly's Nullah. The act received its fair share of public scrutiny, especially from the opposition (the Trinamool Congress)- both in legislature and the streets of Kolkata. However, inspite of valiant efforts to stop the eviction proceedings, they were carried out. The evictions were carried out on the orders of the state government, by the Calcutta Municipal Corporation and the Irrigation department- the custodians of the landscape. Keeping aside the deep political agendas in this issue, the case, and the governing structures throw up pointed questions on the fissures that exist between the stakeholders and the custodians of the land. Both, I argue, function in a colonial paradigm of "improvement" and the "narrative of deliverance".<sup>64</sup>

The city mayor at the time, Subrata Mukherjee, had taken a pro- active role in "improving" the city and implementing municipal policy reforms, and in that light had made controversial decisions such as taxes on water, clearing the pavements of hawkers and evicting squalor settlements. A point to be noted though, is that neither the CMC nor the State government accepted the responsibility for the squatters resettlement, alleging that as "illegal" occupants, they were not eligible.<sup>65</sup>

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The *Statesman* claimed that the conditions in Tolly Nullah were worse than before. The article went on to highlight the futility of the eviction drive: “the only thing that seems to have been cleaned are the dwellers. The nullah remains stagnant as ever”.<sup>66</sup> The area of the evicted bustees is now a part of the waste landscape and informal landfill. The canal is a sewer. The inhabitants of the settlements that were evicted were left to fend for themselves, in possibly more wretched conditions. The situation portrays the inefficacy and short sightedness of the public sector and the failed developmental rubric that the it functions under. Does a situation like this demand a new imagination, one that rearticulates the “image of improvement”?<sup>1</sup>

## SUMMARY

The research in this section was geared towards two issues: the physical and the ecological. On the physical front, the new Nation State of India had co-opted several colonial policies. These, combined with the new “Modern” state lead to the further degradation of the ecological balance. The construction of more highway along with and ventures like Salt Lake city resulted in the filling up of ecologically significant wetlands, important elements in the drainage of the city.

On a social front, the increased industrialization lead to more migrants moving into the city. These new migrants inhabited the old industrial landscape. In addition, refugees from the partition- settled in slums and *bustees* along the canals. On account of the lack of services, the waste of from these *bustees* was released into the canals. Recently, under the umbrella of neo-liberalism, the informal settlements have been evicted under “Improvement drives” by the government.

This brings us to the present state of the channel, which lies within the categories of the Sacred versus the Profane, the Continuous versus Fragmented and lastly the Natural versus the Artificial.

The historical analysis, essentially provides an understanding of the range of issues the channel faces and reveal how the channel has developed its facets. Moroever, it chronologically unpacks the reasons for the preset state of the channel- its dissociation from the schema of the City.

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## ENDNOTES

- 1 Calcutta has largely been attributed as a purely Colonial venture in popular history. Moreover, the British did not consider Charnock a founder. It has been a purely Marxist formulation in the 20<sup>th</sup> century. For more on the subject, consult: Durgaprasad Bhattacharya, "Calcutta: Misconceived Tercentenary," *Economic & Political Weekly*, Vol. 25, No. 37, 1990: 2041-2042.
  - 2 Sukanta Chaudhuri, *Calcutta: the Living City* (Calcutta;New York: Oxford University Press, 1990), p.2
  - 3 Sunando Bandyopadhyay, "Location of Adi Ganga Palaeochannel, South 24-Parganas, West bengal," *Geographical Review of India*, 1996: 93-109.
  - 4 Holwell was the Collector of Calcutta from 1752 and 1756). He wrote an account of the incident in which he claimed that of 146 prisoners, 123 suffocated when imprisoned in the tiny room, termed as the Black Hole of Calcutta. His version of events, which was not challenged by other survivors, was widely accepted at the time in Britain. wikipedia, *Black Hole of Calcutta*, December 20, 2009, [http://en.wikipedia.org/wiki/Black\\_Hole\\_of\\_Calcutta](http://en.wikipedia.org/wiki/Black_Hole_of_Calcutta) (accessed January 31, 2010).
  - 5 Kalighat is presently a neighborhood in Kolkata. It is also the location of the famous Kali Temple.
  - 6 J. Z. Holwell, *Interesting Historical Events, Relative to the Provinces of Bengal and the Empire of Indostan*, pt.3 (London: T Becket and P.A. De Hondt, 1771).
  - 7 C R. Wilson, *The early annals of the English in Bengal (Volume1)* (London: W. Thacker & Co., 1895), p.128
  - 8 Kalighat is considered to be one of the fifty-one *pithas* of the Goddess. The manifestation of the Goddess here is known as Dakshinakali; her consort Shiva is Nakuleshwar; Vishnu in the form of Krishna, dwells under the appellation of Shyam Ray in an adjacent temple. The association of these three deities makes Kalighat a unique meeting –point for both Shakta and Vaishnav pilgrims, for ascetics as well as householders. Sukanta Chaudhuri, *Calcutta: the Living City* (Calcutta;New York: Oxford University Press, 1990), p.24
  - 9 C R. Wilson, *The early annals of the English in Bengal (Volume1)* (London: W. Thacker & Co., 1895),p.130-132
  - 10 Sunando Bandyopadhyay, "Location of Adi Ganga Palaeochannel, South 24-Parganas, West bengal," *Geographical Review of India*, 1996: 93-109.
  - 11 Ibid.
  - 12 Sukanta Chaudhuri, *Calcutta: the Living City* (Calcutta;New York: Oxford University Press, 1990), p.3
  - 13 Sunando Bandyopadhyay, "Location of Adi Ganga Palaeochannel, South 24-Parganas, West Bengal," *Geographical Review of India*, 1996: 93-109.
  - 14 Ibid
  - 15 (Ray, 1947, 1949; Battacharrya, 1954; Dutt, 1963; Basu. 1989; Dutt,1992), see: Sunando Bandyopadhyay, "Location of Adi Ganga Palaeochannel, South 24-Parganas, West bengal," *Geographical Review of India*, 1996: 93-109.
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16 Ibid.

17 Robert Travers, *Ideology and Empire in Eighteenth Century India* (Cambridge: Cambridge University Press, 2007), p.2

18 Ibid, p.3

19 There are several accounts of the siege of Bengal from Siraj-ud Daula. However, all these end in the Battle of Plassey and the British reign in Bengal. This particular account has been taken from: Robert Travers, *Ideology and Empire in Eighteenth Century India* (Cambridge: Cambridge University Press, 2007), p3-4. Also see: Michael Edwardes, *The Battle of Plassey and the Conquest of Bengal* (New York: Macmillan, 1963).

20 Robert Travers, *Ideology and Empire in Eighteenth Century India* (Cambridge: Cambridge University Press, 2007), p.4

21 Thomas R. Metcalf, *Ideologies of the Raj* (Cambridge: Cambridge University Press, 1994), p.16

22 Ibid, p 17

23 "The distinctive features of this liberal consensus in the fields of both Anglo-American and early modern studies were an assertion of the centrality of individual natural rights, an instrumentalist or conventionalist understanding of government as a product of human artifice designed and directed to the securing of rights, and a statement of the importance of private property rights and the unleashing of essentially selfish and materialist passions channeled through the political and economic institutions of a competitive, individualistic, and capitalist society. In sum, early liberal modernity peaked in John Locke."

Lee Ward, "Reexamining the Roots of Anglo-American Political Thought," in *The Politics of Liberty in England and Revolutionary America*, 1-10 (Cambridge: Cambridge University Press, 2004).

For a general historical view on Whig history see *wikipedia*, February 24, 2010, [http://en.wikipedia.org/wiki/Whig\\_history](http://en.wikipedia.org/wiki/Whig_history) (accessed March 23, 2010).

24 Thomas R. Metcalf, *Ideologies of the Raj* (Cambridge: Cambridge University Press, 1994), p.16-17

25 Edgar Thorpe, *The Pearson General Studies Manual 2009* (New Delhi: Dorling Kindersley, 2009)

26 Despina Ilopoulou, "The Uncertainty of Private Property: Indigenous versus Colonial Law in the Restructuring of Social Relations in British India," *Dialectical Anthropology*, 2001: p.66

27 Ibid, p. 65-66

28 Christopher V Hill, "Water and Power: Riparian Legislation and and Agrarian control in Colonial Bengal," *Environmental History Review*, 1990: p.8

29 *Taqqavi* was Mohammad Tughlaq's policy of the State giving loans for resuming agricultural productions interrupted by natural agencies. For more information see: Satish Chandra, *Historiography, religion, and state in medieval India* (New Delhi: Har-Anand Publications, 1996), p 222

30 Rohan D'Souza, *Drowned and dammed : colonial capitalism, and flood control in eastern India* (New Delhi: Oxford University Press, 2006), p.83

31 Gunnel Cederlöf, "Fixed boundaries, fluid landscapes," *The Indian Economic and Social History Review*, 2009: p. 516

32 Radhakamal Mukherjee, *The changing face of Bengal, a study in riverine economy* (Calcutta: University of Calcutta, 1938), p 4

33 Ibid

34 Iftekhar Ali in his ecological study of the historical development of East Bengal identifies a number of substantial works that have engaged ecological factors to examine some forms of economic activities. As mentioned, about the same time as Mukherjee (1930), Birendranath Ganguli threw significant light on our understanding of nature's inherent capacity to influence the pattern of human fertility behavior in a given ecological circumstance. In the 1970s, Panandikar linked deltaic ecological properties with economic well-being or woes, while Binay Bhuhsan Chaudhuri identified the fertile deltaic region of Bengal with the successful commercialization of agriculture in the nineteenth century. Recently, Sugata Bose has updated the works of Radhakamal Mukherjee and Birandranath Ganguli by reminding us of the important link between the rivers of eastern Bengal and demographic pattern.

According to Ali, "These works, often imbued with a Tagorian sense of appreciation of nature as a pristine provider, are remarkable attempts to document the role of nature, particularly the river, on economic activities. Some remarkable works have dealt with the *chars* and forest, with specific focus on the reclamation process, tenural pattern and environmental resource management. Notwithstanding their importance in the history of the colonial revenue system and policy formulations, these works have not examined the questions of social, economic and political relations over a longer period of time, keeping broader ecological issues at the centre. These works are, however, important for our purpose and once placed in perspective their merit could be fully appreciated in the light of the new developments in the field of environmental history." Dr. Iftekhar Iqbal, "Towards an Environmental History of Colonial East Bengal: Paradigms and Praxis," *Journal of the Asiatic Society of Bangladesh*, 2005: 501-518.

35 Rohan D'Souza, "Colonialism, Capitalism and Nature: Debating the Origins of Mahanadi Delta's Hydraulic Crisis," *Economic and Political Weekly*, 2002: 1266

36 These flood utilizing strategies can be divided into two broad types. One, largely defensive, involved coping with temporary dislocations in crop output by adopting risk-distribution cropping practices. Second were attempts to actually harness silt-laden floodwaters by leaching the latter into their fields at appropriate moments in the inundation cycle. Flood dependence as agrarian practice seemed to sustain itself without fundamentally unsettling the equation between hydraulic volatility and geomorphologic process. Rohan D'Souza, *Drowned and dammed : colonial capitalism, and flood control in eastern India* (New Delhi: Oxford University Press, 2006), p.45

37 Rohan D'Souza, "Colonialism, Capitalism and Nature: Debating the Origins of Mahanadi Delta's Hydraulic Crisis," *Economic and Political Weekly*, 2002: 1266-67.

38 In Eastern Bengal, waterways were often seen as rivals to the railways as means of transport and there was a feeling that with the completion of the railway networks, the transport and communication systems would be faster and more reliable and this could have been done at the expense of the slower mode of water transport. A report on the waterways of Bengal (1906), after describing the worldwide expenditure on the improvement of waterways, pointed out that

India had done comparatively little in this context. It calculated that the total expenditure on the improvement of navigation facilities had not exceeded 5,000,000 pounds during the past 40 years whereas the expenditure on railways during the same period had exceeded 200,000,000 pounds. Dr. Iftekhar Iqbal, "Towards an Environmental History of Colonial East Bengal: Paradigms and Praxis," *Journal of the Asiatic Society of Bangladesh*, 2005: 501-518.

39 Ibid, p.5

40 The number of newspaper articles that show the flooding problems Kolkata faces annually, is testament to the scale of the problem. For more information, see:

41 Philippe Cullet, "Water Law in India," *IELRC Working Paper*, 2007: p.3

42 Ibid, p. 3

43 CommonLII, *Indian Legislation*, [http://www.commonlii.org/in/legis/num\\_act/ra1989121/](http://www.commonlii.org/in/legis/num_act/ra1989121/) (accessed February 6, 2010).

44 "This approach offers a corrective to what was too easily described during the colonial era as the 'blessings of British rule', namely the pacification and unification of the country, legal codification, the sue of the English language, public works, and a range of social reforms. Critics of European modernity, among them Britons as well as Indians, even at that time, saw the dark side of these changes, among them racism, militarism and the economic exploitation that a was part of the colonial relationship. British rule in the 1830's and 40's had been founded in Enlightenment notions of universal human destiny and expectations of progress, although, even then an authoritarian strain was evident in evangelical and utilitarian reform. But by the 1870's the mood was different, above all in an explicitly authoritarian attitude among colonial officials. They were for the most part convinced of an essential difference between British and Indian that justified indefinite control of political power by a superior race " (A concise history of India, Metcalf, p.92)

45 The reference is made to the shift of the capital from Calcutta to New Delhi in the early Twentieth Century.

46 Sukanta Chaudhuri, *Calcutta: the Living City* (Calcutta;New York: Oxford University Press, 1990), p.33

47 Dr Nitai Kundu, *The case of Kolkata, India*, (Kolkata: Institute of Wetland management & Ecological Design , 2003).

48 Satyesh C Chakraborty, "The Story of a River Port," in *Kolkata Port trust Anniversary* (Kolkata: IIM, Calcutta, 2004), 1-12.

49 Ranjan Biswas, *Rivers of Bengal: A Compilation* (Kolkata: West Bengal District Gazetteers, Higher Education Dept., Govt. of West Bengal, 2002), p.225

50 Ibid, p.225-228

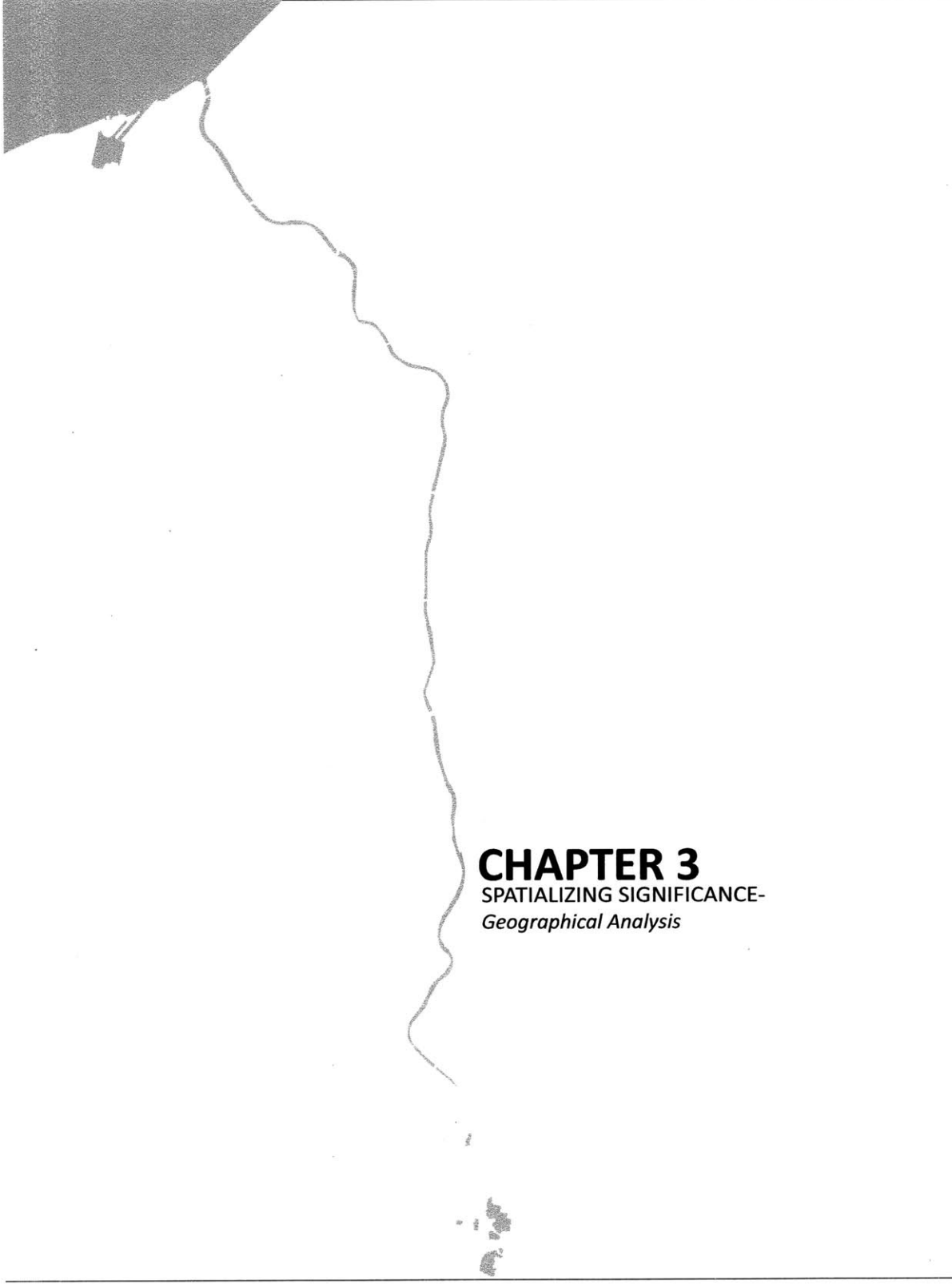
51 Keya Dasgupta, *Genesis of a Neighborhood The mapping of Bhabanipur*, Occasional Paper (Calcutta: centre for Studies in Social Sciences, 2003), p.6



- 52        wikipedia, *wikipedia*, <http://en.wikipedia.org/wiki/Bonbibi> (accessed April 20, 2010).
- 53        Barbara Daly Metcalf and Thomas R Metcalf, *A concise history of modern India* (Cambridge: Cambridge University Press, 2006), p.87
- 54        Ibid, p.27
- 55        wikipedia, "Tryst with destiny," *Wikipedia*, April 6, 2010, [http://en.wikipedia.org/wiki/Tryst\\_with\\_destiny](http://en.wikipedia.org/wiki/Tryst_with_destiny) (accessed April 18, 2010).
- 56        Sukanta Chaudhuri, *Calcutta: the Living City* (Calcutta;New York: Oxford University Press, 1990), p.72
- 57        Dr Nitai Kundu, *The case of Kolkata, India*, (Kolkata: Institute of Wetland management & Ecological Design , 2003), p.7
- 58        Sukanta Chaudhuri, *Calcutta: the Living City* (Calcutta;New York: Oxford University Press, 1990), p.79
- 59        Dr Nitai Kundu, *The case of Kolkata, India*, (Kolkata: Institute of Wetland management & Ecological Design , 2003), p.5
- 60        Ibid
- 61        Ibid
- 62        Ibid
- 63        Sukanta Chaudhuri, *Calcutta: the Living City* (Calcutta;New York: Oxford University Press, 1990), p.86
- 64        Nagarik Mancha and Shalti Research Group, *the city demolished mapping demolitions in kolkata, 1990 onwards...*, 5 5, 2010, <http://koldemo.wikidot.com/s-tolly-nullah>.
- 65        Shahana Chattaraj, *Eviction or Inclusion? The politics of Resettlement in Calcutta's Squatter Settlements* (Cambridge: Massachusetts institute of Technology, 2000) p.108
- 66        Swagata Sen, "Eviction changes little at Tolly's nullah.," *The Statesman*, December 25, 2002.
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**CHAPTER 3**  
SPATIALIZING SIGNIFICANCE-  
*Geographical Analysis*

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## INTRODUCTION

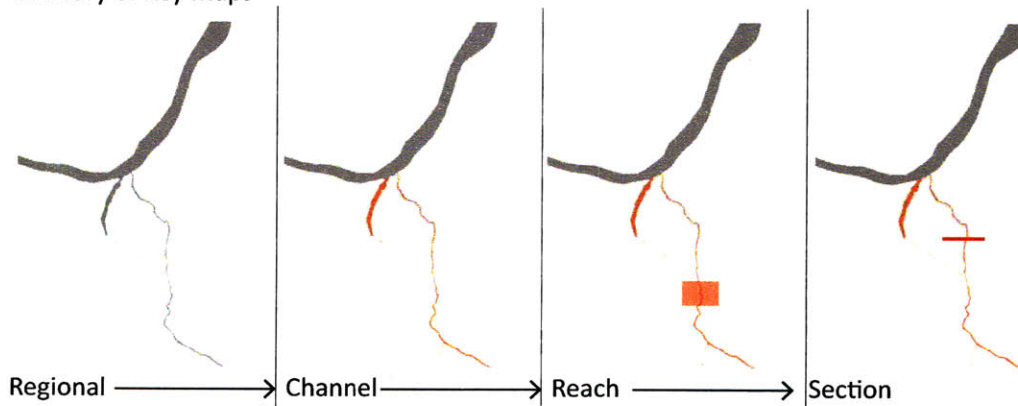
The Historical Analysis showed how the channel has become divorced from the city in the last three centuries. The intent of the Geographical Analysis in this chapter is:

1. To understand the present condition of the channel.
2. To unearth potential relationships of the channel with the city, at the regional scale ,local scale and with the immediate abutters. This will be used in the design proposal to re-integrate the channel with the city.

The physical condition of the channel has been analyzed on four scales:

1. The Regional Scale
2. The Channel Scale
3. Reach Scale
4. Channel Sections

### Glossary of Key Maps



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**REGIONAL SCALE ANALYSIS**

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## REGIONAL SCALE ANALYSIS

As derived from the Historical Analysis, on the Regional scale, the channel was used as a Drainage basin and for Transport.

In that context, the Regional analysis has been based on the Adi Ganga as a possible transport and navigational resource as well as a more integrated part of the drainage system of the city.

As seen in the maps below, the scale of the channel has changed dramatically over the past three centuries. In addition to the scale, the channel also faces other problems. This section analyses these problems and excavates its potentials on a Regional scale.

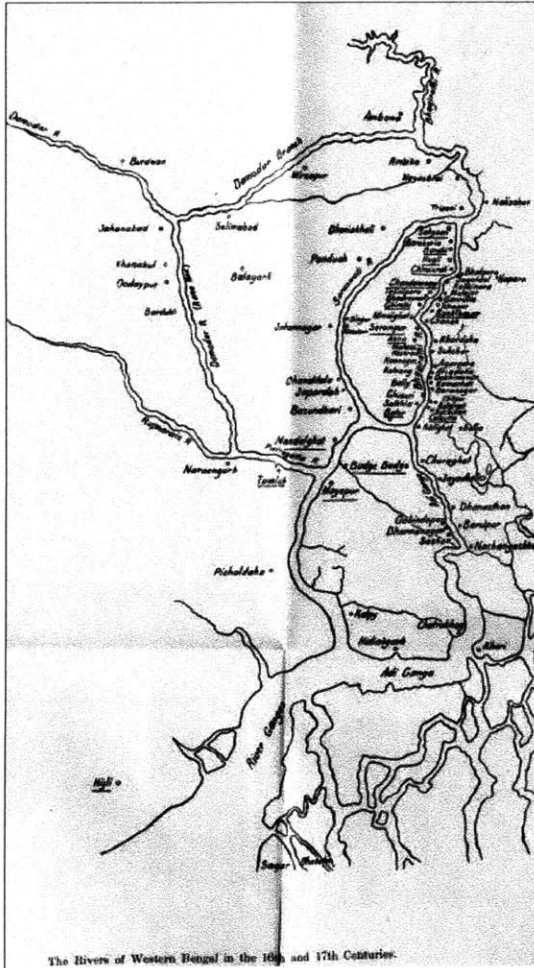


Fig 3.1: The rivers of West Bengal in the 16th and 17th Century

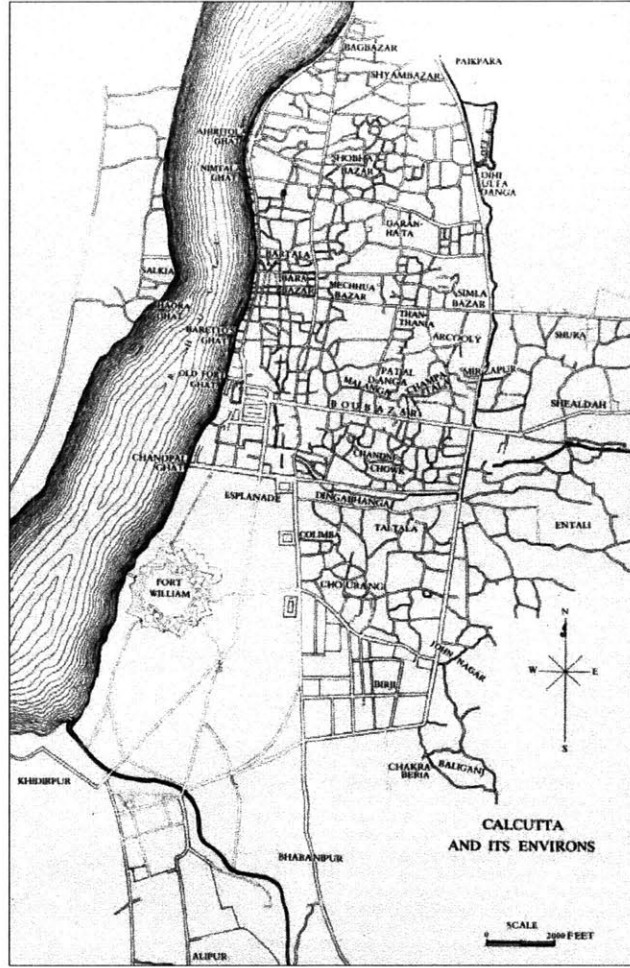


Fig 3.2: Map showing Adi Ganga in the late 18th Century



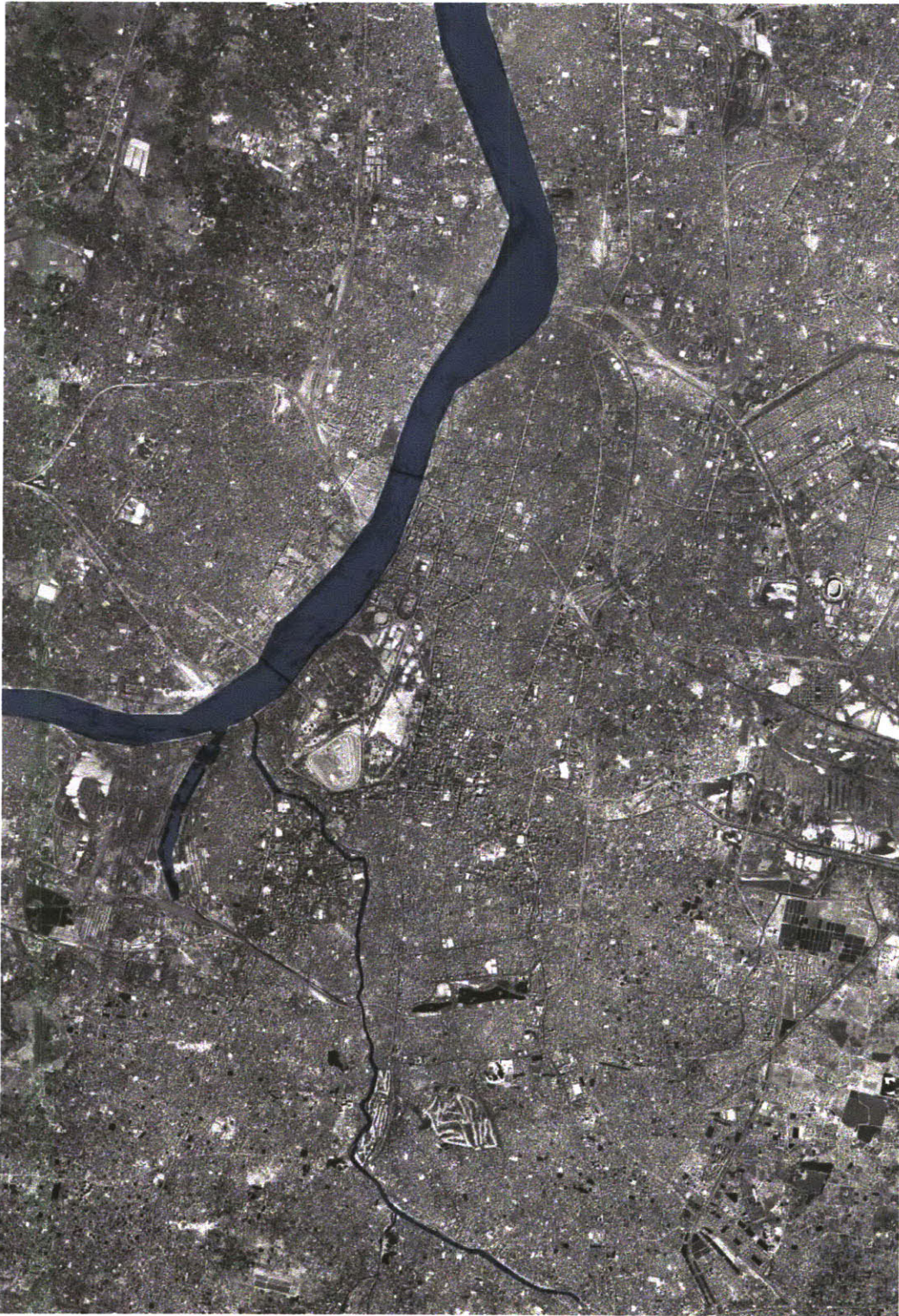


Fig 3.3: Present day Adi Ganga

## ADI GANGA AND KOLKATA'S DRAINAGE

### Present System of drainage in Kolkata

The Kolkata Municipal Corporation (KMC) area generates roughly 600 million litres of sewage and wastewater every day and more than 2,500 metric tons of garbage (KMC 2006). The city proper has a combined sewer disposal system laid in west to east. Drainage system follows the natural slope of the city. The KMC area has been divided into basins and sub-basins. The elements of drainage installations are:

(i) conduits for trunk and branch drains, (ii) open channels – lined or unlined, (iii) outfalls – with or without gates, (iv) pumping stations, (v) canals, (vi) water bodies, (vii) wetland and (viii) The river (Kulti).

The drainage is carried by underground sewers to pumping stations, which dispose the load to channels and canals. The channels and canals dispose drainage partly to eastern wetland system and the rest to river Kulti, which flows over rural areas and swamps in the Gangetic Delta, and carries the discharge to Bay of Bengal. Approximately, from a household to the estuary of Bay of Bengal, the distance a sewer travels is 60 Km. Huge quantities of garbage are deposited at Dhapa Dumping Ground at the eastern fringe.<sup>1</sup>



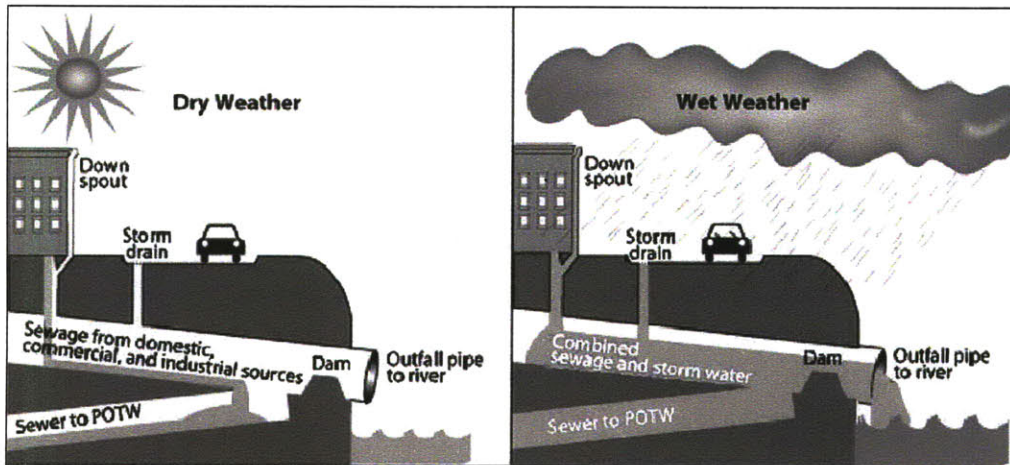


Fig 3.4: Image to show combined drainage system

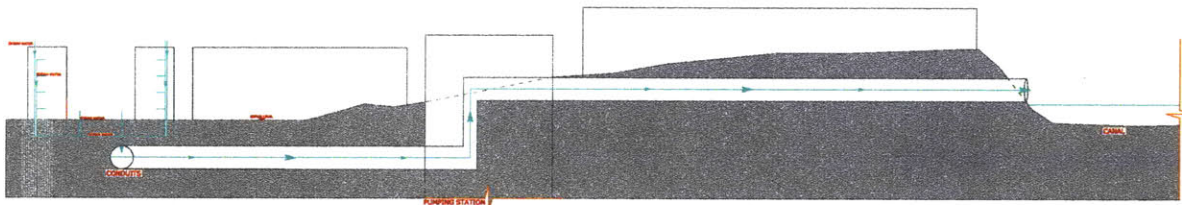


Fig 3.5: Conceptual diagram of Calcutta drainage



Fig 3.6: Image to show outfall into the Adi Ganga

## **Problems with the Existing System:**

According to the Master Plan for sewerage and drainage for the Kolkata Municipal Corporation the key Issues with the present system are:<sup>2</sup>

### **1. Lack of an Integrated Urban Plan**

An integrated urban planning approach is required in Kolkata, which entails a more comprehensive approach to planning and utilities. This needs to encompass urban services including roads, traffic, water supply, electricity, telecommunications, public space, green areas and sewerage systems. The KMC has also identified a review of the KMC Act, to strengthen KMC's planning and regulatory role. In the context, it is worth analyzing the scale of present day operations. Does the KMC, which in the present day administers 185 sq. Km, need to revise its present administrative purview?

### **2. Sewer Desilting**

Siltation of the trunk sewer system is seen as the biggest issue facing Kolkata at present. It has been assumed for the purposes the Master Plan Study that 60% of the sewer capacity on average is filled with silt, and this will need to be removed as a priority. KMC are currently seeking "Expressions of Interest" from experienced specialist contractors for the purposes of commencing desilting pilot trials.<sup>3</sup>

### **3. Alleviation of Flooding**

Along with the urgent need for sewer desilting, the alleviation of flooding has a high priority for the Master Plan. The floodwaters are from a combined sewer system and the floodwaters contain a proportion of sanitary sewage.

### **4. Pump Stations**

The major pumping station buildings require upgradation. The hydraulics of the sewer upstream of the pump station is unsatisfactory and needs to be improved- the sewers are too flat and operate in a flooded condition reducing their flow capacity.

### **5. Channels**

Due to a paucity of funds, periodic maintenance is not undertaken - the channels were last maintained in 1999. Responsibility for maintenance of the channel system lies with the Irrigation and Waterways Department (as mentioned earlier) whilst the maintenance of the trunk sewers and pump stations is the responsibility of the KMC. This separation of responsibility for different parts of the drainage systems leads to problems.

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## 7. Sewage Treatment

The majority of the sewage (DWF) from the core inner city area, about 1,100 Mld in magnitude, receives no formal treatment and is discharged via the channels 36 km distant to the Kulti River. In the medium to long term, wastewater treatment is recommended to control disease and to protect the receiving water environment of the River Kulti.

## 8. Institutional Issues:

Cost recovery is low and KMC relies on State Grants for a significant proportion of its current expenditures. Suggestions for improvement of cost recovery for sewerage and drainage in the medium term include increasing the tariff for sewerage and drainage services to consumers and imposing a flat annual charge on householders connected to the sewerage system, increasing the water tariff and increasing the property tax collection rate. There are circumstances under which it would be better to contract out the production or delivery of services for achieving cost effectiveness, efficiency and citizen satisfaction. It has been suggested that KMC identify the functions in which Private Sector Participation (PSP) would be a better management option.

The question here is: Is there an effective strategy that uses a Public- Private partnership at a local level, for more autonomous solutions and decision making. The number of governance structures involved in the issue of channel clean up is large (the Irrigation department, Waterworks Department, Kolkata Municipal Corporation), which in the bureaucratic milieu of Indian governance leads to a high level of inefficacy.

Moreover, the Channels are, at the present, an integral part of the sewage system- Is there an effective way to separate the two systems without a city wide intervention?

## What are the measures being taken?

### 1. Intervention by State Pollution Control Board

The West Bengal Pollution Control Board (WBPCB) empowered to enforce the Water (Prevention & Control of Pollution) Act, 1974 directed (in 2004) all Municipal Corporations and Local Authorities to ensure while granting permission for construction of any housing complex located within their jurisdiction having around 100 flats or more to its own 'wastewater treatment system' before discharging into the road sewer main of the Municipality or so (KMC, Chowdhury, 2004).<sup>4</sup>

### 2. In-house sewage treatment

It has become mandatory by the directive of the KMC that all large housing, commercial and other development projects in and around Kolkata have to treat wastewater (except storm water from roofs of the buildings) in the in-house Sewage Treatment Plants (STP), and the treated water can either be utilized by the inhabitants or be discharged into the municipal sewer main where it exists or to the nearby canal or pond designated for it.

### 3. Rain water harvesting

The storm water from roofs of the buildings is collected separately into a storage tank with provision for filtration, treatment and recharging it into the aquifer or storage. Rainwater harvesting helps reducing drainage problem, and provides water for use (Gupta, 2004). Hence, rainwater harvesting and treatment of wastewater have become part of the architectural and construction management business, providing better environment and sustainability, and economic generation to such consultants, labourers and other people.

### 4. Open area with vegetative cover

In any large architectural project, a large portion of the open area (mandatory open space being 60% of the plot area) is directed to be treated with green cover (grass lawn and trees) as children's playground and recreational area, which helps in minimizing quantity of run-off to some extent and provides for some rainwater recharging into the ground. (KMC, 2004).

### (5) Conservation and retention of water bodies & recovery of Wetland

The Government enforces the West Bengal Inland Fisheries Act, 1993 (Amended) to restrict filling up of any water body. The Municipality is keeping vigilance and taking legal

### **5. Conservation and retention of water bodies & recovery of Wetland**

The Government enforces the West Bengal Inland Fisheries Act, 1993(Amended) to restrict filling up of any water body. The Municipality is keeping vigilance and taking legal action against any offender and reclaiming the water body at the offender's cost. The State Environment Department has declared the 'East Kolkata Wetland (Conservation & Management) Ordinance 2005' to define the wetland area. The State Department of Land & Land Ceiling has also kept proper vigilance on any attempt of urbanization in the area.

### **6. Desilting and cleaning of sewer lines, outfalls and canals**

According to the KMC, there is work being done in this regard. Previously and till date in some areas where width of road is narrow, human beings use to remove silts manually. The State Government acknowledges the need to dredge and conserve canals. A number of canal restoration and rehabilitation projects have been started by the State Irrigation Department and the KMC, atleast on paper.

### **7. Solid waste management**

The Kolkata Environmental Improvement Project (KEIP) has proposed for construction of a new Sanitary Landfill site spread across 114 hectares at Dhapa. The proposal has been cleared by the East Kolkata Wetland Management Authority and will be constructed within 2008. As sustainability value addition, it will have – (a) composting and recycling units, (b) waste to power conversion unit, (c) planned pisciculture and (d) a green belt (KEIP, 2006).<sup>5</sup>

### **8. Slum improvement programme**

The KEIP's slum improvement programme has included works like (i) widening, realignment and lining of drains, (ii) construction of sewer/drain lines and (iii) provision of solid waste containers, along with other works to upgrade environmental condition of slums in the city.

### **10. Kolkata Environmental Improvement Project (KEIP)**

This is a multi-agency endeavor to arrest environmental degradation in fringe areas where drainage & sewerage networks are inadequate. Its work has included – (i) efficient interception and collection of sewage by providing secondary sewers, (ii) build trunk sewers in addition to existing trunk lines, (iii) develop separate storm water drainage systems including

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pumping stations where necessary, (iv) laying new underground conduits in narrow roads and connect properties to the new networks, (v) construct/rehabilitate pumping stations, and (vi) upgrade treatment plants and construct new ones where necessary (KEIP, 2006).

### **11. Gross physical planning and fund investment by Government and Municipality**

A total of Rs.2520crore (around US\$550 million) is being spent over a period from 2005 to 2009 by the Government and Municipality through the Jawaharlal Nehru National Urban Renewal Mission (funded partly by US Aid, partly by Central Government), Kolkata Environmental Improvement Project (funded partly by Asian Development Bank), and Project Nikashi (Drainage). The major works taken up under these projects are – dredging and re-excavation of canals, revamp of drainage and sewer system and network, drainage development, new pumping stations, repair and restoration of old pumping stations, automation in pumping stations, procurement of sewage-cleaning machines, etc.

### **12. Role of NGOs & other organizations**

Recently, various organizations have been advocating for and working on decentralized sewage treatment systems in fringe areas of Kolkata where central sewer collection systems are absent. Through anaerobic treatment system, wastewater can be treated to produce water for irrigation, agriculture and pisciculture. These are demonstrated to public and various authorities, looking at the example of the kolkata Wetlands.<sup>6</sup>

The critique here, is that although the Masterplan does identify key problems, the scope is rather ambitious. The inherent flaw, in my opinion, lies in the broad directives.

Instead of relying on changing the entire system, Is it more reasonable to propose certain meso level interventions that filter through to the city by example?

**The maps in the succeeding pages indicate the regional patterns of water drainage, open space, and transportation infrastructure in Kolkata.**

**They are used to analyze a potential connection of the Adi Ganga channel with the city.**

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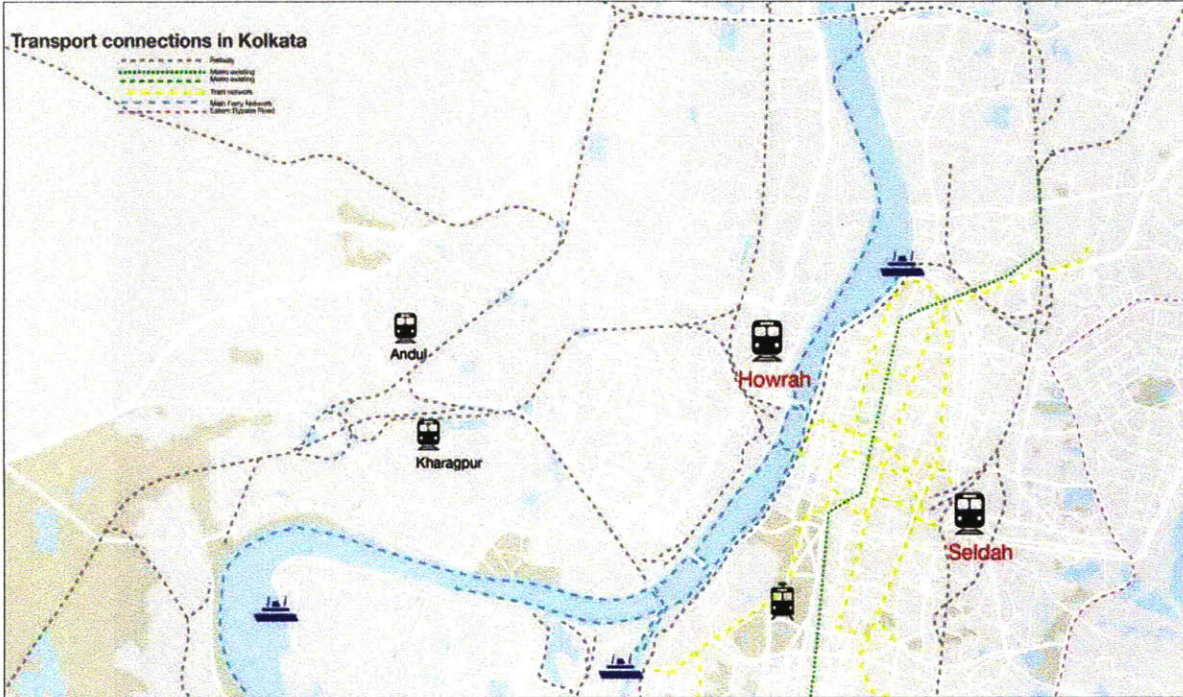
**Fig 3.7: Water Systems in the Kolkata Metropolitan region**

The channels in the city flow east- west in the direction of the Wetlands from the Hughli river. Thus, they become convenient outfall systems, carrying waste to the wetlands where it is biologically treated. The channels and streams are the waste carrying veins of the city.

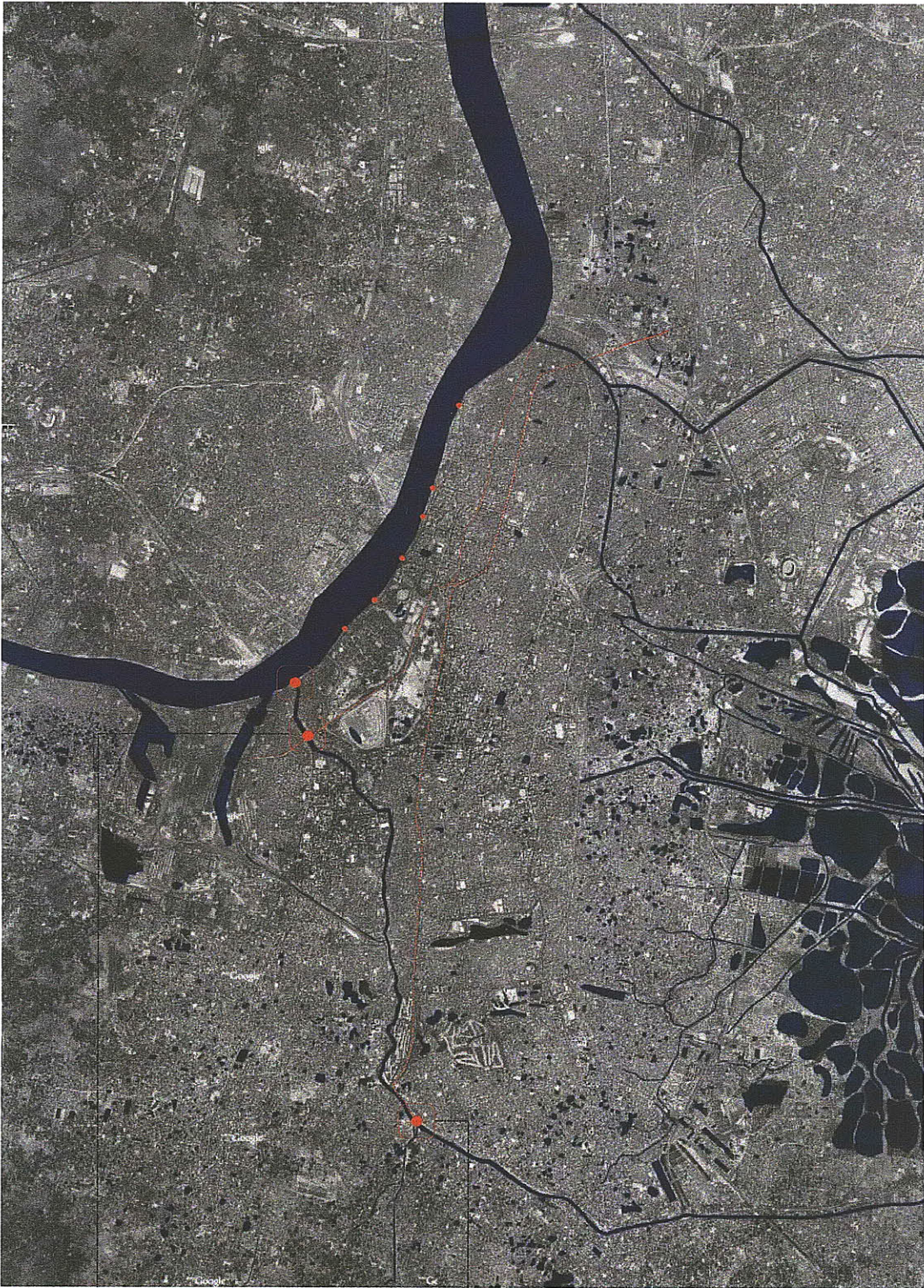


**Fig 3.8: Water Systems and Green networks in the Kolkata Metropolitan region**

As noticeable, the green spaces are concentrated around the wetlands or in the colonial city.



**Fig 3.9: Existing Transport Connections**  
(Source- ETH studio report, <http://www.studio-basel.com/Projects/Kolkata.html>)

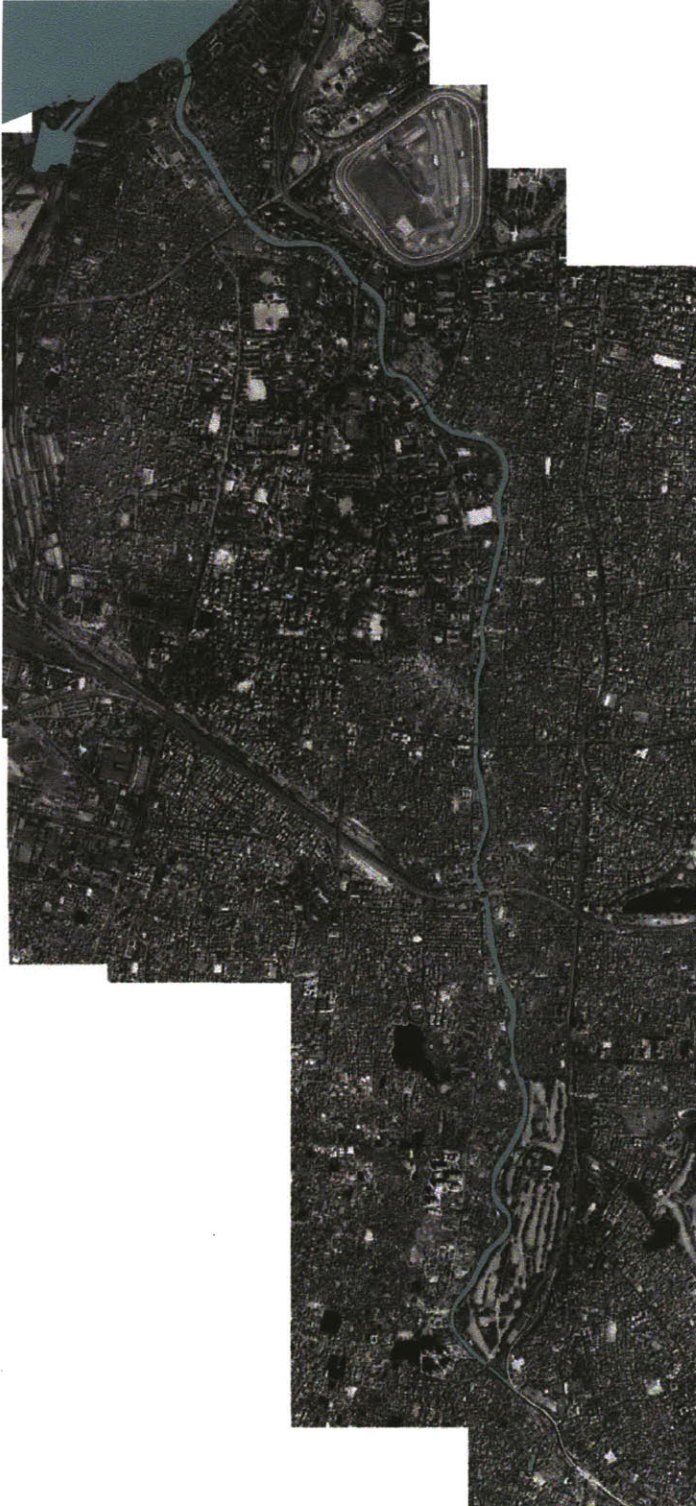


**Fig 3.10: Possible connections with Regional Transport Network**

**CHANNEL SCALE ANALYSIS**

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## CHANNEL SCALE ANALYSIS



The Analysis on the Channel Scale has been done to show the highly fragmented nature of the fabric that surrounds it. On a strategy level, this shows a need for a more integrated analysis (carried out at the scale of the Reach).

The diagrams shown on the Channel-scale are:

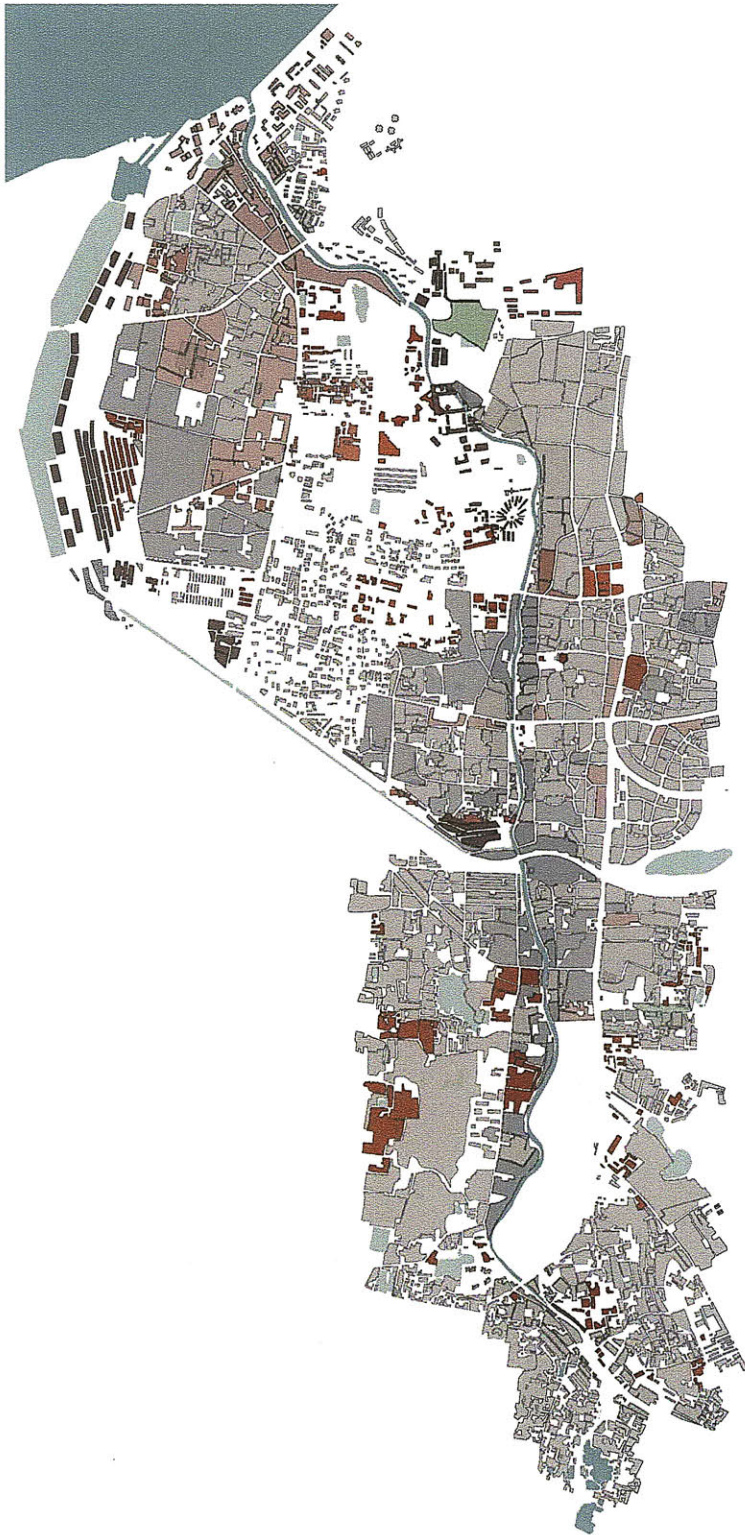
1. The figure ground
2. The land Use pattern
3. The open space that surrounds the channel

Fig 3.11: Map at the Channel Scale.



Map shows the disparity in density between zone A and B












Fig 3.12: Figure Ground



Different land uses surround the channel. This displays the need for more local interventions that look at different conditions.

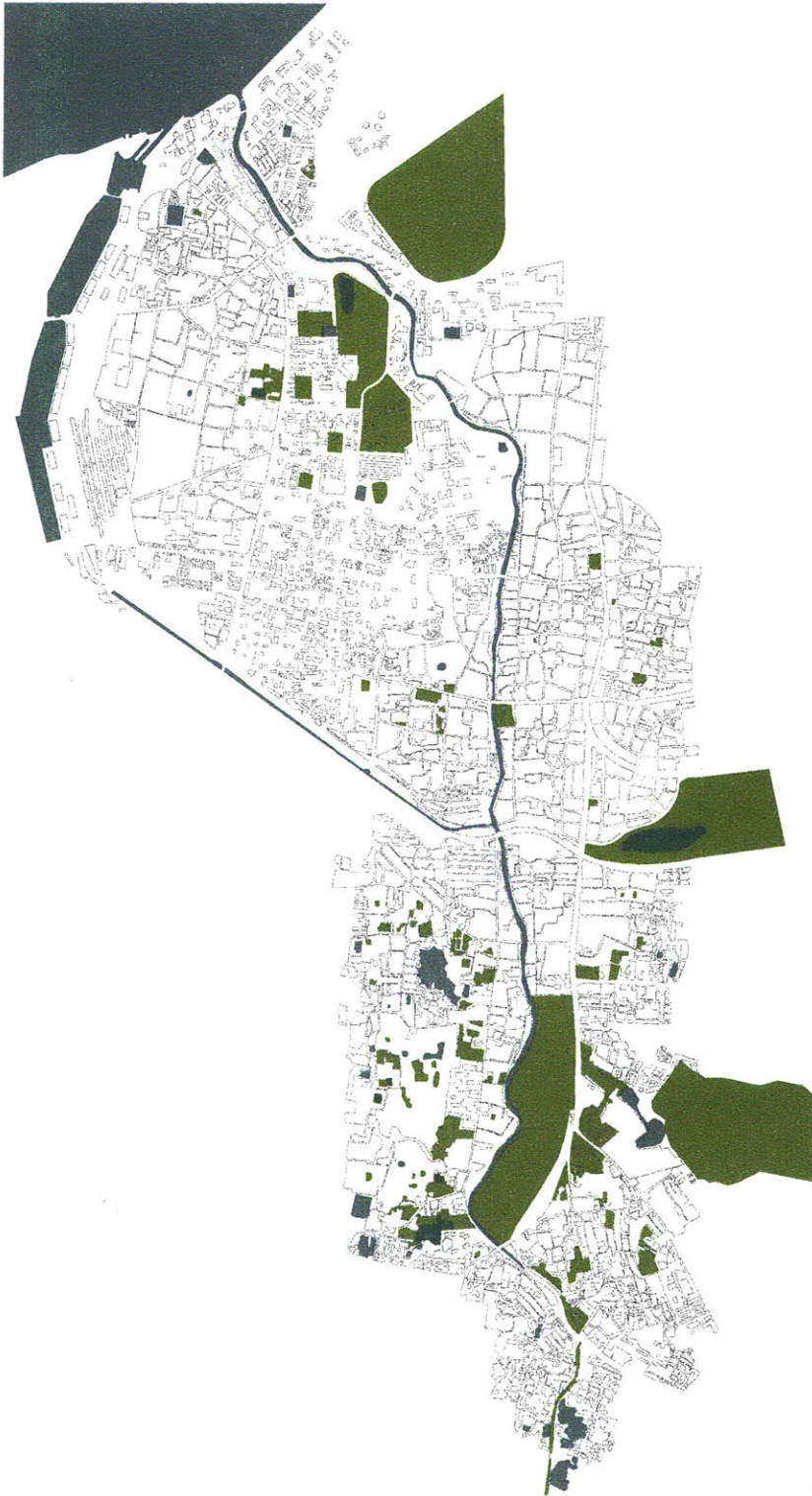
The large institutional, cultural and commercial land use abutting the channel could be used advantageously in the proposal.

**KEY:**

|   |                              |
|---|------------------------------|
|  | Residential                  |
|  | Commercial                   |
|  | Administrative               |
|  | Industrial                   |
|  | Mixed-Residential&Commercial |
|  | Mixed-Residential&Industrial |
|  | Educational & Cultural       |
|  | Park & open space            |
|  | Hospital                     |
|  | Burial/Cremation ground      |
|  | Prison                       |

**Fig 3.13: Land Use Map**





The mapping of open spaces near the channel show possible linkages.

These open spaces could be used to make urban scale connections and opening the channel at a local level.

**Fig 3.14: Open spaces near the channel**

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**REACH SCALE ANALYSIS**

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## REACH SCALE ANALYSIS

The analysis on the Reach scale was carried out to get a more local understanding of the channel and its adjoining conditions.

The intent behind the analysis has been to map latent significance at a more neighborhood level. Even though, the identity of the channel is perceived as singular, the adjoining conditions are highly fragmented. The mapping is geared towards finding connections and resolutions between the fragmented conditions. These can be then potentially designed to create a greater degree of access to the channel.

The channel has been divided into four reaches. A Reach can be defined a short channel segment. In this case, I have considered the area between two important bridges as a definitive unit for analysis.

Each Reach has been further broken down to two zones, which are neighborhoods adjacent to each bank of the channel. The zones have been studied using their historic data, character, fabric , the important nodes (temples, public institutions, mosques,schools) and transport linkages.

Finally, the study of the edge conditions and channel sections give a clearer picture of the channel itself and form the scale of intervention.

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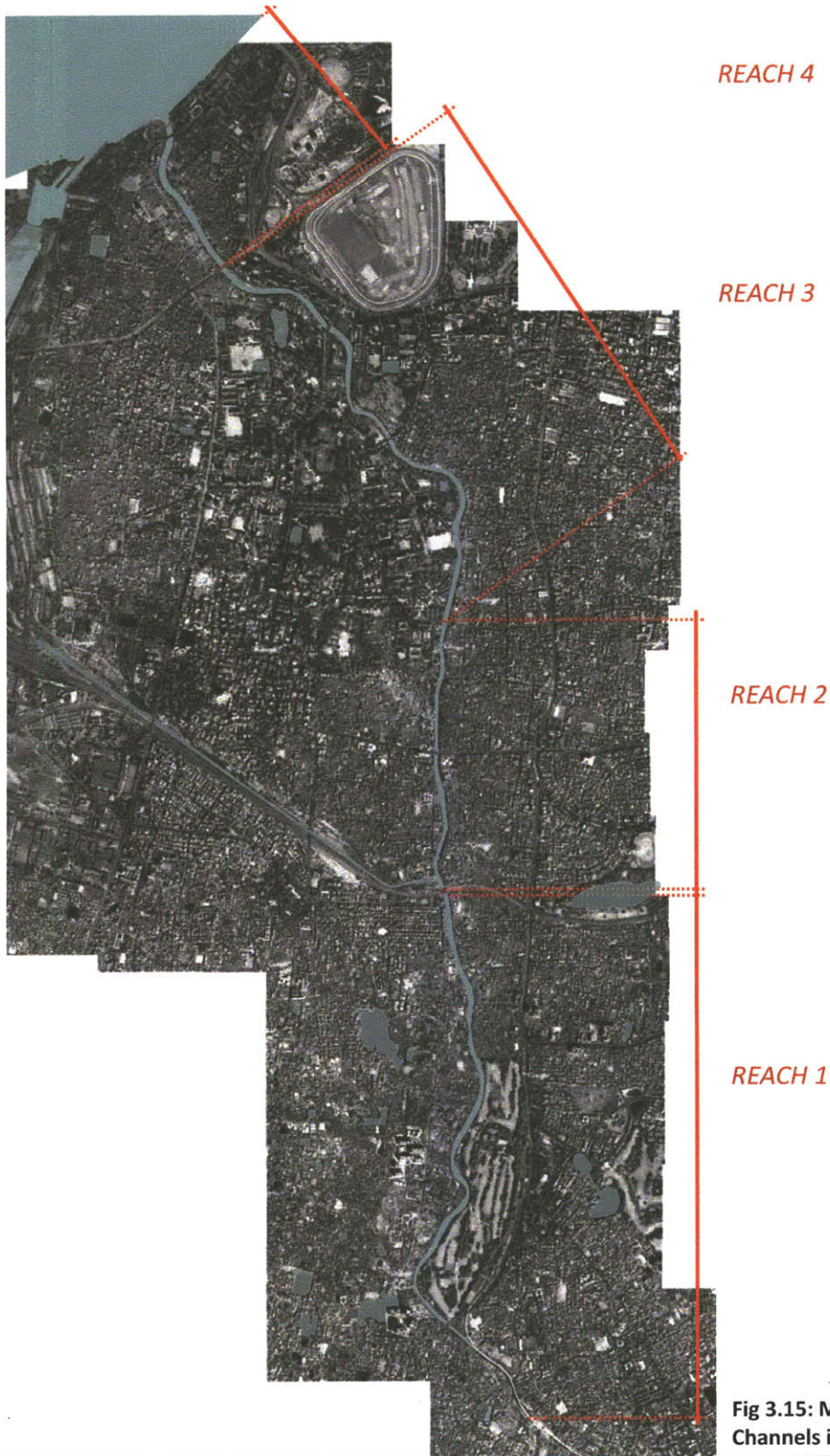


Fig 3.15: Map to show breakdown of Channels into Reaches



**Fig 3.16: MAP SHOWING EXTENT OF REACH 1**

REACH 1:



Fig 3.17: Map of Reach 1



Fig 3.18: Image of Metro piers on the channel



Fig 3.19: Figure ground - Reach 1 (New Alipore and Tollygunge)

Reach 1 spans through Tollygunge and New Alipore. The area is heavily built up with low to medium rise construction. With the exception of a large green space, the Tollygunge club, there are scattered open spaces across the landscape.

This reach shows the interface of the Metro piers that pierce through the Adi Ganga.

**HISTORICAL DATA**

**LANDUSE MAP**

**NEW ALIPORE**

New Alipore was created as a planned residential suburb by the Kolkata Metropolitan Development Authority (KMDA) in the fifties to house the burgeoning population of the city. It is considered to be a better planned area of the city, in terms of infrastructure and is home to a wide variety of people from all walks of life. The Eastern part of the area is one of the most congested parts of South Kolkata, with offices of large number of transport companies.<sup>7</sup>

**TOLLYGUNGE**

Tollygunge was named after Major William Tolly, who in 1775-76 had started the project to excavate and dredge the Tolly's Nullah. Today, it is one of the more expensive real estates in the city.











Historically, it grew along with Baliganj (north of Tollygunge) from a market setting. (ganj means Market). Up until the Eighteenth Century, Tollygunge was a jungle, sprinkled with European garden houses. The Mysore princes, sons of Tipu Sultan, settled here after the Vellore mutiny in 1806, and a small Muslim community grew out of their kothis (villas). They also extended their patronage to the Tollygunge Club and the Gold Club in the early nineteenth century. Today, however, it is one of the most rapidly developing areas in Kolkata.<sup>8</sup>

**NEW ALIPORE & TOLLYGUNGE**



**Fig 3.20: Land use - Reach 1 (New Alipore and Tollygunge)**

Key:

|  |  |
|--|--|
|  Residential                  |  Mixed-Residential&Industrial |
|  Commercial                   |  Educational & Cultural       |
|  Administrative               |  Park & open space            |
|  Industrial                   |  Hospital                     |
|  Mixed-Residential&Commercial |  Burial/Cremation ground      |



**NODES, OPEN SPACES, TRANSPORT LINKS** **INFERENCES**

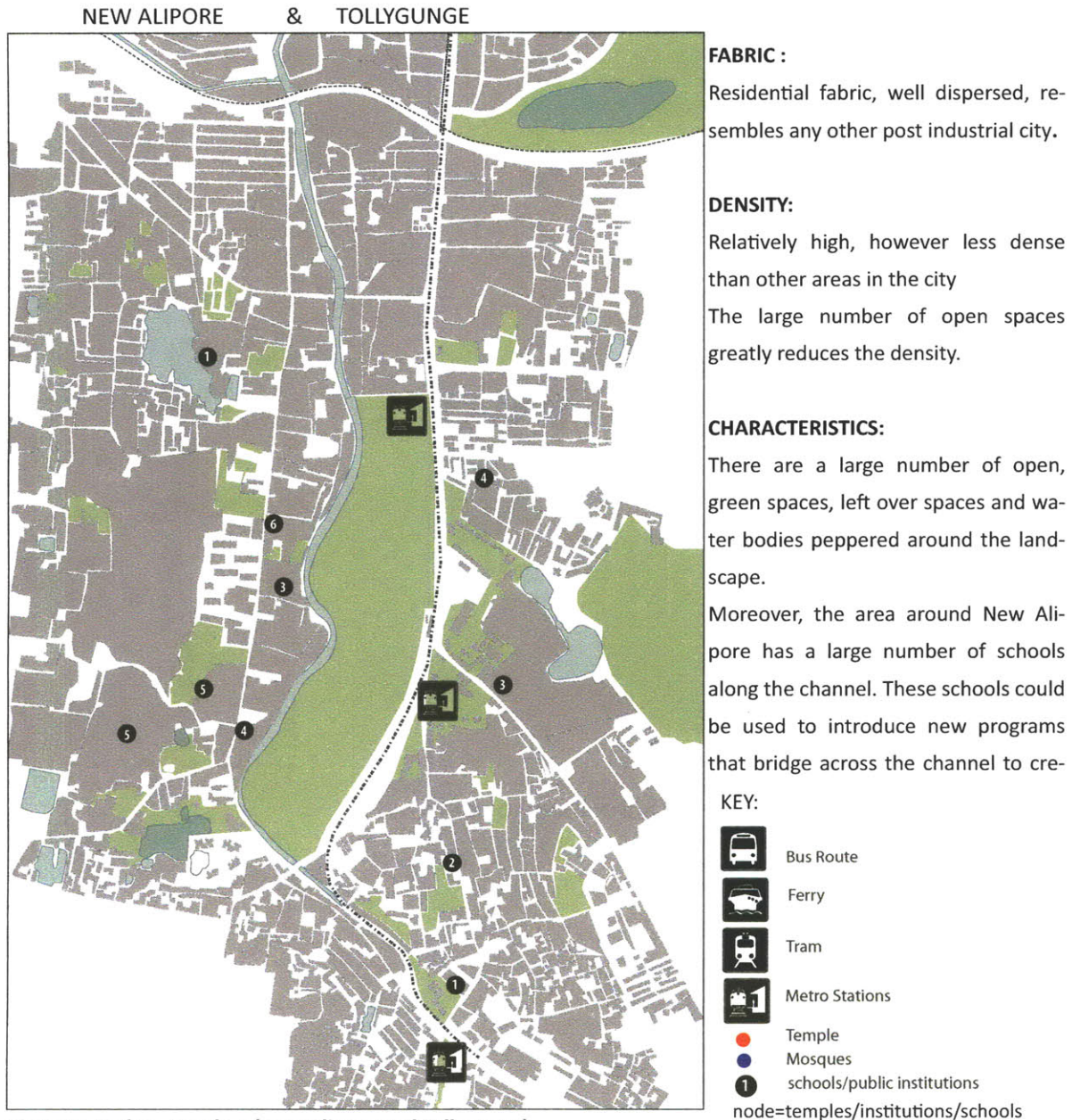


Fig 3.21: Nodes - Reach 1 (New Alipore and Tollygunge)

FABRIC AND EDGE CONDITIONS

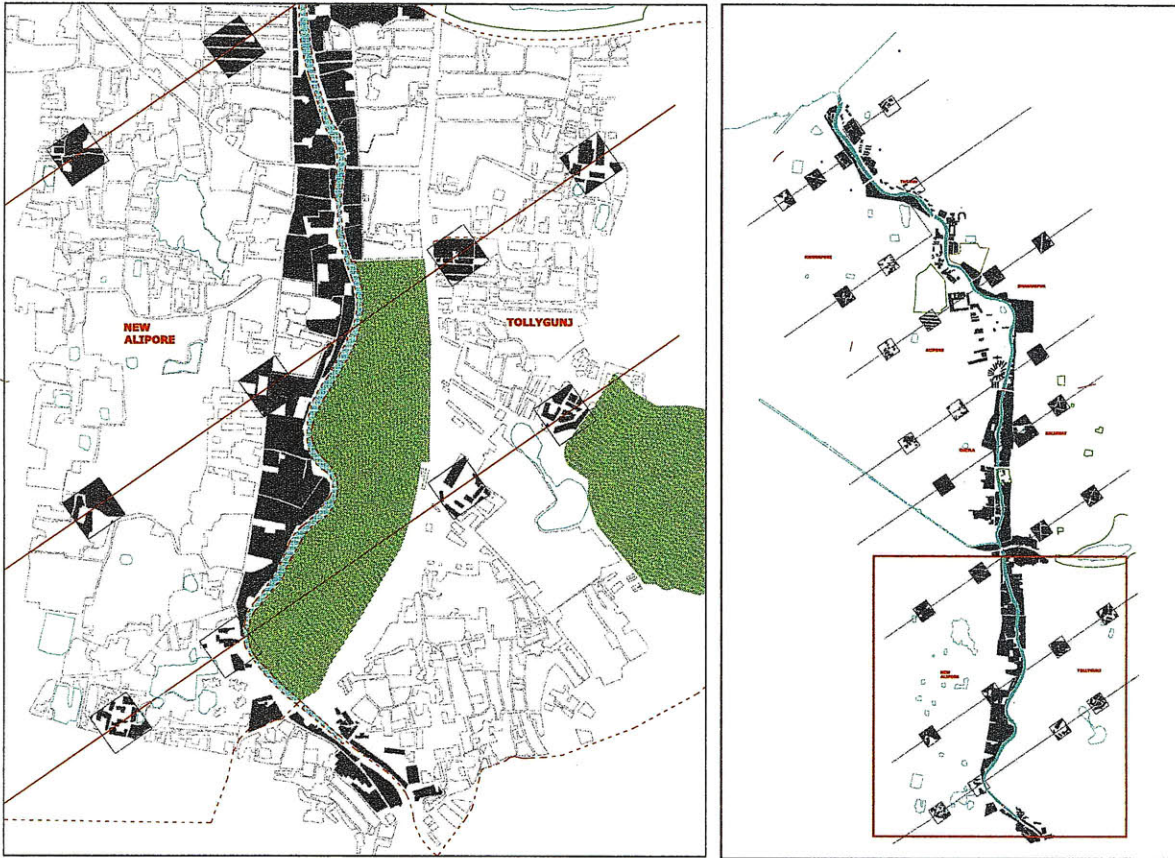


FIG 3.22: COMBINED MAP - REACH 1 (NEW ALIPORE AND TOLLYGUNGE)

### ANALYSIS OF EDGE CONDITIONS

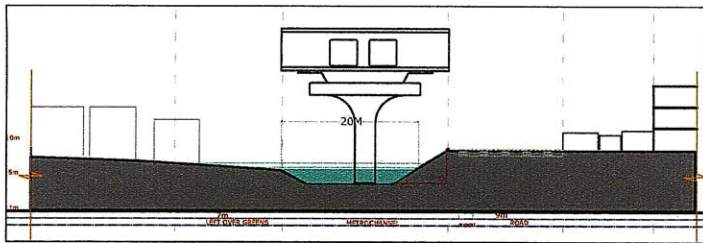


The presence of institutions on the Channel Edge create several opportunities for connections.

The large Open space provided by the Tolly Club creates a contrasting appearance in comparison to the rather built up edge of New Alipore. Moreover the dispersed open spaces could be connected to reveal a new narrative.

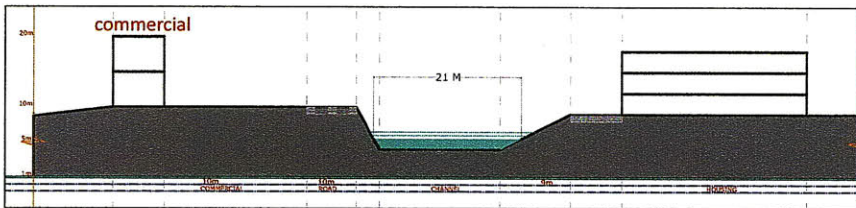
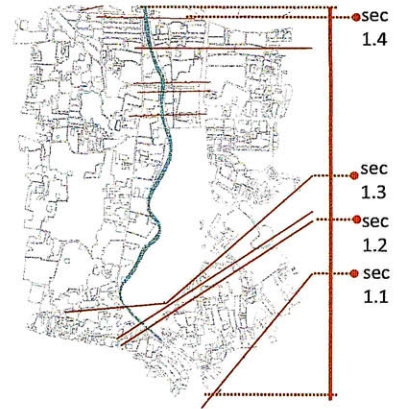
The intersection of the Metro with the Channel; is at a point of higher density with a largely commercial land use.

FIG 3.23: EDGE CONDITIONS-REACH 1 (NEW ALIPORE AND TOLLYGUNGE)



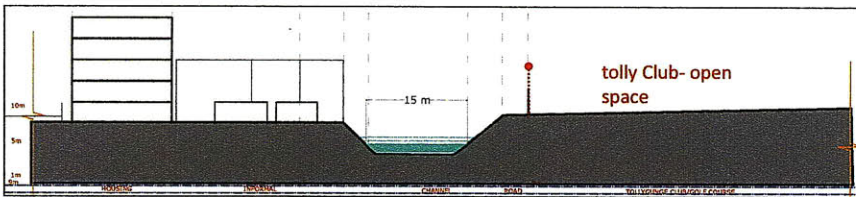
Sec 1.1

- Possibility of a vertical connection with the channel
- The Road on one side can be used to increase access.
- However, the channel, here, does not receive adequate sunlight and is very narrow.



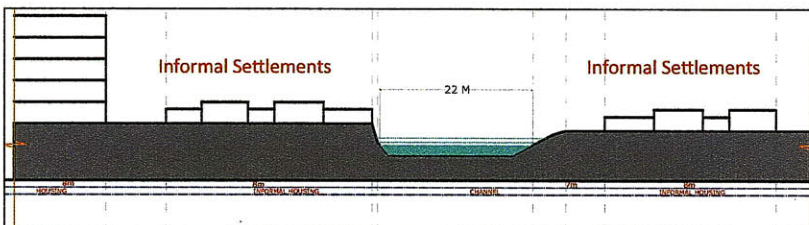
Sec 1.2

- Commercial land use at edge
- The Road on one side can create large possibility in terms of access
- Natural levee at one end creates problems with accessibility



Sec 1.3

- The Tolly Club provides a large open space for connections
- The wall between the Club's open space and the channel create exclusive conditions
- number of schools can be used as stakeholders in creating a more dynamic interface between the club and the channel edges



Sec 1.4

- Informal settlements on either edge- need for services and a more dynamic relationship with the channel

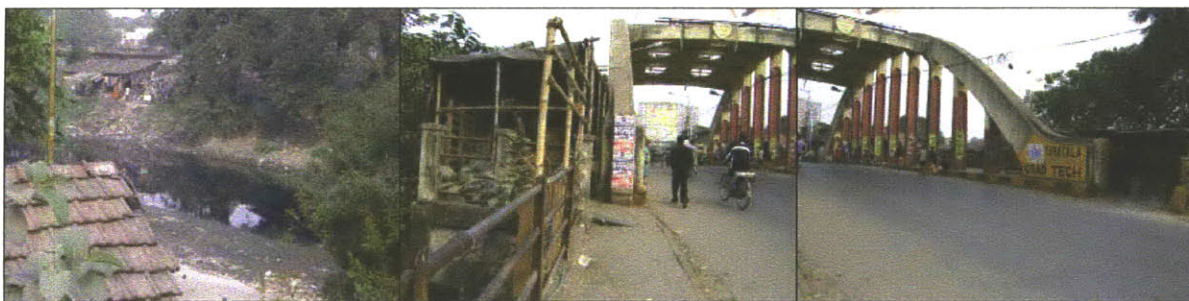
Fig 3.24: SECTIONS THROUGH EDGE CONDITIONS- REACH 1 (NEW ALIPORE AND TOLLYGUNGE)



Metro Piercing the channel



Tollygunge section: wall separating the club



Sahapur Road: no relationship of the channel with the adjoining conditions.

Fig 3.25: IMAGES TO SHOW TYPICAL CONDITIONS- REACH 1 (NEW ALIPORE AND TOLLYGUNGE)



**Fig 3.26: MAP SHOWING EXTENT OF REACH 2**

REACH 2: CHETLA & KALIGHAT



Fig 3.27: Map of Reach 2



Reach 2 spans from the eastern Baj Baj Railway or the northern boundary of Tollygunge and Reach 1, and comprises of the dense temple landscape of Kalighat and the rather informal fabric of Chetla.

Fig 3.28: Figure Ground - Reach 1 (Chetla & Kalighat)



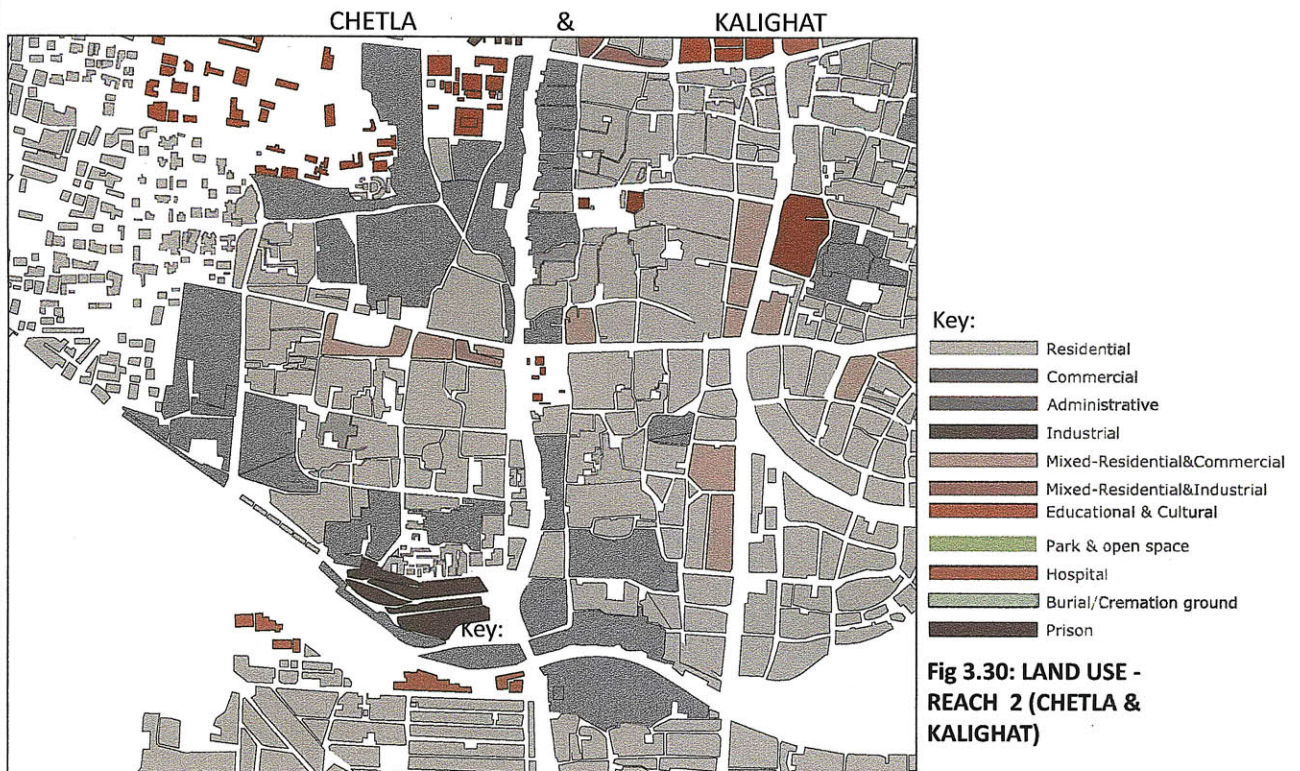
Fig 3.29: Image of channel near the Kalighat temple

**CHETLA**

The neighborhood of Chetla can be considered to be a part of the neighborhood, Behala. Today, Behala encompasses one of the largest suburban agglomerations of the city of Kolkata. Huge growth of population especially since the early eighties resulted in the area being on the radar of both the daily wage earners, common populace and educated classes. Due to this enormous and unplanned growth, the traffic is by and large dependent on the arterial Diamond Harbour Road, in spite of the availability of the parallel James Long Sarani (commonly known as Rail Line) as an option. Due to lack of planning and space, encroachments by street-hawkers of the sidewalks on both sides of the busy Diamond Harbour Road have resulted in the reduction of pedestrian paths.<sup>9</sup>

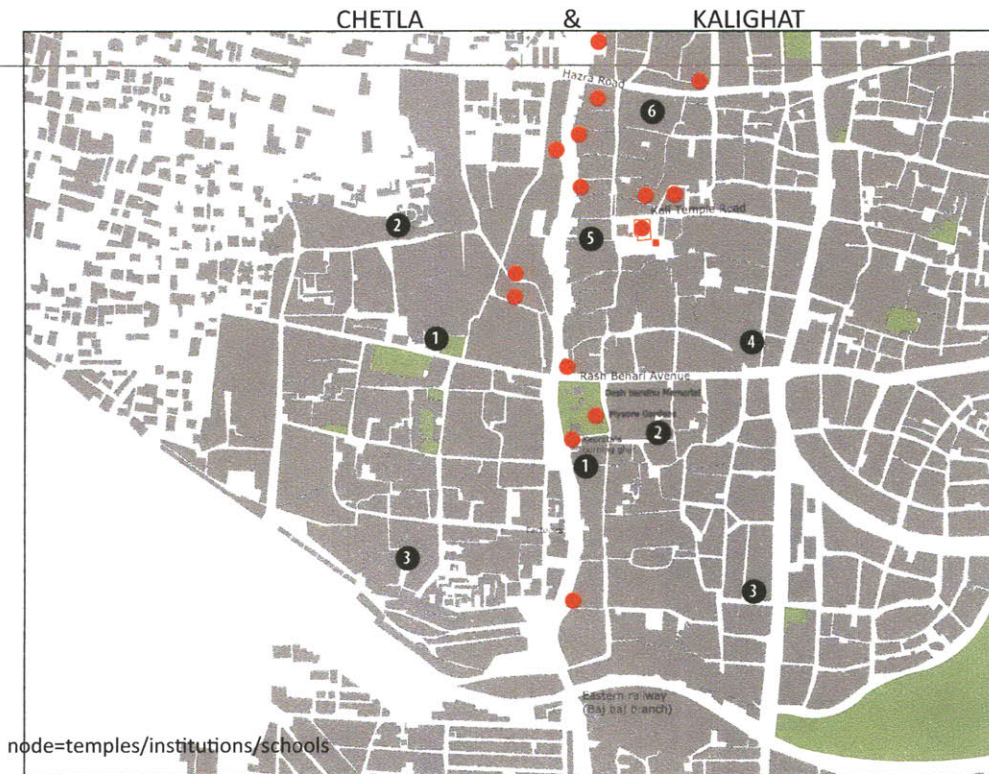
**KALIGHAT**

Kalighat can be considered to be a part of Bhabanipore (analyzed later). It has a similar character in terms of fabric, density and style of construction. The most important structure in this neighborhood is the Kalighat temple (images on succeeding page) The Temple attracts numerous devotees throughout the year. Moreover, there is a large population of craftsmen and vendors who depend on the temple economy, leading to a vibrant urban fabric. However, the large informal population in the area also ensues a need for the provision of services. The juxtaposition of poverty and sacredness have led to the rather strange condition of the channel.



**Fig 3.30: LAND USE - REACH 2 (CHETLA & KALIGHAT)**





**Fig 3.31: NODES - REACH 2 (CHETLA & KALIGHATE)**

**FABRIC :**

Very Dense fabric in both the neighborhoods








**DENSITY:**

Very high density. High instances of Informal settlements.  
Very few open spaes

**CHARACTERISTICS:**

There are a large number of temples along the channel. The presence of Kalighat is definitely advantageous from a strategic point of view. The presence of Industrial landuse on the southern and eastern edge of Chetla (part of the port complex in the north) is a cause for concern.

**KEY:**

-  Bus Route
  -  Ferry
  -  Tram
  -  Metro Stations
  -  Temple
  -  Mosques
  -  schools/public institutions
- node=temples/institutions/schools

FABRIC AND EDGE CONDITIONS

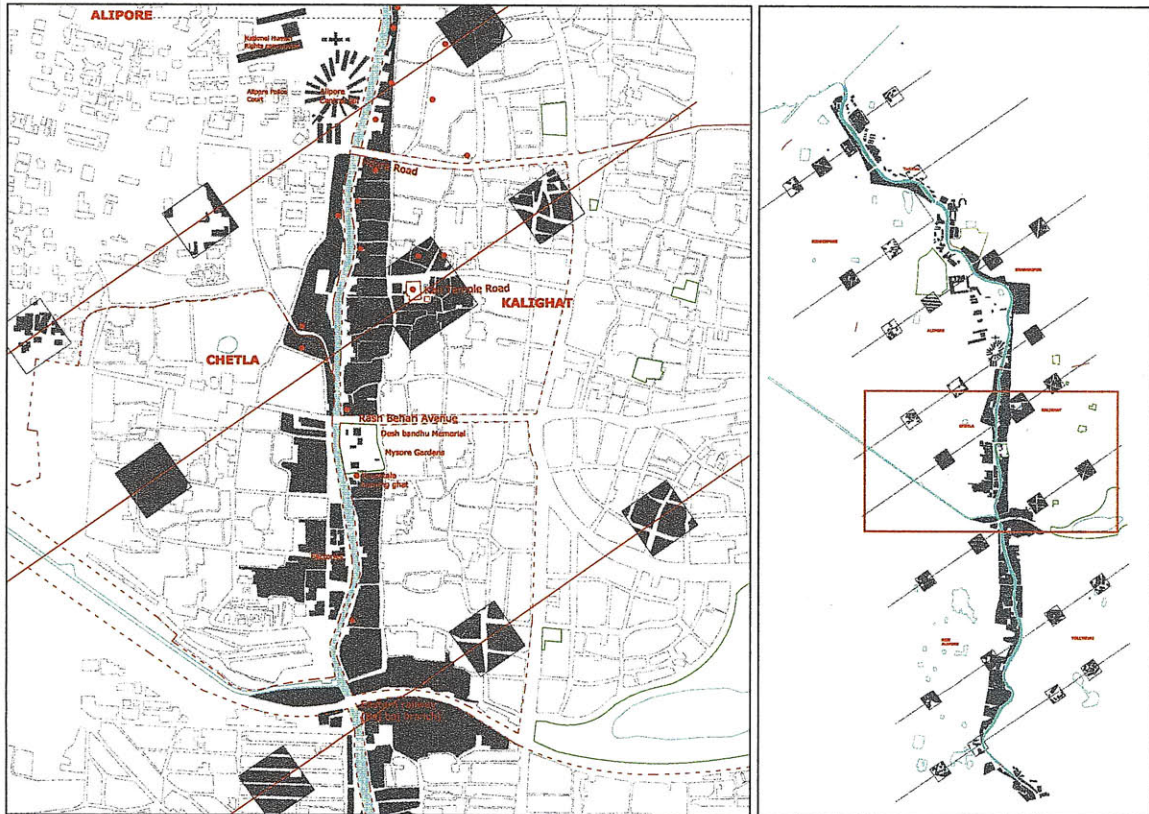


Fig 3.32: COMBINED MAP - REACH 2 (CHETLA & KALIGHAT)

ANALYSIS OF EDGE CONDITIONS

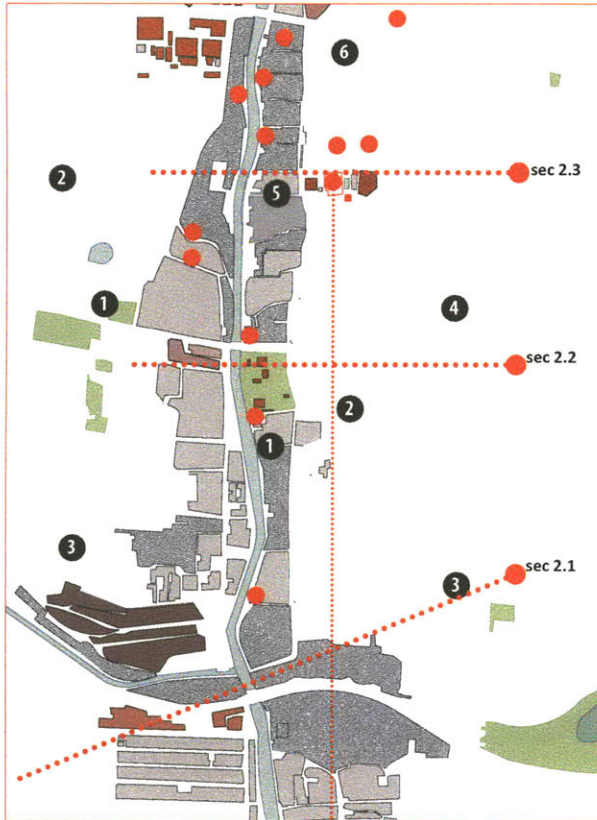


Fig 3.33: EDGE CONDITIONS- REACH 2 (CHETLA & KALIGHAT)

The presence of the Temples on the Channel Edge creates several design opportunities, that can make use of these religious features to safeguard the channel.

The large informal land use at the edge of the channel create several problems in terms of additional pollution and encroachment of the flood bank.

KALIGHAT TEMPLE

KALIGHAT TEMPLE

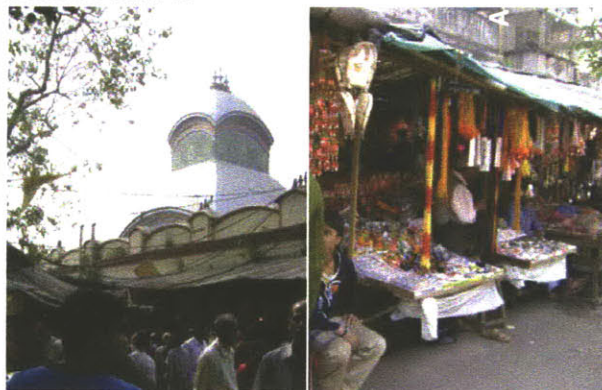
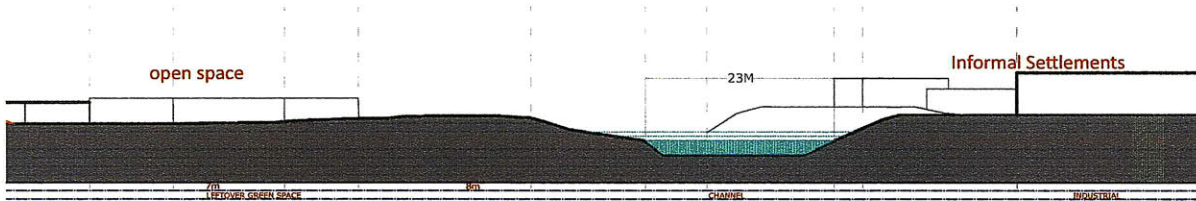


Fig 3.34 IMAGES TO SHOW KALIGHAT TEMPLE AND ITS SURROUNDINGS THAT HAVE A VIBRANT COMMERCIAL ENTERPRISE.

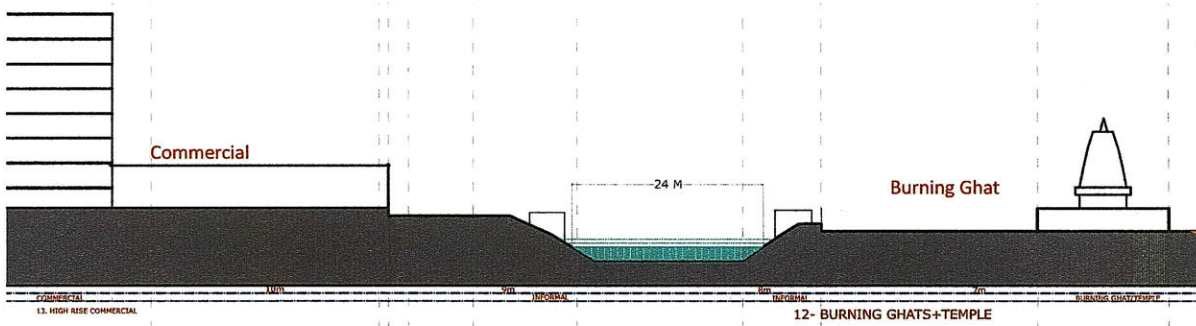
Kalighat is regarded as one of the 52 Shakti Peethams of India, where the various parts of Sati's body are said to have fallen, in the course of Shiva's Rudra Tandava. Kalighat represents the site where the toes of the right foot of Shakti or Sati fell.

The Temple: The Kalighat temple in its present form is only about 200 years old. It has been referred to in Mansar Bhasan composed in the 15th century, and in Kavi Kankan Chandi of the 17th century when the temple was situated on the Adi Ganga itself. It was moved to its present location in 1809.<sup>10</sup>



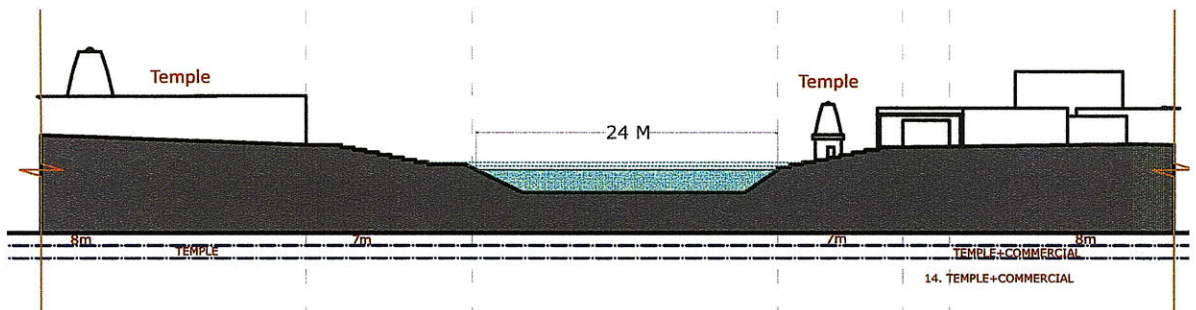
### Sec 2.1

- Informal settlements on both edges, which lack basic sanitation services.
- The presence of a large open space between the channel and the surrounding land uses open-up possibilities for a more Riparian intervention and design.



### Sec 2.2

- The Keortala burning ghat creates possibilities for direct linkages between the channel and the religious landscape of the neighborhood, using landscape features like ghats.
- The commercial land use on the other edge and the presence of a large buffer can lead to a more softscape geared strategy.



### Sec 2.3

- the section of the channel near the Kalighat temple has the following issues: pollution, lack of access, lack of connection between the 2 banks.
- However, several religious practices are held here (image alongside)- leading to dichotomous identities of Sacred and Profane

**Fig 3.35: SECTIONS THROUGH EDGE CONDITIONS- REACH 2 ( CHETLA & KALIGHAT)**



Channel Splitting- point of confluence with the Chetla boat canal



The keortala burning Ghat and adjoining areas



Adi Ganga near the Kalighat Temple

IDOL  
RELIGIOUS CEREMONY

Fig 3.26: IMAGES TO SHOW TYPICAL CONDITIONS- REACH 2 (CHETLA & KALIGHAT)



**Fig 3.37: MAP SHOWING EXTENT OF REACH 3**

REACH 3: ALIPORE & BHABANIPORE

REACH 3- Alipore & Bhabanipore



Fig 3.38: Map of Reach 3



Fig 3.39:Figure Ground (Alipore & Bhabanipore)



The two zones that flank either sides of the channel in Reach 3 are Bhabanipore and Alipore . The 2 neighborhoods have contrasting fabrics and characters.

Fig 3.40: Typical image - Reach 3 (Alipore & Bhabanipore)

**ALIPORE**

Alipur is possibly a derivative of Alinagar, the name Siraj-ud-Daulla gave the city (after his grandfather Nawab Alivardi Khan) on sacking it in 1756. But the name has also been associated with Ali Naqi Khan, who had a house in this area as well as a ghat named after him on the Adi Ganga.

At first a Muslim locality, Alipur was taken over by the British elite in the latter part of the Eighteenth century. Warren Hastings built Hastings House and perhaps Belvedere, the Magistrate's House, and Richard Barwell, the house that became the military Orphan Asylum and then St. Thomas' s School.

Later, Alipur became the headquarters of the 24-Parganas District, and acquired Military installations and a Meteorological observatory. The Bustee lands around adjacent to the Zirat bridge were acquired for the Zoo.

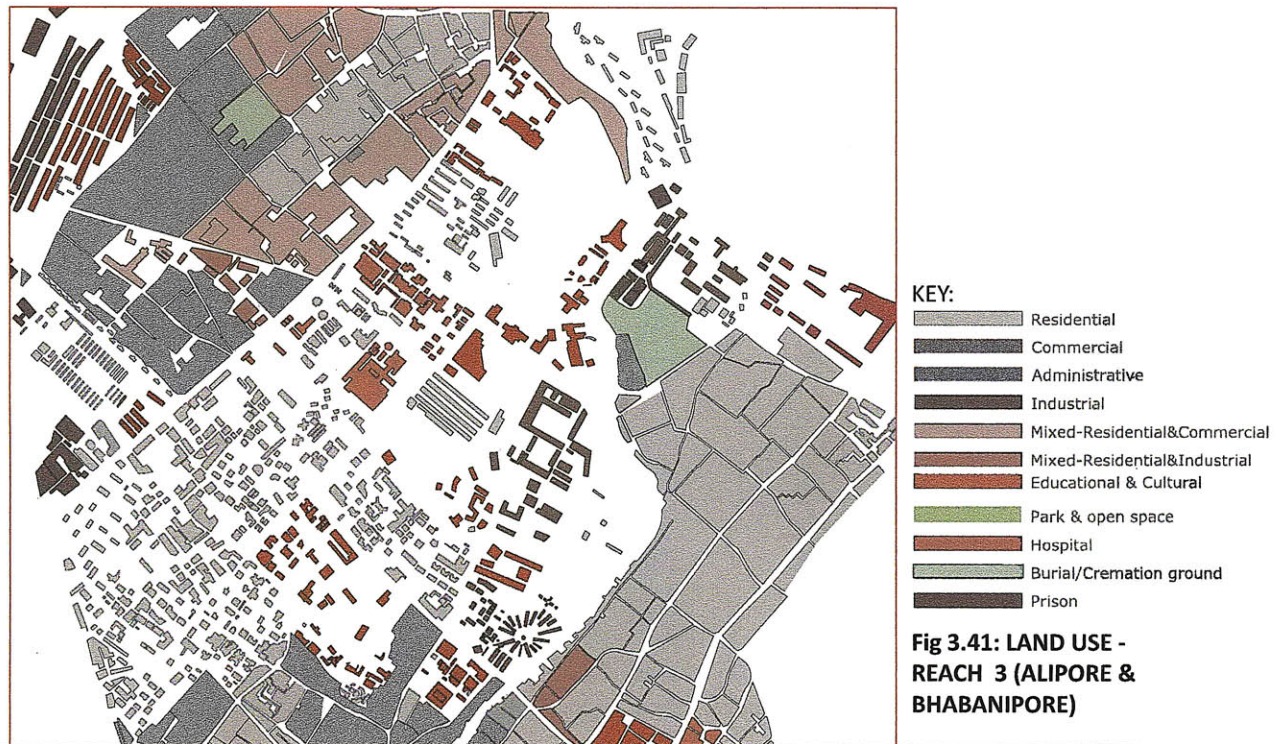
The life of the Old Calcutta elite is still evoked by the open spaces of Alipur around Belevedere Estate (once the Lieutenant Governor's palace now housing the National library), Hastings House, the Zoo and the gardens of the Agri-Horticultural Society.<sup>11</sup>

**BHABANIPORE**

Existed as a dihi (village) in 1765; a part of Dihi Chakraberia was also subsumed within it. Here it is said to have the original shrine of Kali (Bhabani), about a mile from the present site of Kalighat., to which the shrine was shifted only in 1809. By the temple, flowed the Adi Ganga.

The construction of Harish Mukherjee Road, and the extension of Hazra Road to Kalighat, helped to open up Bhabanipur at the beginning of the century.

Bhabanipur developed among rigid caste and occupational lines. The kansaris (braziers), shankaris( conch-workers), telis (oil-pressers) all had their paras (shops), while commodities were sold in pattis, like the chaul patti (rice- market) identifiable even today. At the same time, Indian lawyers, including the most illustrious ones of old Clacutta, flocked to live in Bhabanipur: the Sardar Diwani Adalat, the Company's highest appellate court, had shifted to the old Military hospital there, and the District Judge's Court was in nearby Alipur.<sup>12</sup>





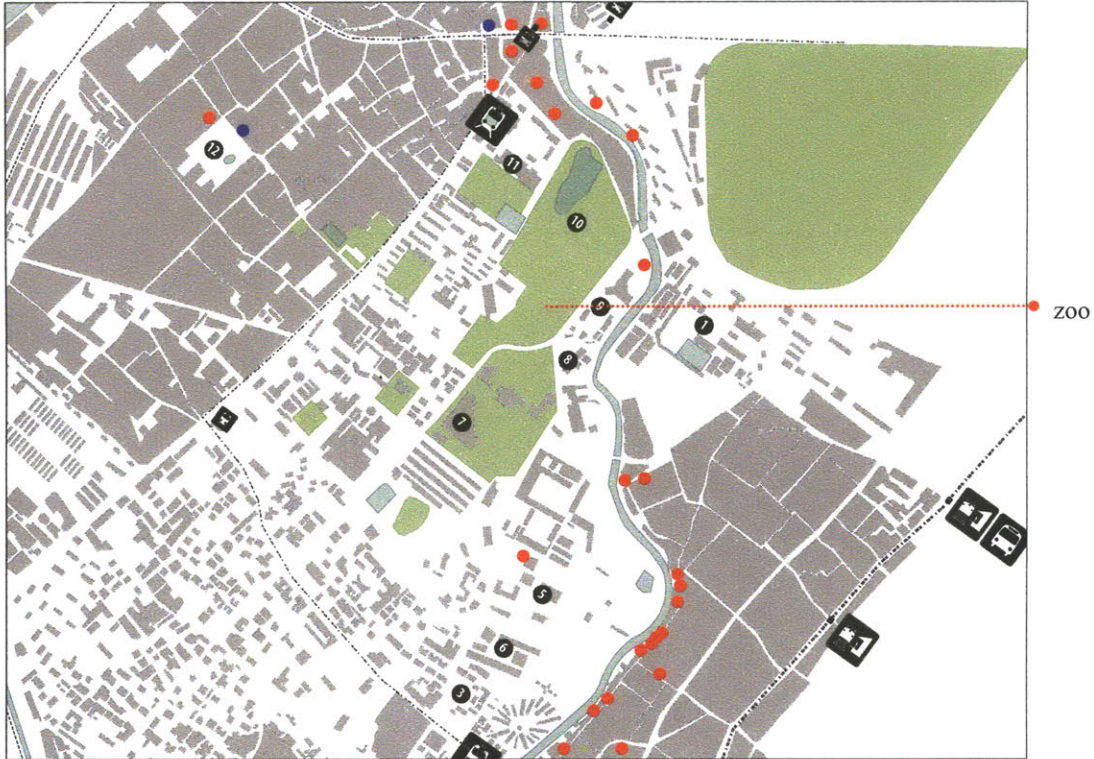


Fig 3.42: NODES - REACH 3 (ALIPORE & BHABANIPORE)

**FABRIC :**

Bhabanipore has an extremely dense fabric. the opposite is true for Alipore that has a sparse dispersed fabric with many single family residential units.








**DENSITY:**

Bhabanipore is extremely dense whereas Alipore is not. There are large open spaces in Alipore. However, these spaces are not coherent in terms of programme or function, an exception being The zoological gardens.

**CHARACTERISTICS:**

The large number of temples on the channel in Bhabanipore

**KEY:**

-  Bus Route
  -  Ferry
  -  Tram
  -  Metro Stations
  -  Temple
  -  Mosques
  -  schools/public institutions
- node=temples/institutions/schools

FABRIC AND EDGE CONDITIONS



Fig 3.43: COMBINED MAP - REACH 3 (ALIPORE& BHABANIPORE)

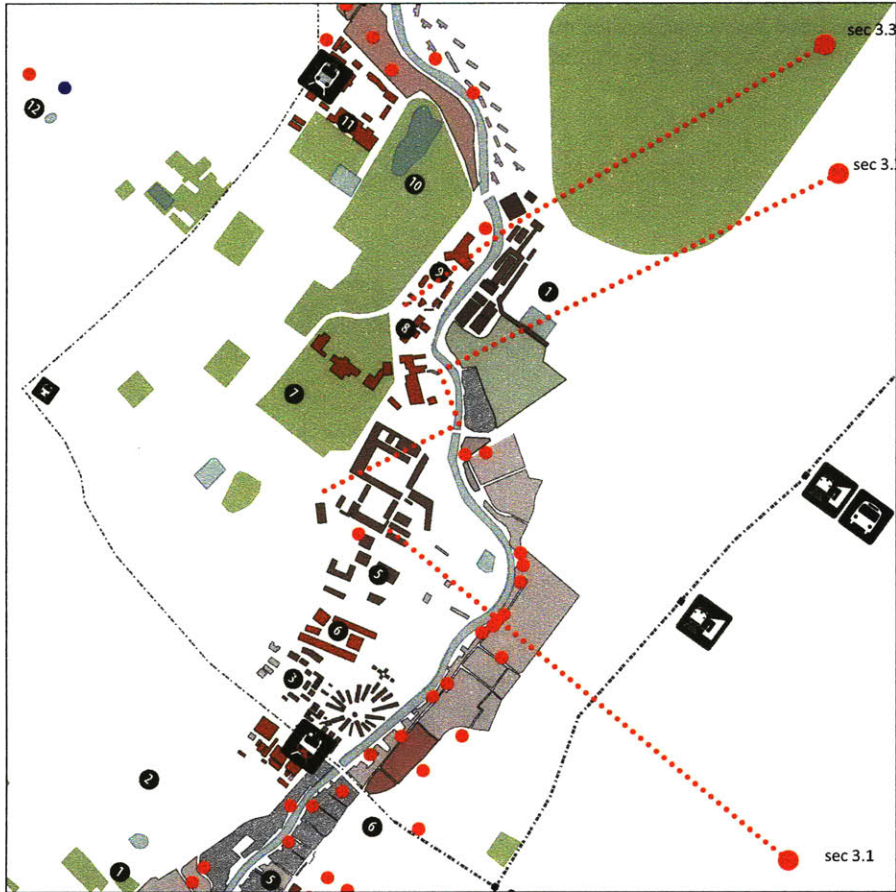
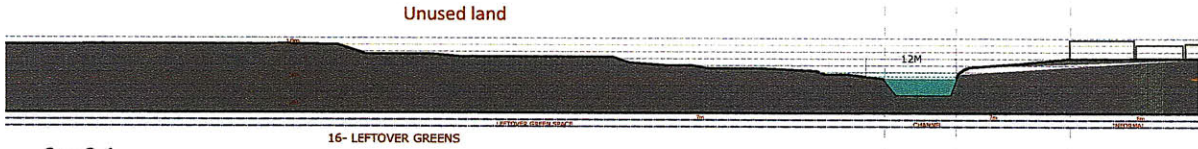


Fig 3.44: EDGE CONDITIONS- REACH 3 (ALIPORE & BHABANIPORE)

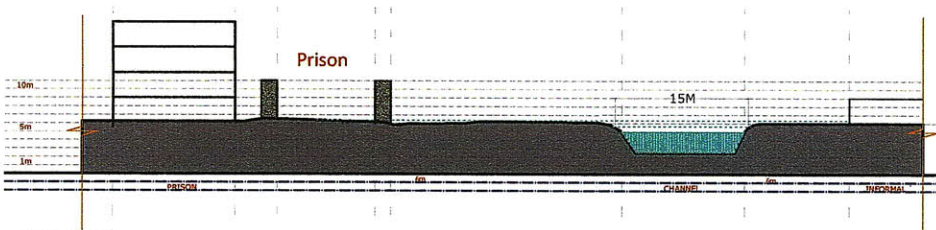
The presence of temples on the edge of Bhabanipore and the institutional setup in Alipore can create interesting spatial and riparian designs.

Moreover, the transport loop around the channel make this section suitable to create a transfer node.



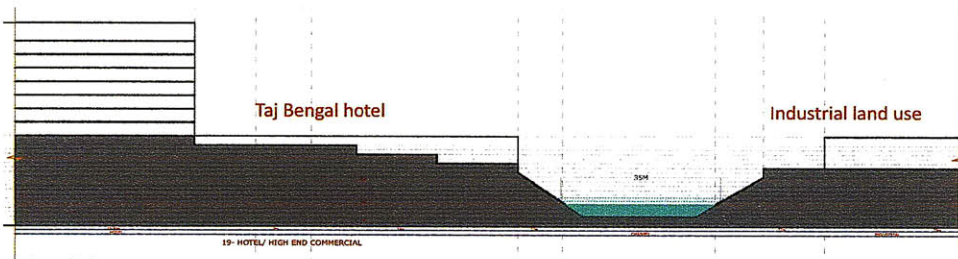
Sec 3.1

- the presence of a large open land make this location suitable for Riparian interventions and for an ecological landscape approach to waste water treatment.



Sec 3.2

- The prison along the channel creates interesting challenges and questions: How can there be increased accessibility without compromising security?



Sec 3.3

- The interface between the luxury hotel and the channel can be used to create more public spaces, like Gardens that can eventually be maintained by the hotel.  
- This can also be used to change the image of the channel.

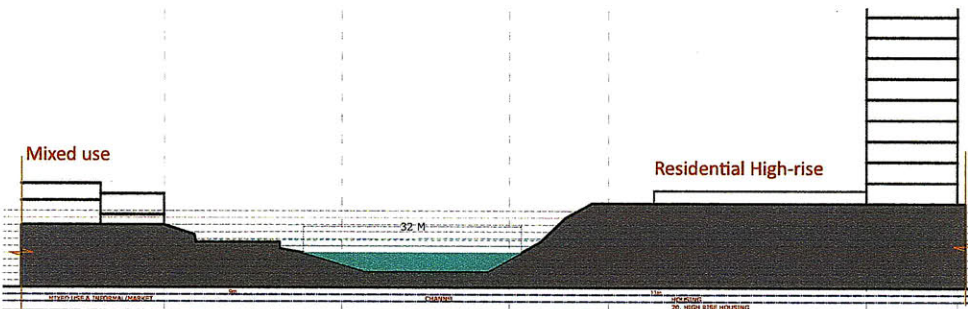


Fig 3.46: SECTIONS THROUGH EDGE CONDITIONS- REACH 3 ( ALIPORE & BHABANIPORE)



Informal settlements along the channel



Informal settlements along the channel



High rise residential and low rise informal growth

Fig 3.47: IMAGES TO SHOW TYPICAL CONDITIONS- REACH 3 (ALIPORE & BHABANIPORE)



Fig 3.48: MAP SHOWING EXTENT OF REACH 3

## REACH 4:



Fig 3.49: Map of Reach 4



KHIDIRPORE &amp; HASTINGS



Reach 1 spans from the Hughli waterfront to the Khidirpore bridge. The two neighborhoods along the channel are Khidirpore and Hastings. These are historic neighborhoods and have been analyzed in this section.

Fig 3.50: Figure ground-  
Reach 4 (Khidirpore & Hastings)

Fig 3.51: TYPICAL IMAGE - REACH 4 (KHIDIRPORE &amp; HASTINGS)

**HASTINGS**

Hastings was the site of a Muslim burial ground predating the erection of the New Fort William.

When the construction of the new fort began, in 1757, the workmen or coolies camped here- giving rise to the name 'Coolie Bazaar'.

It was renamed 'Hastings' as it grew into a township for the Ordinance and Commissariat Departments, and the Harbor Master's Department of the Port Commissioners.

Today it is described as 'A serene locality at the heart of the City where traces of old world charm of British days are visible'.<sup>13</sup>

**KHIDIRPORE/WATGUNJ**

It developed as a Muslim area for several reasons such as displacement of many Muslims Alipur to make plac for the zoo, and more from the land acquired for King George's (now Netaji Subhash) Docks in Garden Reach: the uprooted took refuge in Khidirpore. Another factor was the migrations of Mominis or Muslim weavers from Bihar and UP after the 1857 mutiny. Many of them had to enter the city surreptitiously. In Calcutta they took up seafaring as an occupation, and were attracted to the neighborhood due to its the proximity of the Khidirpur docks. It is worth mentioning that Garden reach, beyond the compass of the thanas, also became a Muslim area when Wajid Ali Shah, the Nawab of Awadh and his large entourage settled at nearby Metiabruz (matia buruj or earth built fort) after his deposition. This made the Europeans withdraw from their garden houses there in favor of Alipur and Baligunj.

Watgunj too, is closely connected with the khidirpur docks, and commemorates their virtual founder Colonel Henry Watson (1737-84). After working for the army and the Company and becoming chief Engineer in Bengal for the latter, Watson set up the first dockyards in Bengal. Here were the built the frigates Nonesuch (thirty-two guns) in 1782 and Surprise (thirty-six guns) in 1788. Watson also acted second to Philip Francis in the latters historic duel with Warren Hastings.<sup>14</sup>

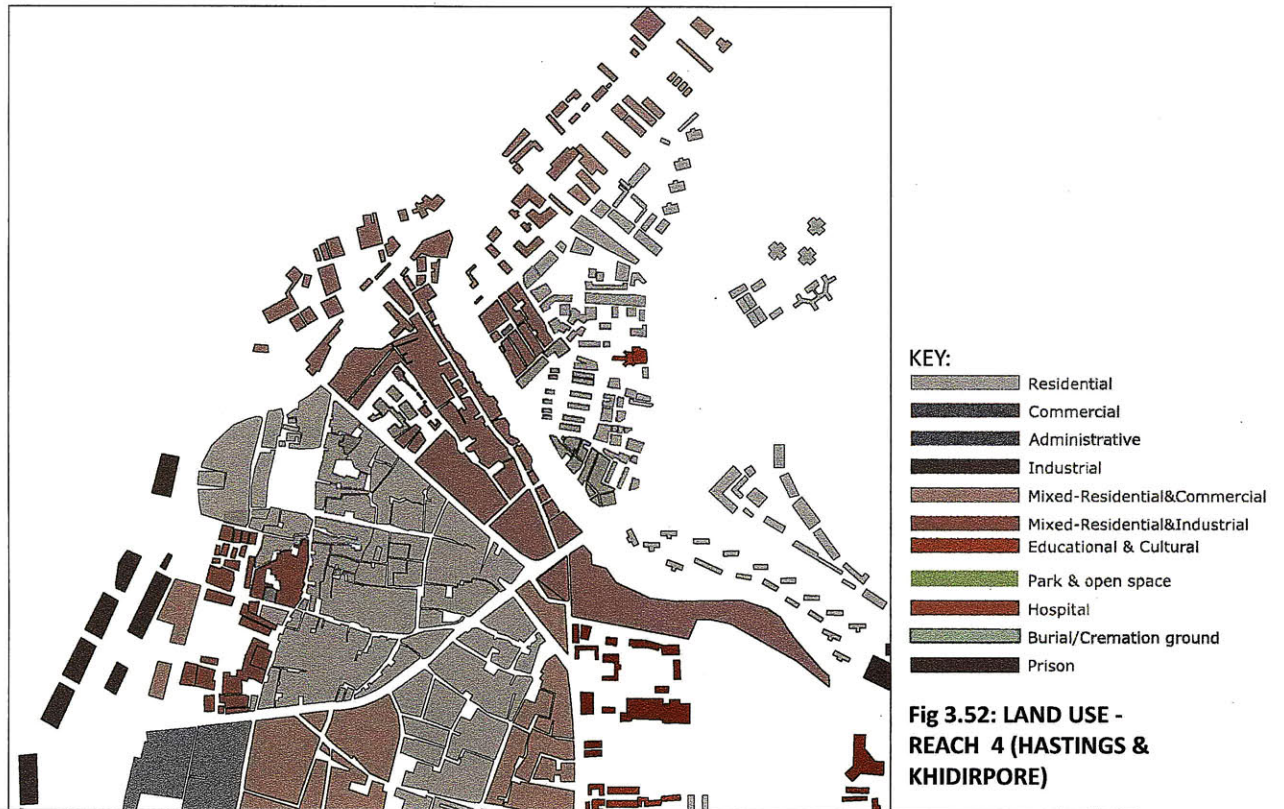






Fig 3.53: NODES - REACH 4 (HASTINGS & KHIDIRPORE)

**FABRIC :**

The fabric in Hastings is very dispersed. This is due to the presence of primarily low rise residential buildings. This contrasts greatly from the fabric in khidirpore, which is densely packed and composed largely of mixed land use.

**DENSITY:**

Low in Hastings and very high in Watgunj.








**CHARACTERISTICS:**

With the exception of the golf course, there are few open spaces within this reach.

Moreover, there is a shift in the demographic, from the fort to the port area the fabric changes- from buildings in the park in Hastings to mixed use development with dense fabric towards to the dock lands in Khidirpore.

It is interesting to note the presence of a large number of temples in a historically Muslim neighborhood.

**KEY:**

-  Bus Route
  -  Ferry
  -  Tram
  -  Metro Stations
  -  Temple
  -  Mosques
  -  schools/public institutions
- node=temples/institutions/schools

FABRIC AND EDGE CONDITIONS

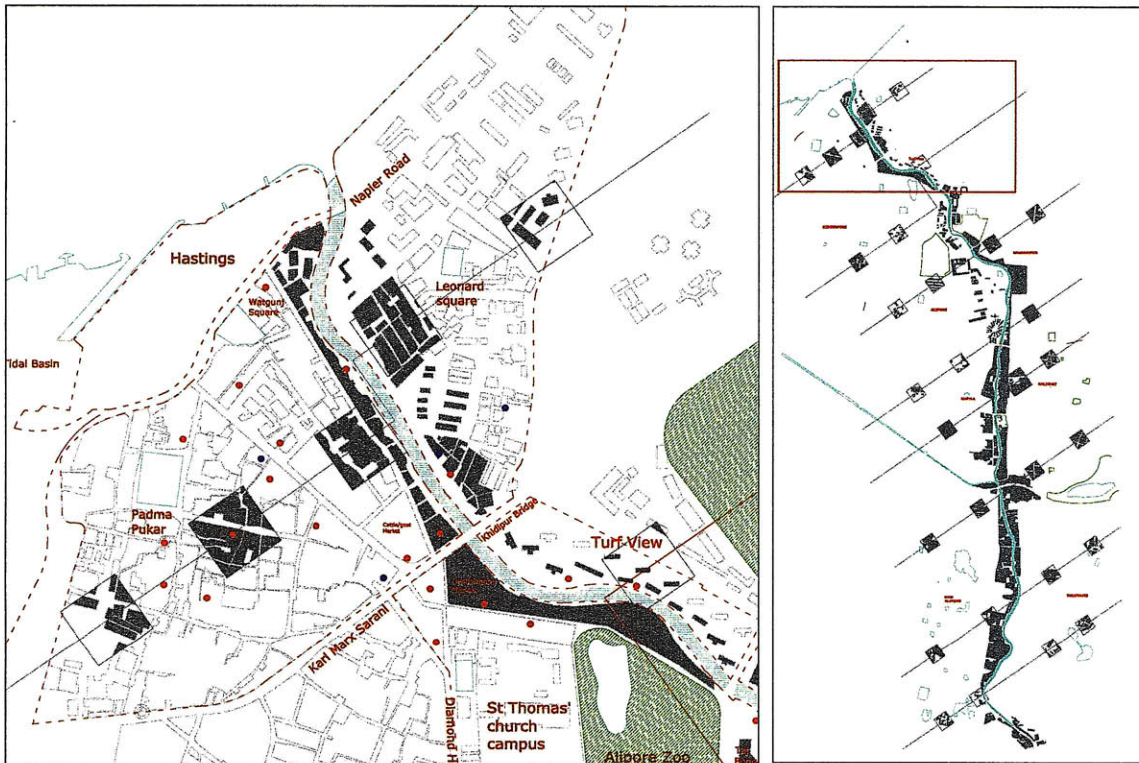


Fig 3.54: COMBINED MAP - REACH 4 (HASTINGS & KHIDIRPORE)

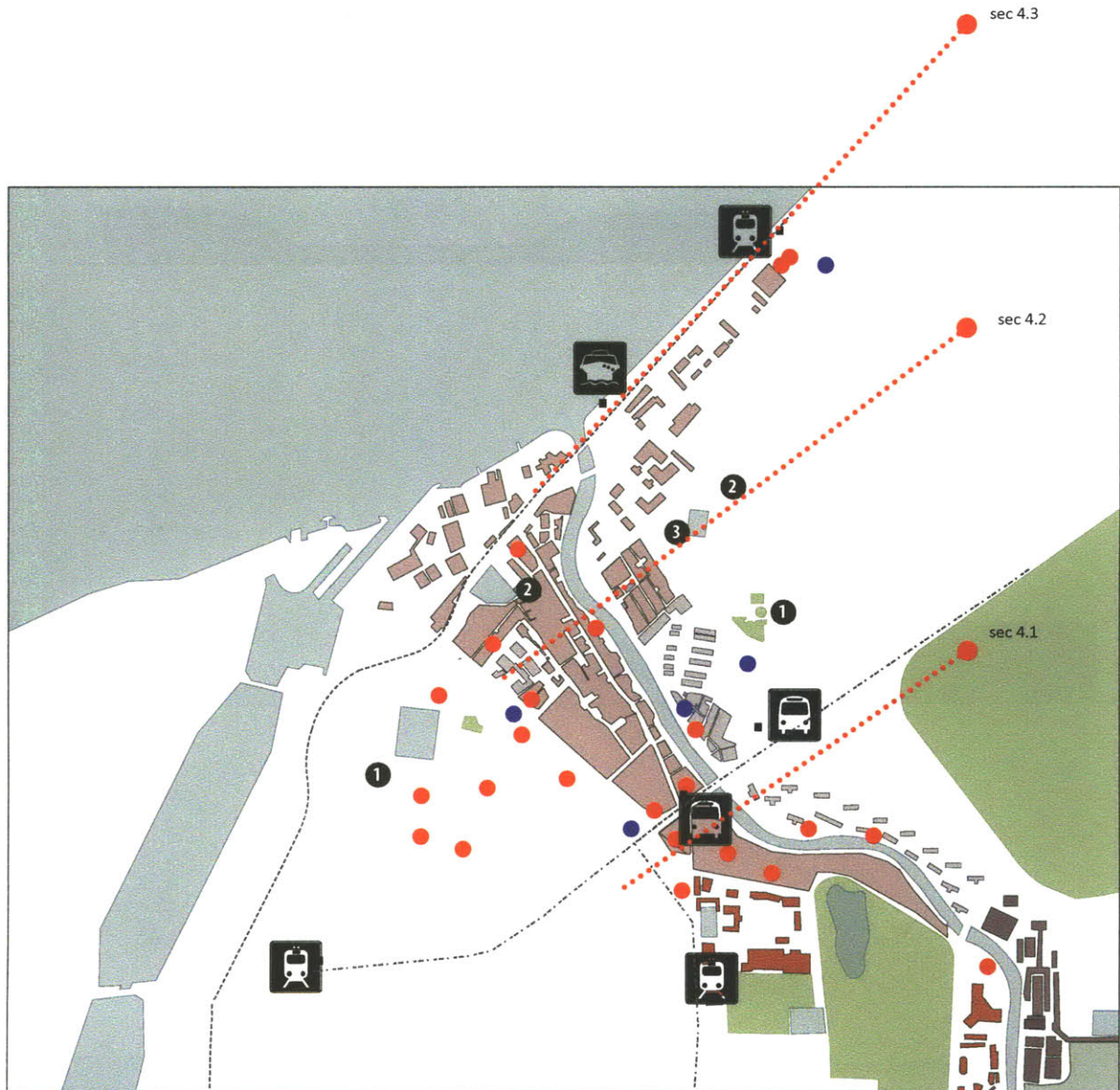
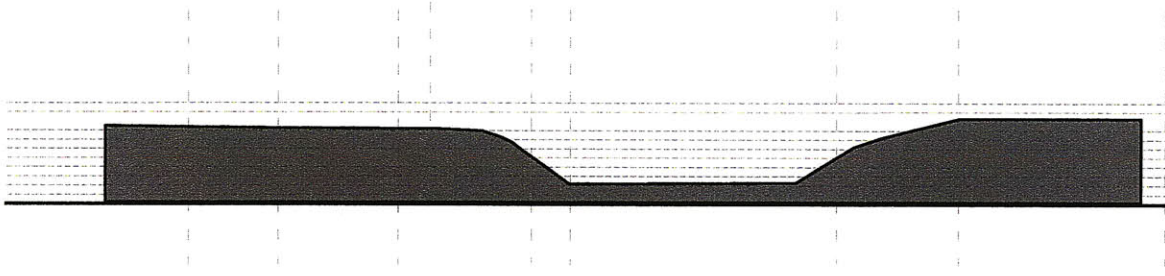
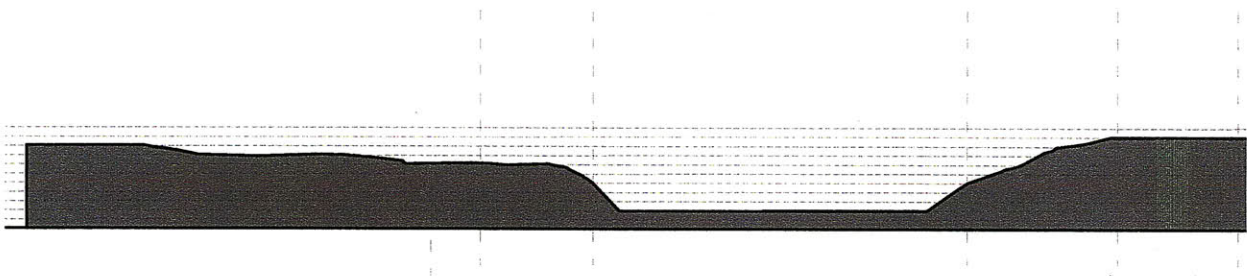
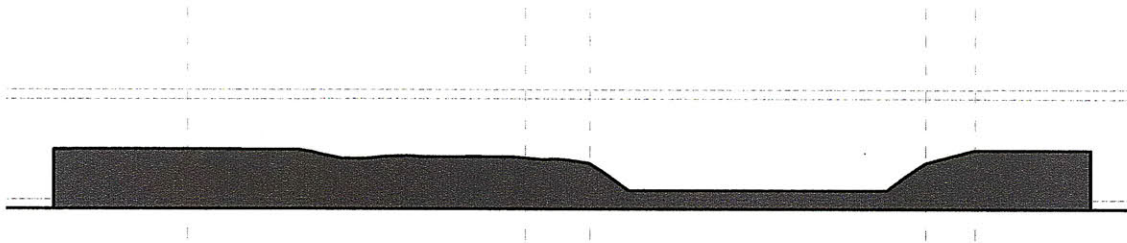


Fig 3.55: NODES - REACH 4 (HASTINGS & KHIDIRPORE)

The edge is very well connected to existing transport routes. Moreover, the large number of of temples and mosques co-existing in one area give this space a unique importance.





Confluence of the Adi Ganag with the Hughli



Image to breadth of channel at this point



Informal jetty near Khidirpore

Fig 3.57: IMAGES TO SHOW TYPICAL CONDITIONS- REACH 4 (HASTINGS & KHIDIRPORE)

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The Geographical analysis reveals the inherent problems at each scale as well as identifies the possibilities or potentials to reconnect the channel with the city at every scale.

These possibilities or opportunities are derived from a recognition of the existing physical condition, and what is needed. Essentially, the analysis provides a clear picture of the gaps in the existing landscape, paving the path for an informed intervention.

The possibilities excavated in this analysis are converted into design strategies in the next chapter.

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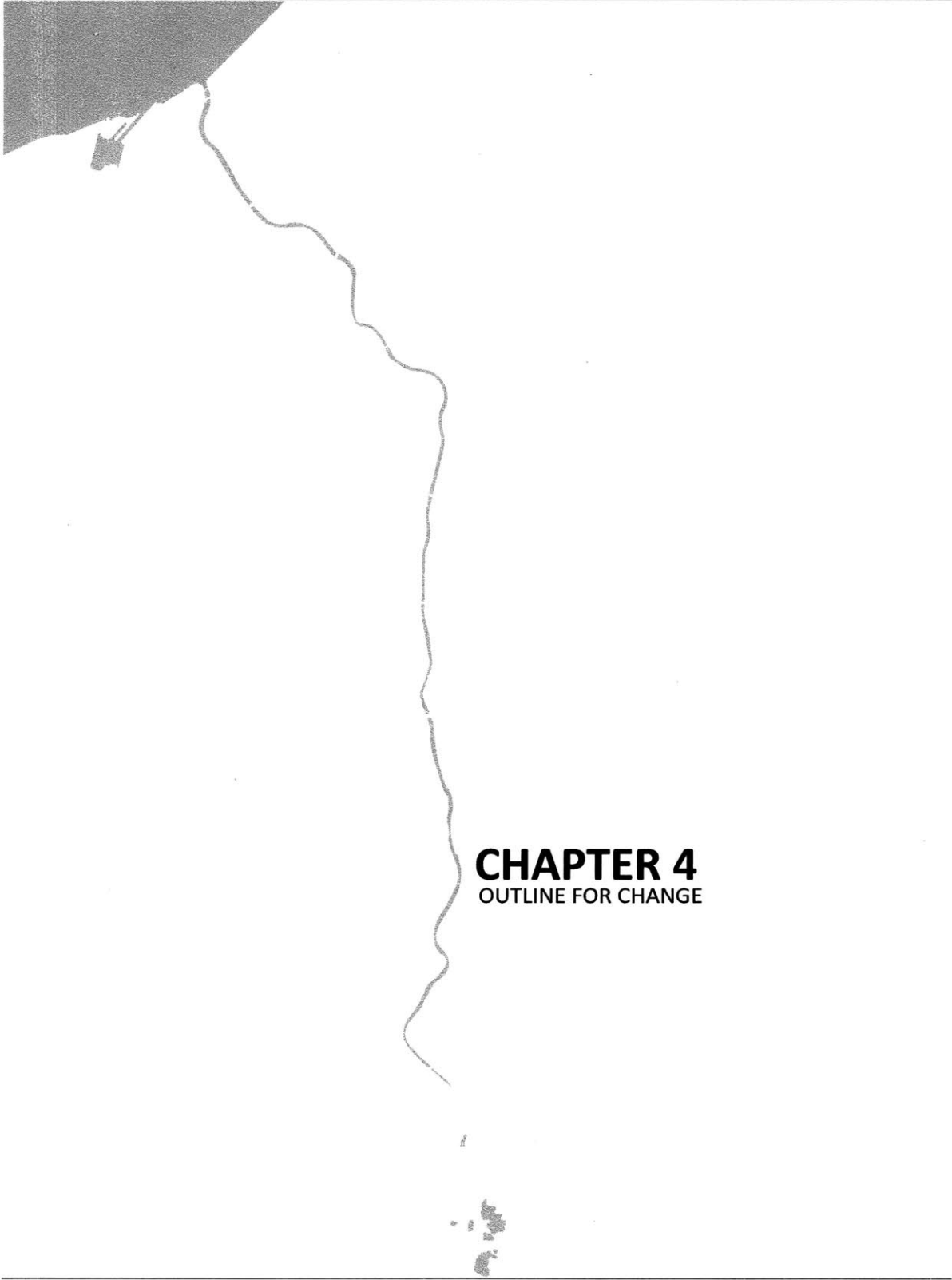


**ENDNOTES**

- 1 Shivashish Bose, Adaptive and Integrated Management of Wastewater and Storm water Drainage in Kolkata, paper (Kolkata: Jadavpur University, 2007).
  - 2 "Executive Summary, Master plan for Sewerage and Drainage," Executive Summary, Master plan for Sewerage and Drainage (accessed 04 15, 2010).
  3. Ibid
  - 4 Ibid
  - 5 ibid
  - 6 see: CSE Webnet, Kolkata Wetlands, [http://www.rainwaterharvesting.org/kolkata/kolkata\\_wetlands.htm](http://www.rainwaterharvesting.org/kolkata/kolkata_wetlands.htm) (accessed march 30, 2010).
  - 7 Wikipedia, New Alipore, [http://en.wikipedia.org/wiki/New\\_Alipore](http://en.wikipedia.org/wiki/New_Alipore) (accessed April 10, 2010).
  - 8 Sukanta Chaudhuri, Calcutta: the Living City (Calcutta;New York: Oxford University Press, 1990)
  - 9 wikipedia, Wikipedia, <http://en.wikipedia.org/wiki/Behala> (accessed April 14, 2010).
  - 10 Sukanta Chaudhuri, Calcutta: the Living City (Calcutta;New York: Oxford University Press, 1990)
  - 11 Ibid
  - 12 Keya Dasgupta, Genesis of a Neighborhood The mapping of Bhabanipur, Occasional Paper (Calcutta: centre for Studies in Social Sciences, 2003), p.10
  - 13 Ibid
  - 14 Sukanta Chaudhuri, Calcutta: the Living City (Calcutta;New York: Oxford University Press, 1990)
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**CHAPTER 4**  
OUTLINE FOR CHANGE

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## INTRODUCTION

The Historical and Geographical Analysis provide an understanding of the channel and reveal its facets, which are: the Sacred and Profane, Continuous and Fragmented, and Natural and Artificial. These describe the tensions under which the channel operates.

The channel becomes an artifact of the sacred by virtue of its mythical significance and of desecration because of its levels of pollution.

Although the identity of the channel lies in its continuity, the physical landscape of the channel is fragmented, with many stakeholders and different edge conditions. Moreover, it is divorced from the workings of the physical city. It has no *living* relationship with the city of Kolkata.

Lastly, while it functioned as a natural drainage basin once, before the onslaught of large scale urbanization, the channel in its artificial, canalized form no longer functions in the same manner. Instead, has been reduced to a sewer, transporting the city's waste.

In essence, although the channel is ethereal, alive in the city's memory, its material umbilical chord is severed from everyday city. Thus reduced to a *Sacred Sewer*.

## STRATEGIES FOR INTEGRATION

This proposal responds to these tensions by re-establishing a living relationship between the Adi Ganga and the inhabitants of Kolkata, the visitor, the pilgrims and the abutters. The strategy operates on a regional, zonal and sectional scale.

Three strategies have been used:

1. A Regional strategy
2. A Linear Strategy
3. A Lateral Strategy

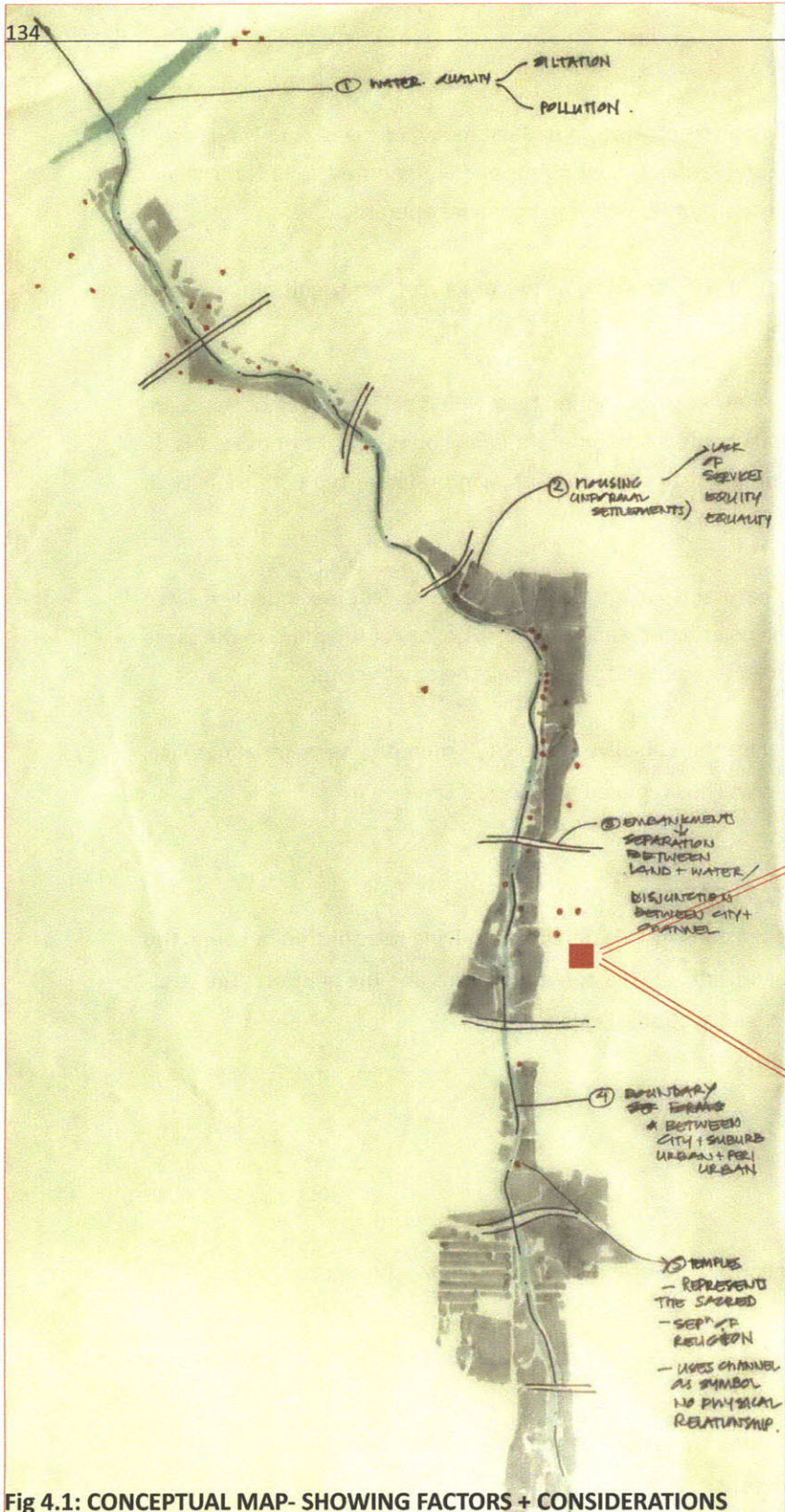
Section 1 conceptually represents my understanding of the relationships at play through the analysis carried out in the earlier chapters.

Section 2 shows the regional level strategy, connecting the channel to the city's transport infrastructure.

Section 3 shows the linear and lateral strategies that operate at the channel scale.

The last section makes larger inferences and conclusions.

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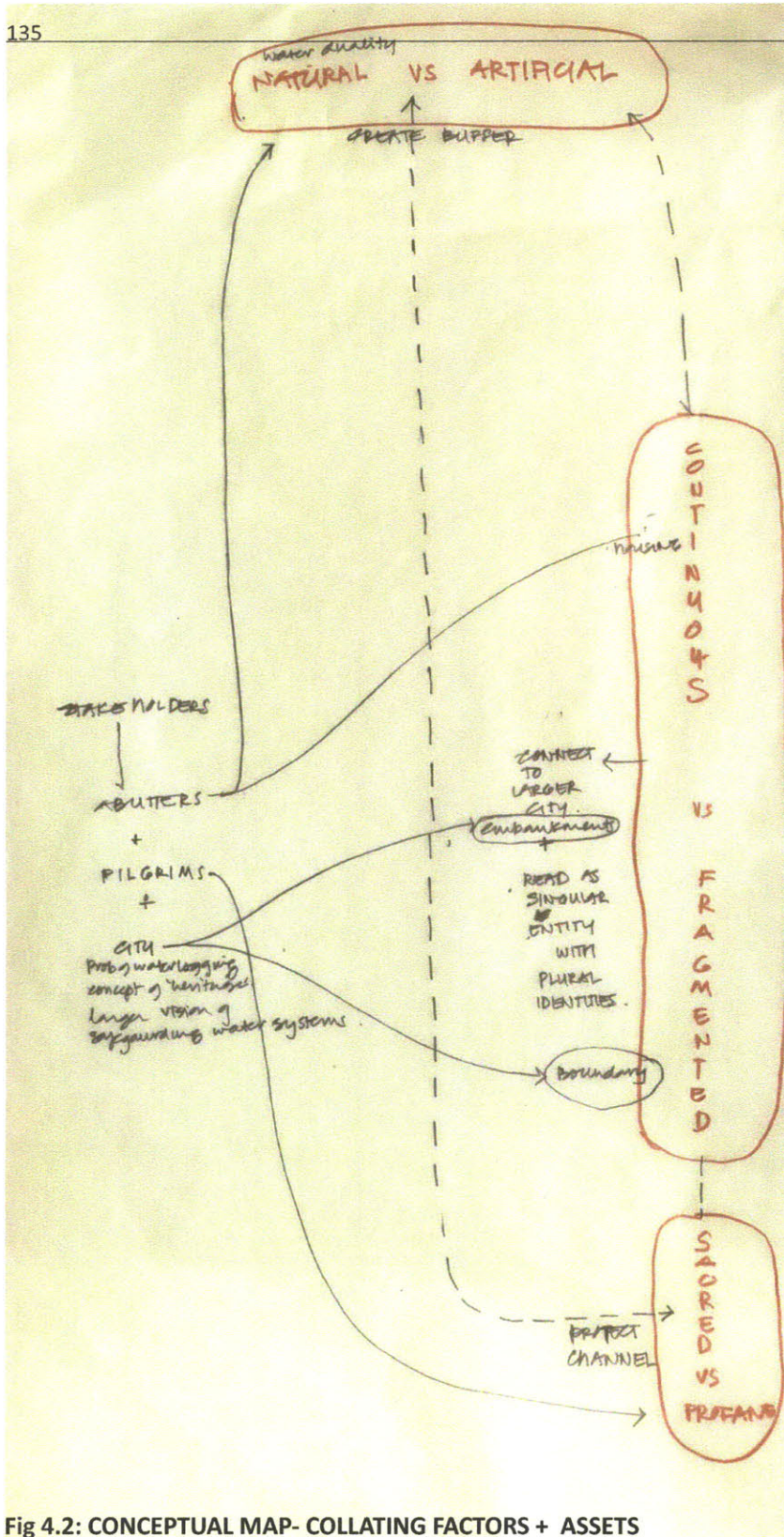


OUTLINE FOR CHANGE

ISSUES

1. CHANNEL WATER QUALITY- POLLUTION, SILTING
2. EDGE CONDITIONS- PRESENCE OF INFORMAL SETTLEMENTS THAT LACK SERVICES
3. BRIDGES- REDUCE ACCESS TO THE CHANNEL.
4. WALLS/ROADS SEPARATING THE CHANNEL AND THE RIPARIANS.

Fig 4.1: CONCEPTUAL MAP- SHOWING FACTORS + CONSIDERATIONS



**ASSETS**

1. TEMPLES
2. INSTITUTIONS ON THE EDGES- COMMERCIAL , CULTURAL, RECREATIONAL
3. PARKS/OPEN SPACES
4. EXISTING TRANSPORT
5. STAKEHOLDERS: CITY, RIPARIANS, PILGRIMS.

Fig 4.2: CONCEPTUAL MAP- COLLATING FACTORS + ASSETS





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## **REGIONAL STRATEGY**

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## REGIONAL STRATEGY

The Regional Strategy establishes the relationship of the channel by grafting it in the City's transport network.

The strategy uses the position of the metro as an asset to create a new transport interchange. The point at which the Metro intersects the channel is used to create a transfer node, from where a visitor can access the new pedestrian and bike linkages provided along the channel.

This new *green* corridor then links to the existing tram network and the ferry network along the Hughli river, to create a new loop. The strategy makes the channel more accessible by introducing a ferry and bike service and providing pedestrian linkages



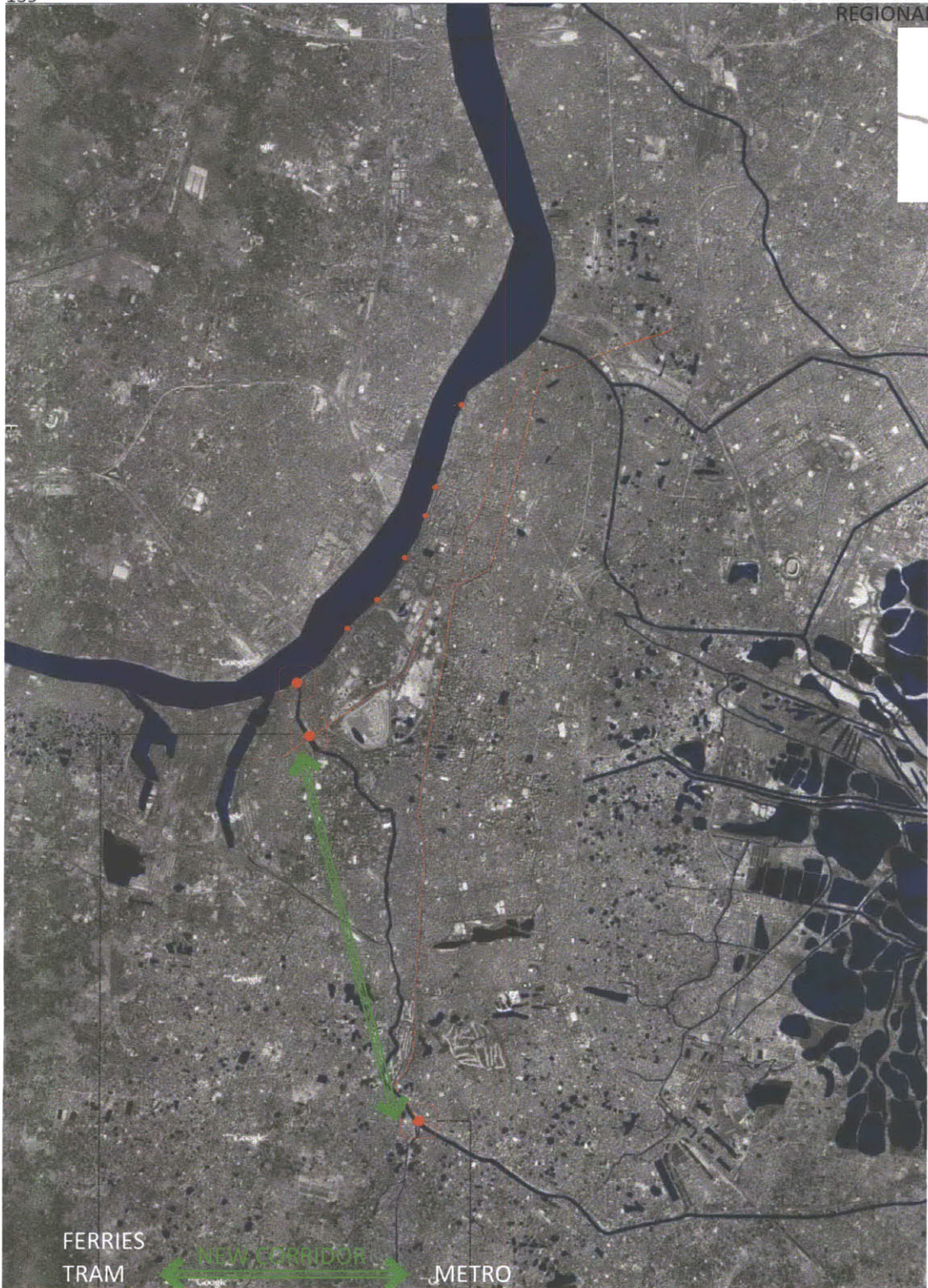


Fig 4.3: INTEGRATING CHANNEL WITH REGIONAL TRANSPORT NETWORK.



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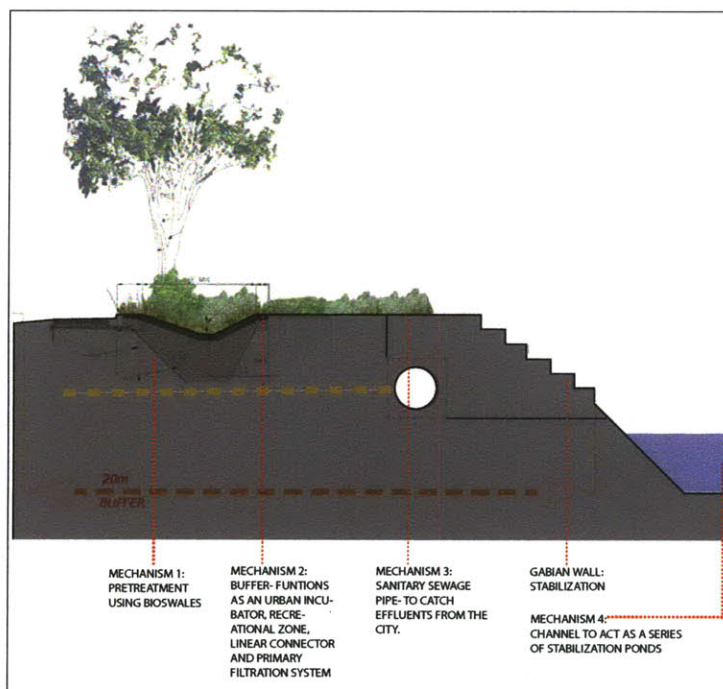
**LINEAR STRATEGY & LATERAL DESIGN**

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## LINEAR STRATEGY

The Linear Strategy consists of a buffer that acts as a recreational zone, an interface between the abutters and the channel as well as a cleansing mechanism for the site.

The linear buffer creates a recreational zone that spans the length of the channel from Tollygunge to Hastings, where the channel meets the river Hughli. As a result of its linear form, the recreational zone is ideal to create new land-water transport linkages as well as new pedestrian and bicycle paths.



**Fig 4.4: CONCEPTUAL SECTION SHOWING THE LINEAR TREATMENT STRATEGY**

The cleansing mechanism for the channel operates using the following mechanisms :

- The Bioswale- that collects storm water runoffs and as acts as a primary treatment agent.
- The Vegetated buffer that acts as the primary filtration system.
- The Channel itself, acts as a series of stabilization ponds where sediments are allowed to precipitate and organic matter is decomposed.
- Lastly, on a subsurface level, a new sanitary sewer line is introduced that catches the waste from the city and carries it to a new treatment plant.

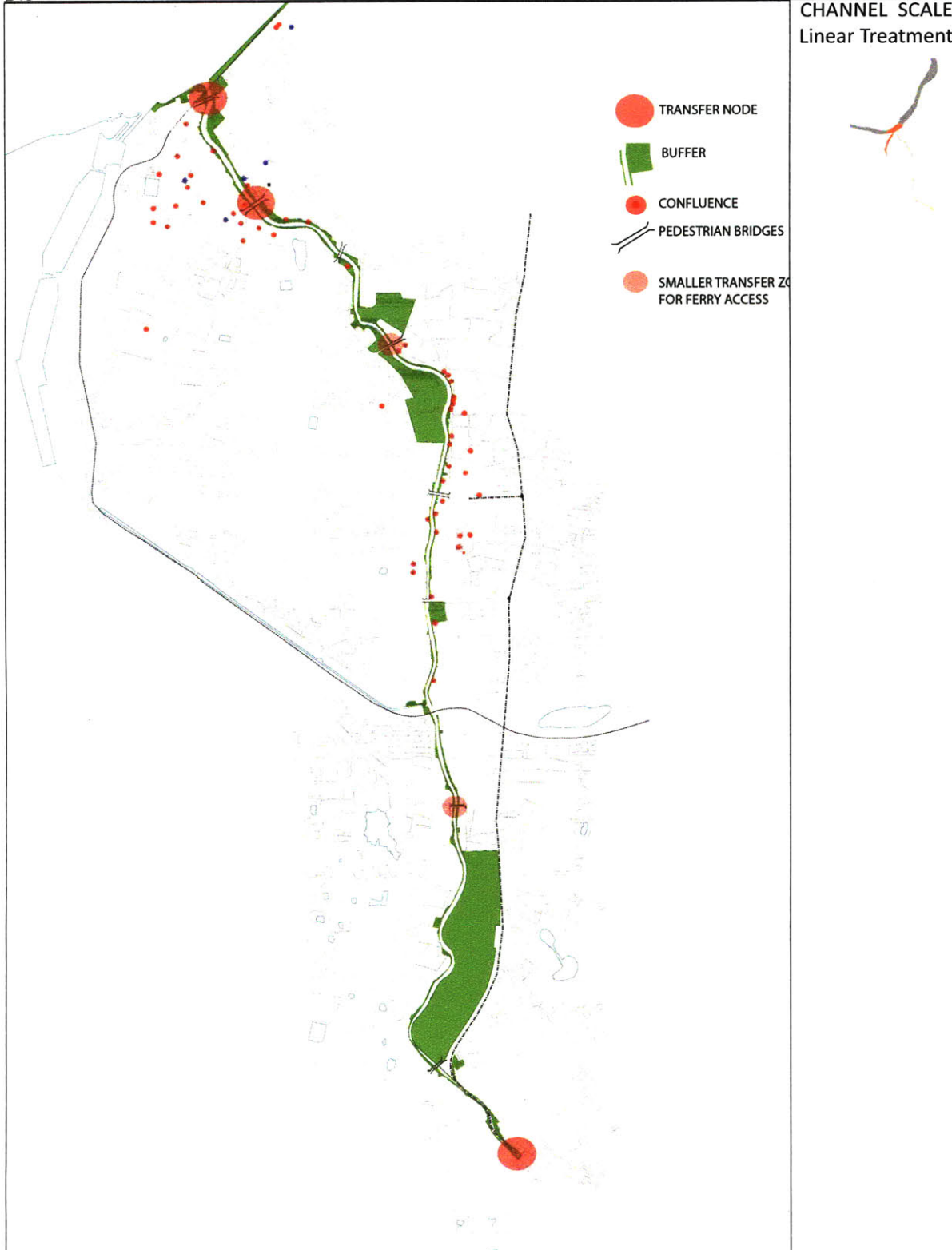


Fig 4.5: PLAN OF THE CHANNEL SHOWING LINEAR STRATEGY

## LATERAL DESIGN

The Lateral strategy creates an interface between the edge condition and the larger zonal programs. Connections are made with adjacent conditions, which vary: from adjoining conditions to more local conditions.



These connections create increased accessibility to the channel, using urban connectors between important historic sites, increasing their “heritage value” as well as that of the Adi Ganga.

The lateral strategy consists of retrofitting existing infrastructure that leads up to the channel. Moreover it acts as a primary local cleansing mechanism for storm water drainage.

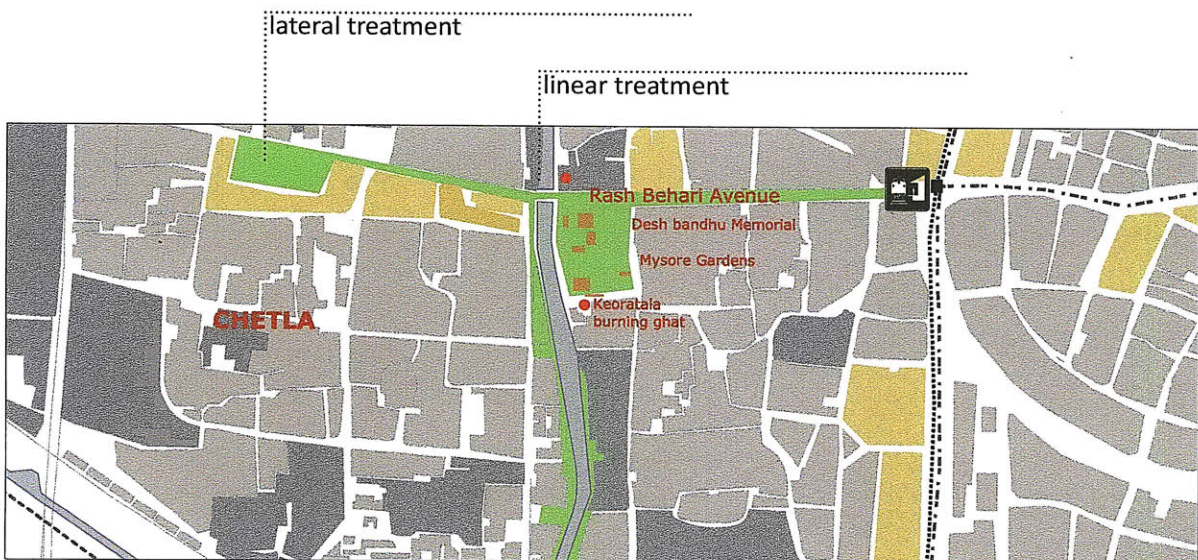


Fig 4.6: CONCEPTUAL STRATEGY SHOWING LINEAR AND LATERAL STRATEGIES



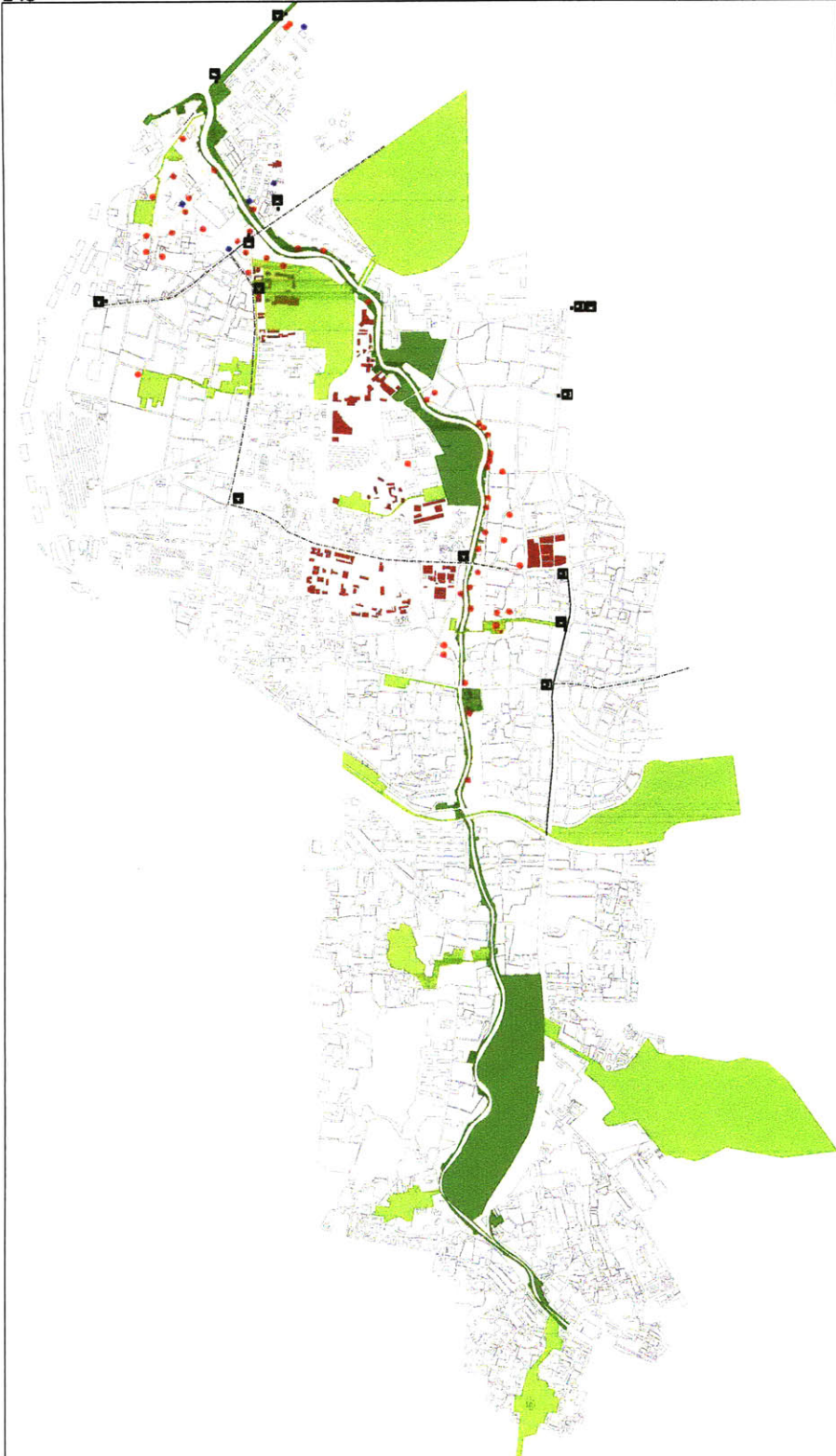


Fig 4.7: PLAN OF THE CHANNEL SHOWING LATERAL STRATEGY



Fig 4.8: LINEAR AND LATERAL STRATEGIES WITH EDGE CONDITIONS

## LINEAR AND LATERAL DESIGN

The linear and lateral strategy, on account of the sense of continuity they provide, transform the narrative that is associated with the Adi Ganga.

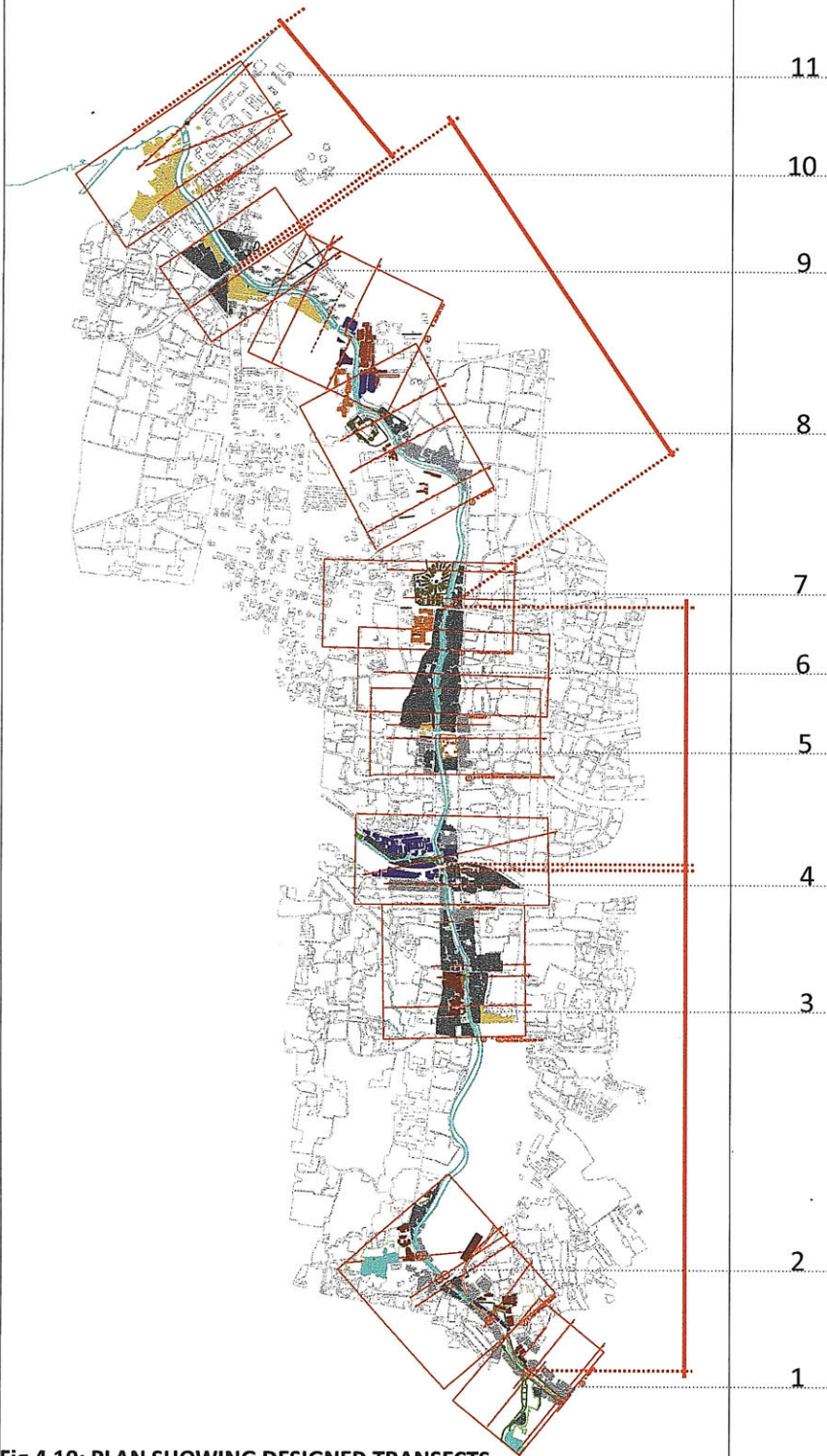
The visitor, pilgrim and city inhabitant can use the new buffer created along the channel as a new public, green corridor, to experience the channel as well as the historic sites, temples and mosques around it.

Moreover, in a landscape of scattered fabric and open spaces, this new constructed landscape acts as a binding glue, filling in the gaps and creating new connections. The bicycle and pedestrian track within the buffer enliven the banks of the channel, transforming its character from a misused garbage dump to a new recreational corridor for the city.



**Fig 4.9: LINEAR AND LATERAL STRATEGIES:  
RESOLVING THE FABRIC**

### LINEAR AND LATERAL DESIGN- AT THE SECTIONAL SCALE



11  
10  
9  
8  
7  
6  
5  
4  
3  
2  
1

While the Regional, Linear and Lateral strategies provide a conceptual model for cleansing the channel as well as a larger narrative, the new buffer needs to mitigate several different edge conditions (as analyzed in the geographical analysis).

The question of how an integrated, ecological based design approach could take place at a local level was addressed taking into consideration eleven transects. These eleven transects encompassed the range of edge conditions along the channel.

The treatment of these transects is shown in the sections following this page.

Fig 4.10: PLAN SHOWING DESIGNED TRANSECTS

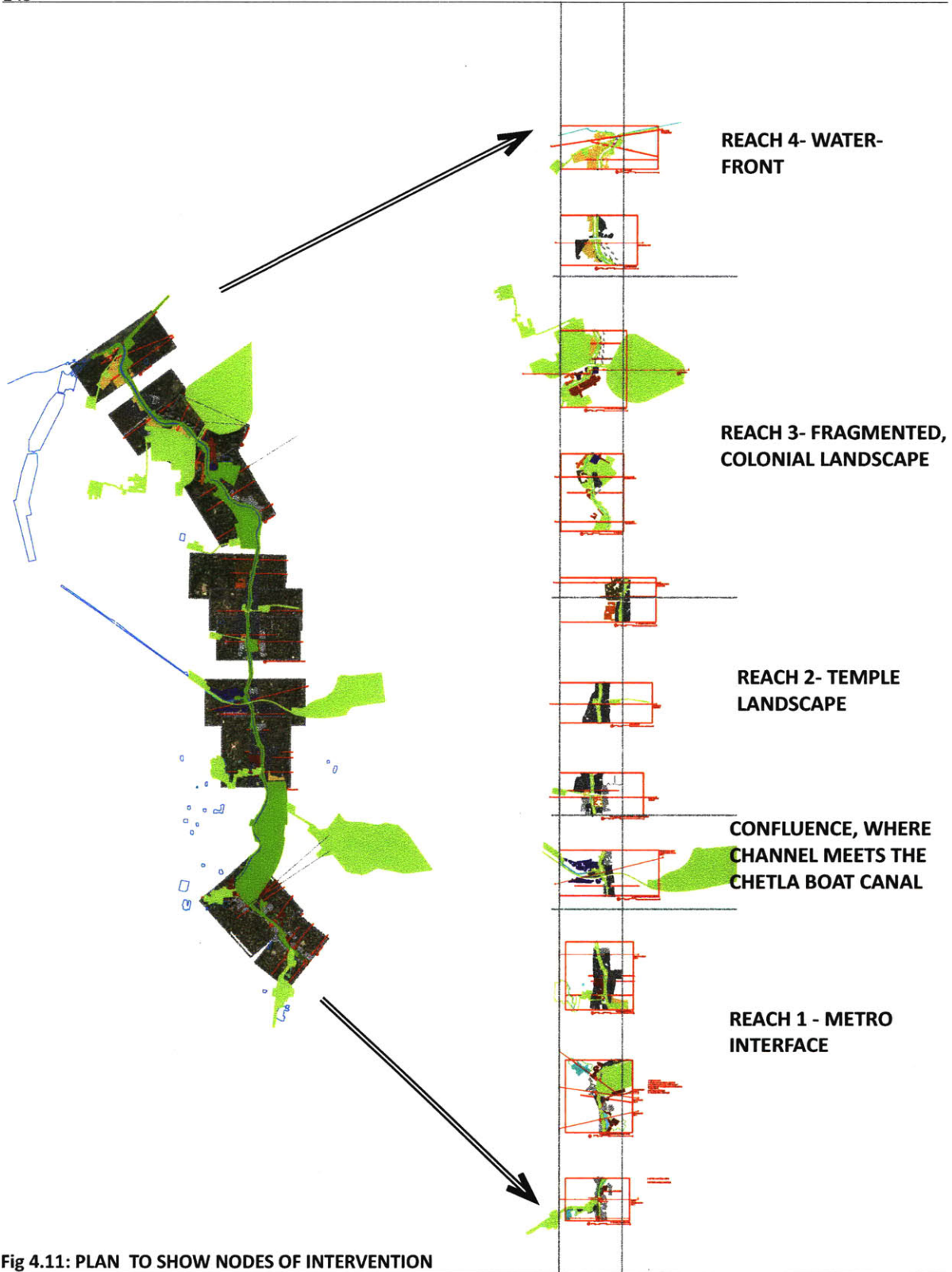


Fig 4.11: PLAN TO SHOW NODES OF INTERVENTION

### 1. METRO SECTION

In the construction of a new narrative for the channel, the metro station is considered as an asset that brings people to the Adi Ganga. the vertical difference is bridged using stairs.



The section marks the starting point of the new pilgrimage upstream. (section alongside)

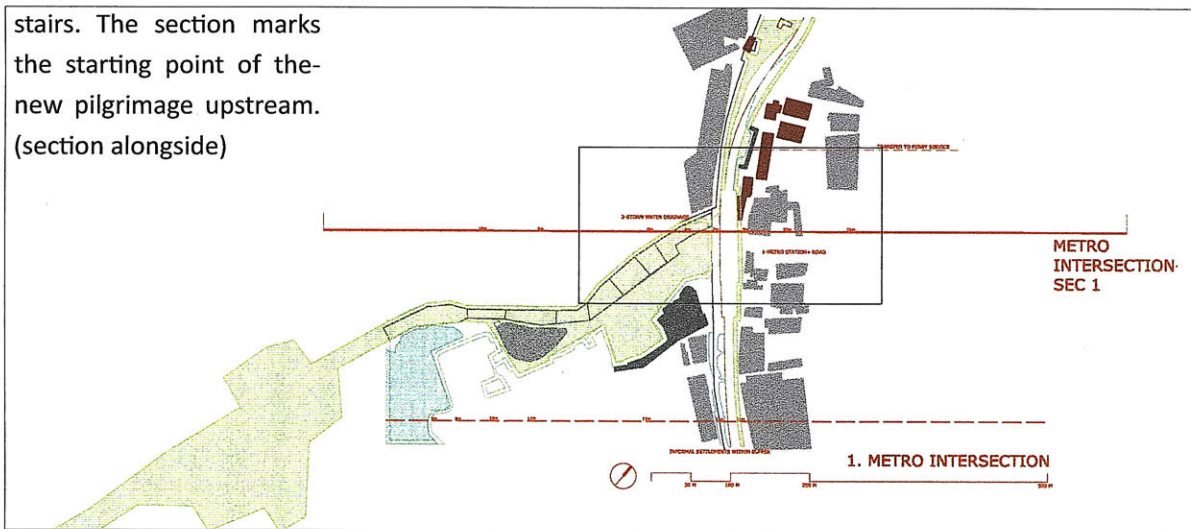
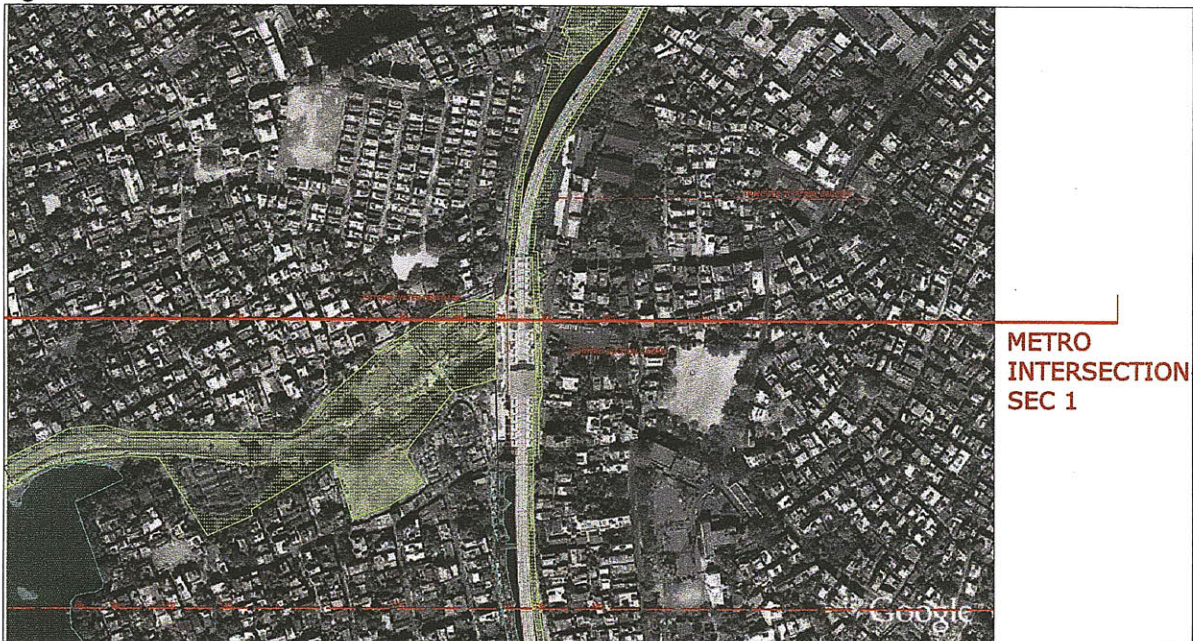


Fig 4.12: MAPS OF TRANSECT 1



### 1. TRANSFORMED METRO SECTION

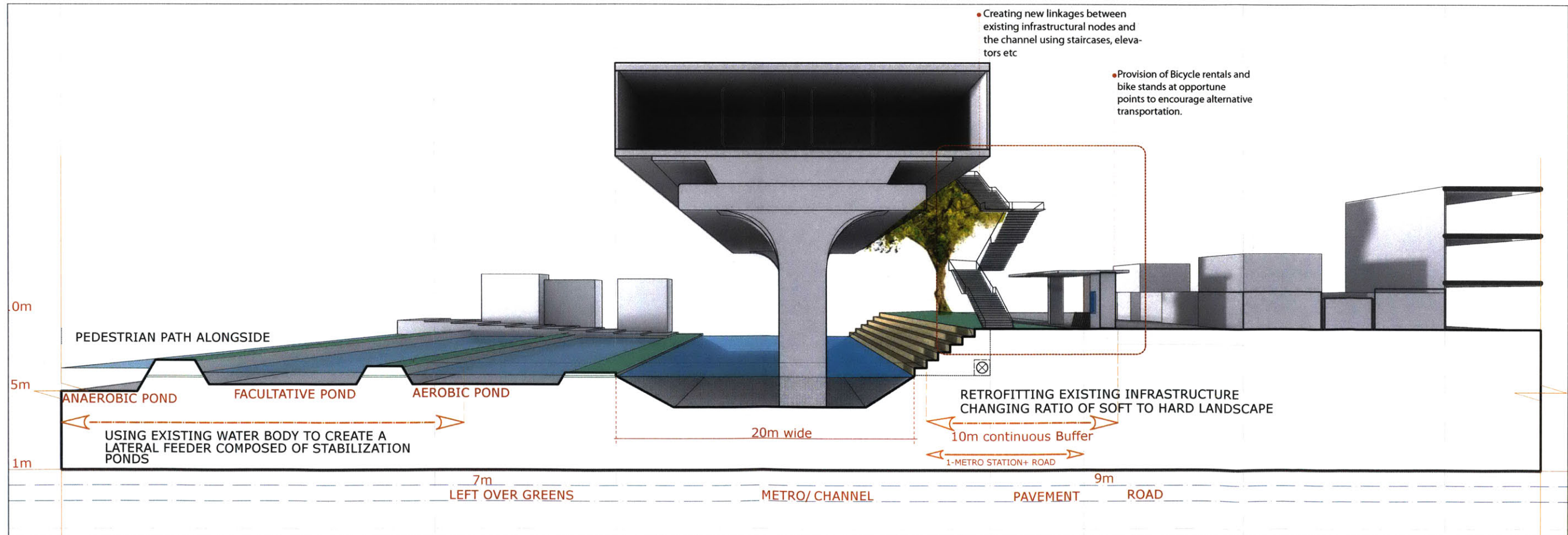
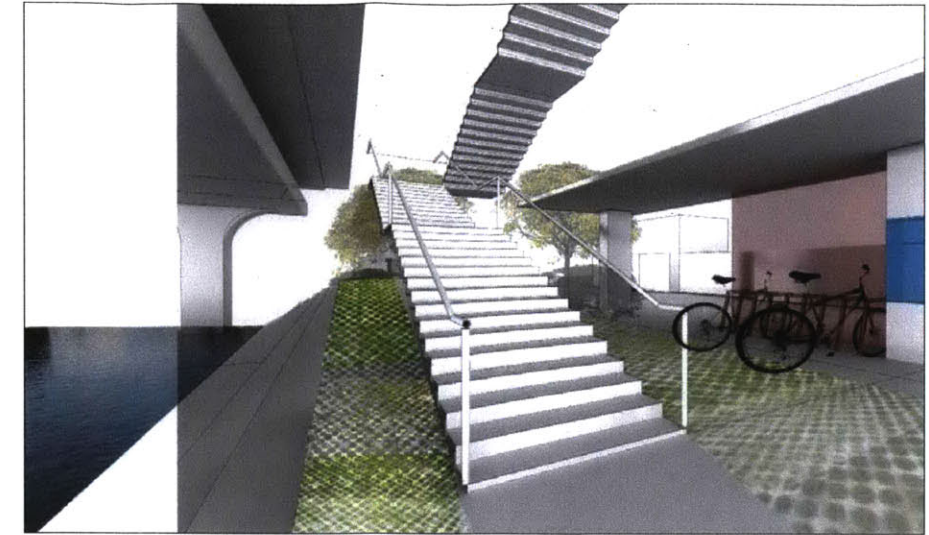


Fig 4.13:METRO SEC 1

**1. TRANSFORMED METRO SECTION**

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## 2. TOLLYGUNGE (MN GHOSH ROAD)

The 3 sections alongside show the various edge conditions looked at and designed in this transect, they were:

- 1. Industrial edges
- 2. Edges with formal housing
- 3. Commercial edges
- 4. Edge conditions with exclusive open spaces

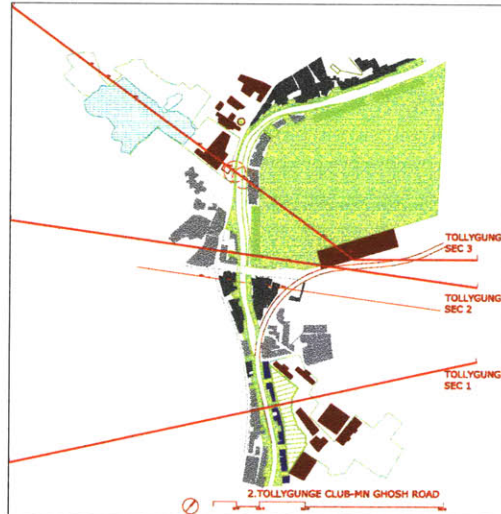
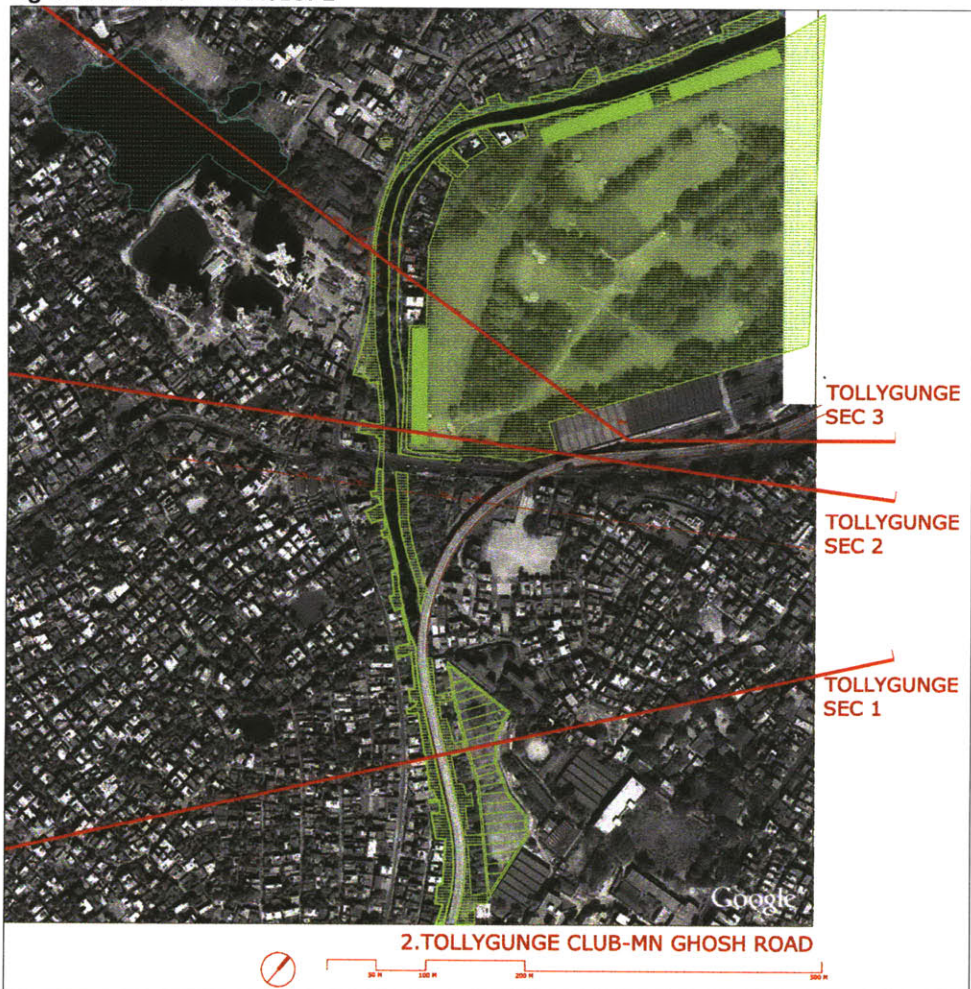


Fig 4.14: MAPS OF TRANSECT 2



2. TRANSFORMED TOLLYGUNGE SECTION 1

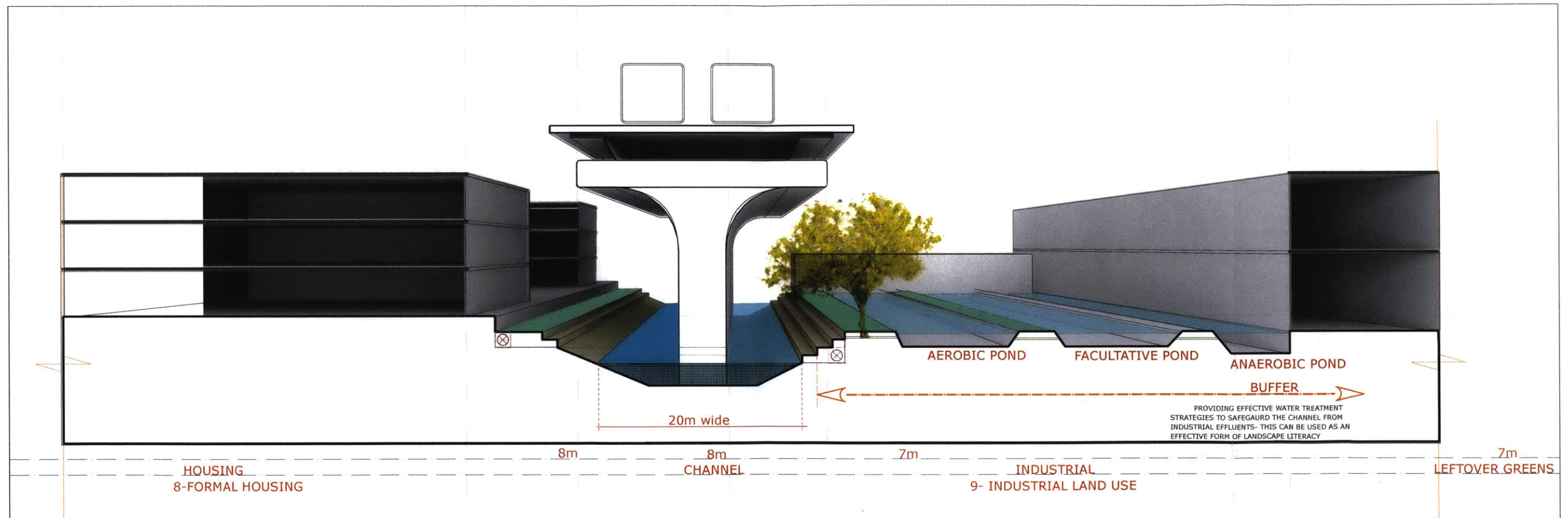


Fig 4.15:TOLLYGUNGE SEC 1

## **2. TRANSFORMED TOLLYGUNGE SECTION**



## 2. TRANSFORMED TOLLYGUNGE SECTION 2

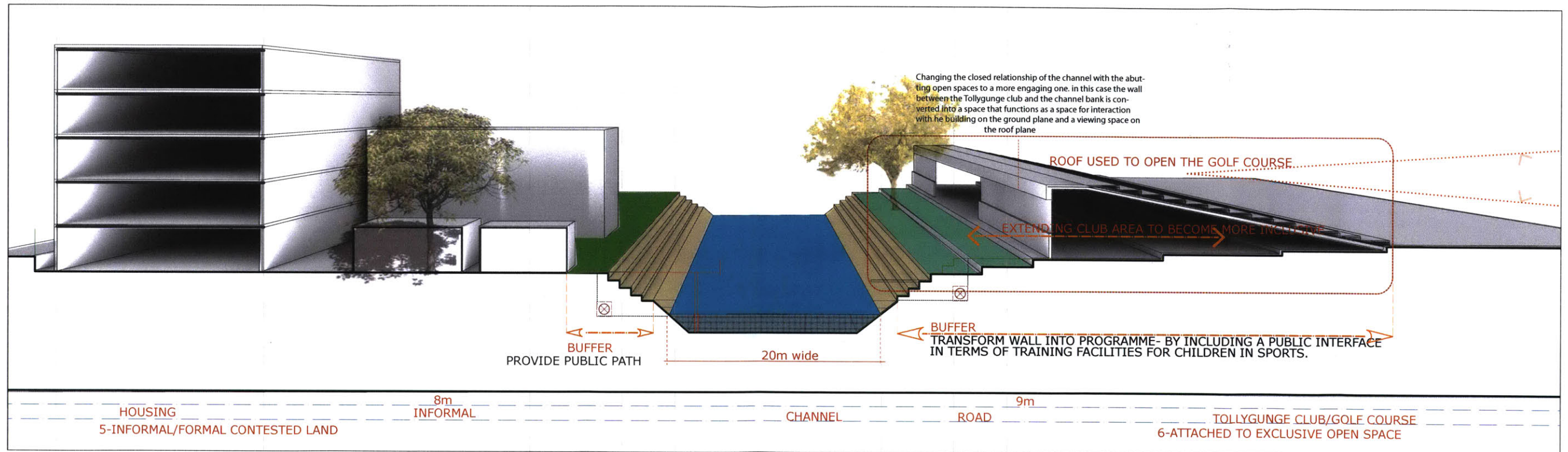


Fig 4.16:TOLLYGUNGE SEC 2

### 2. TRANSFORMED TOLLYGUNGE SECTION 3

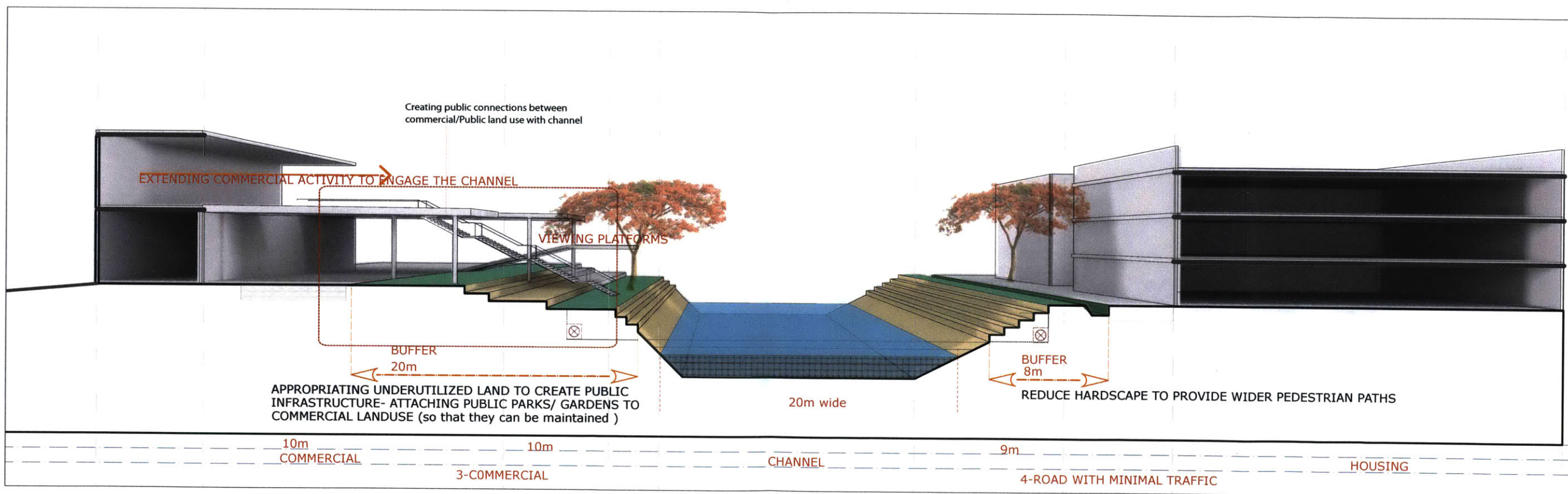


Fig 4.17:TOLLYGUNGE SEC 2

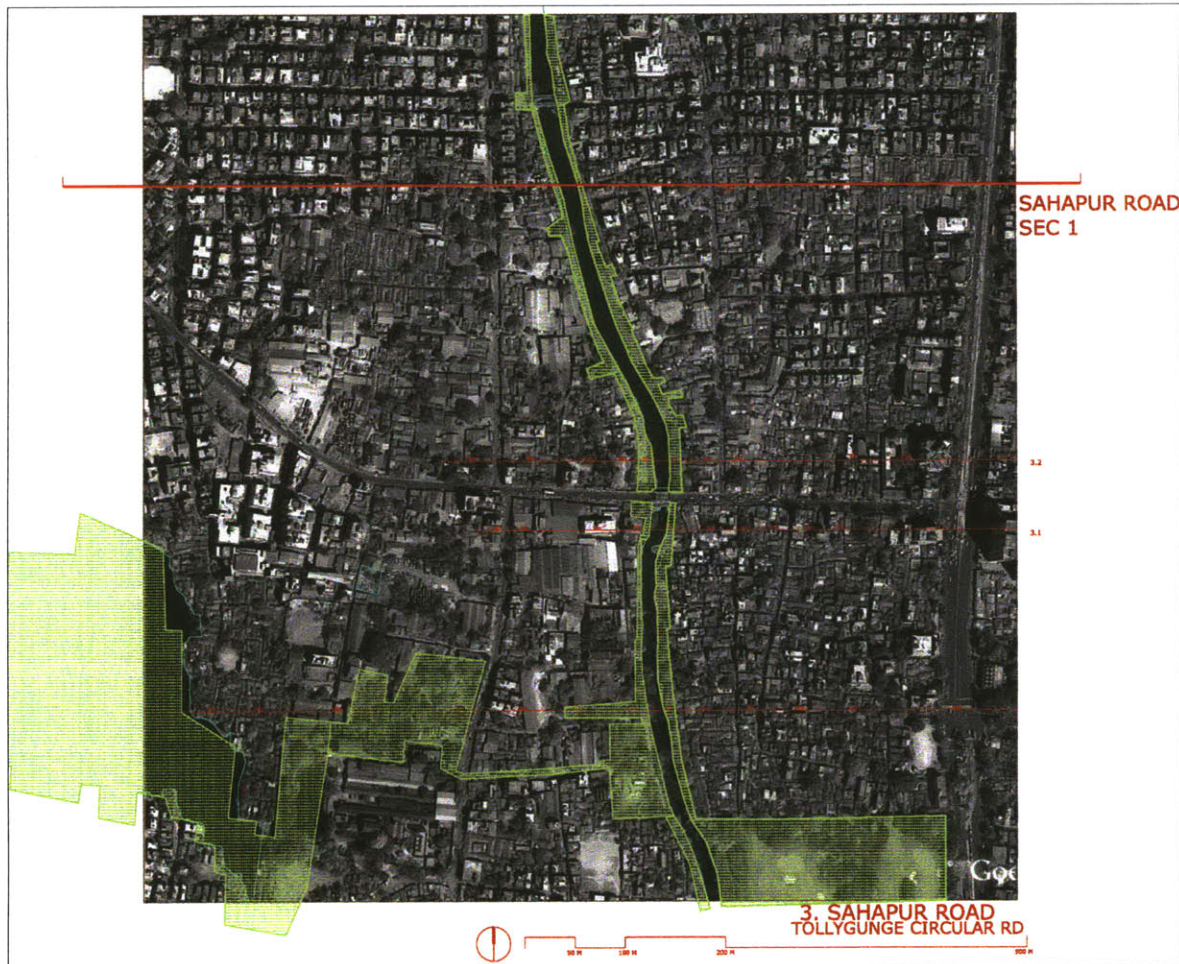


### 3. SAHAPUR ROAD

The section across Sahapur road shows the proposed treatment of informal settlements along the channel- by providing basic sanitation (using pit latrines) and infrastructure to enable a commercial exchange between the visitor and the inhabitants of these informal settlements.



Fig 4.18: MAPS OF TRANSECT 3





### 3. TRANSFORMED SAHAPUR ROAD

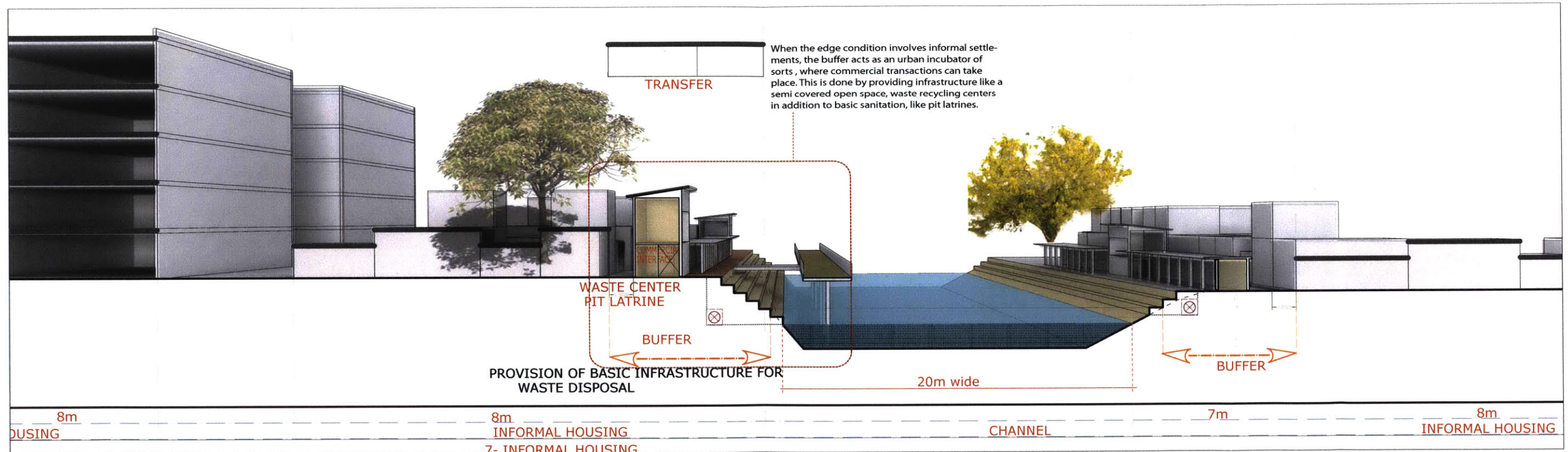


Fig 4.19:SAHAPUR ROAD SEC

### **3. TRANSFORMED SAHAPUR ROAD**

### 4. SECTION WHERE CHANNEL MEETS CHETLA BOAT CANAL

The section on account of being a point of transition, as the visitor or pilgrim moves from the first reach to the temple landscape of Kalighat, and due to the availability of space, is ideal as an ecological park where one can witness how waste- water is treated.

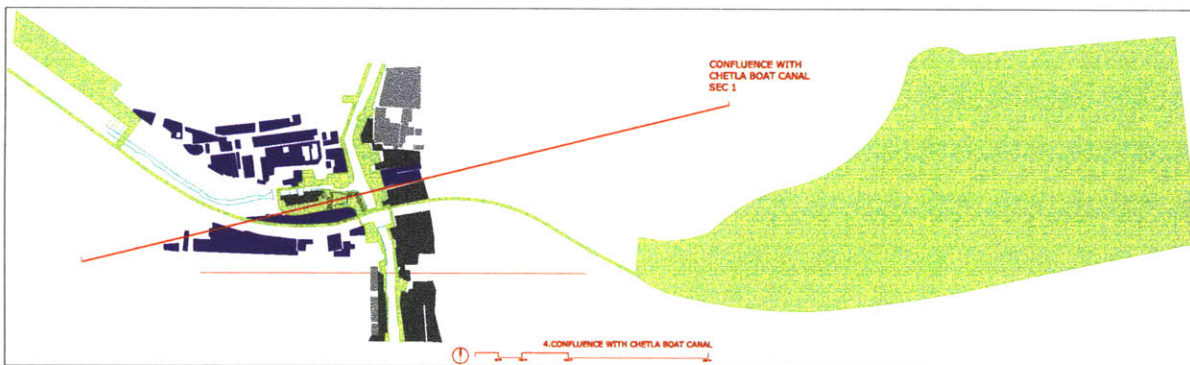
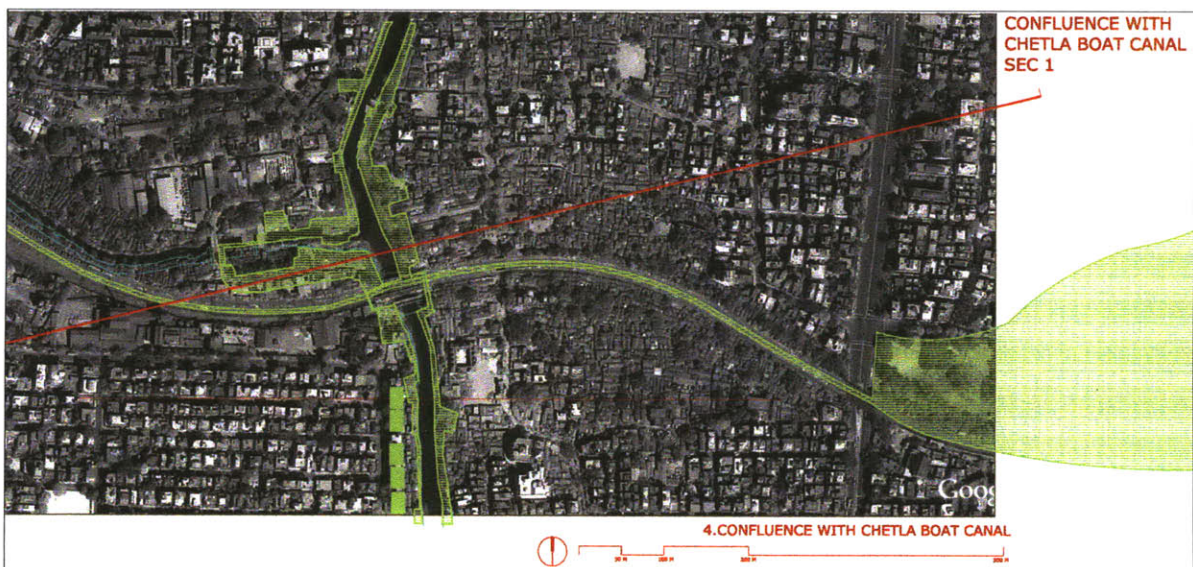


Fig 4.20: MAPS OF TRANSECT 4



### 4. TRANSFORMED SECTION

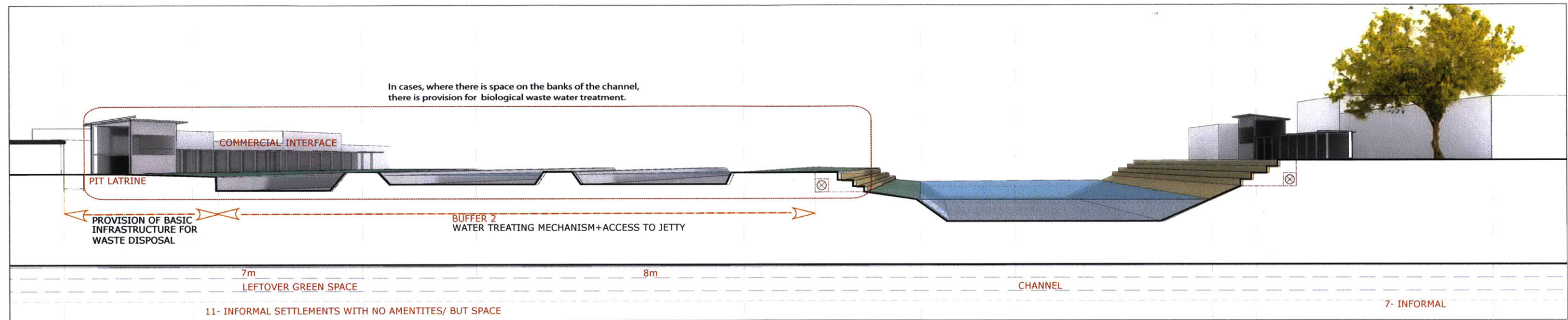


Fig 4.20: CONFLUENCE WITH CHETLA BOAT CANAL

#### **4. TRANSFORMED SECTION**

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### 5. RASH BEHARI AVENUE

This section is the starting point of the journey into the religious landscape, marked with many temples, The edge of the channel adjacent to Keortala Burning ghat (shown alongside) has been treated using a transformed ghat typology, that augments the experience by extruding the ghats in order to slip below the steps new programs.

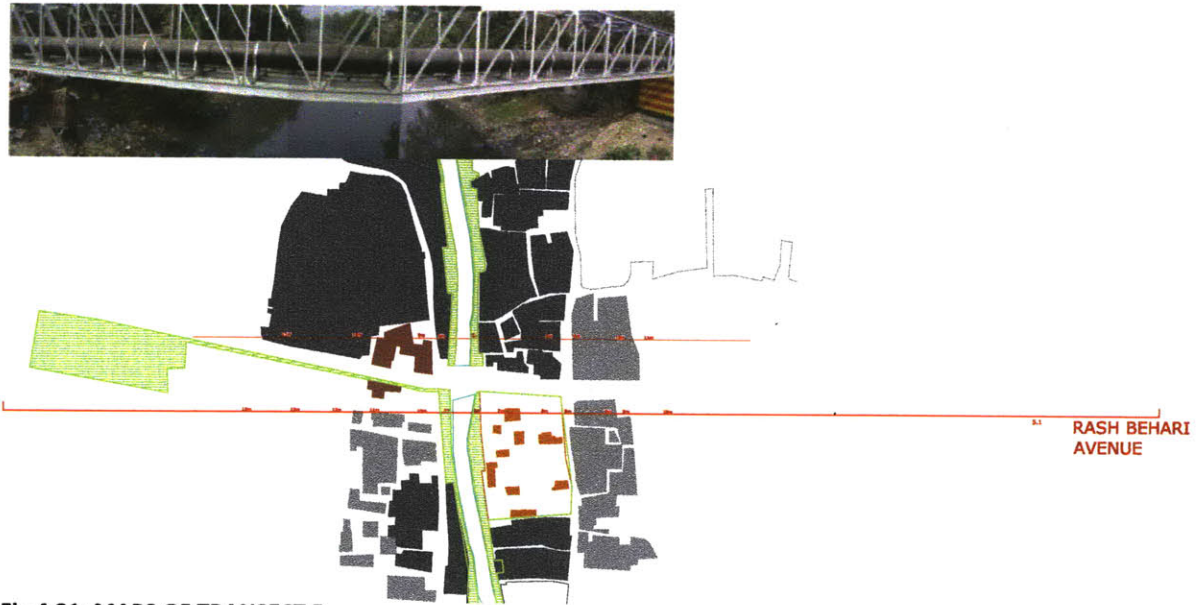


Fig 4.21: MAPS OF TRANSECT 5



### 5. TRANSFORMED RASH BEHARI AVENUE SECTION

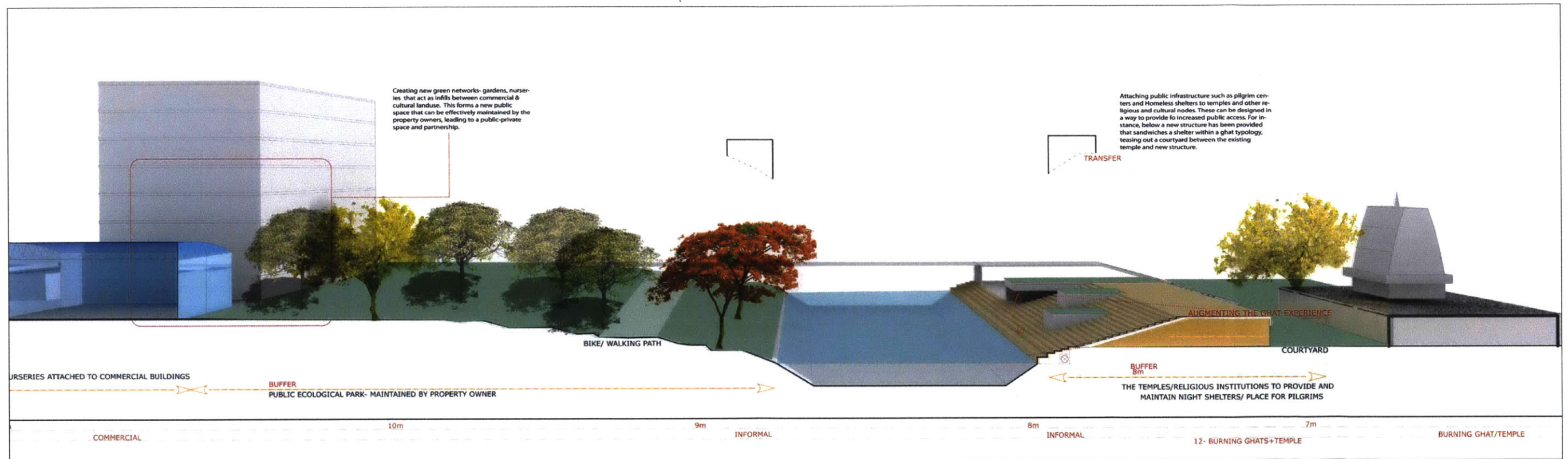


Fig 4.22: RASH BEHARI AVENUE SECTION

## **5. TRANSFORMED RASH BEHARI AVENUE SECTION**



### 6. KALIGHAT

The Adi Ganga near Kalighat is transformed using smaller strategies like providing a pedestrian bridge, waste centers and trees for shade to create new places of rest and movement. On a more urban scale, the temple is connected to the channel.

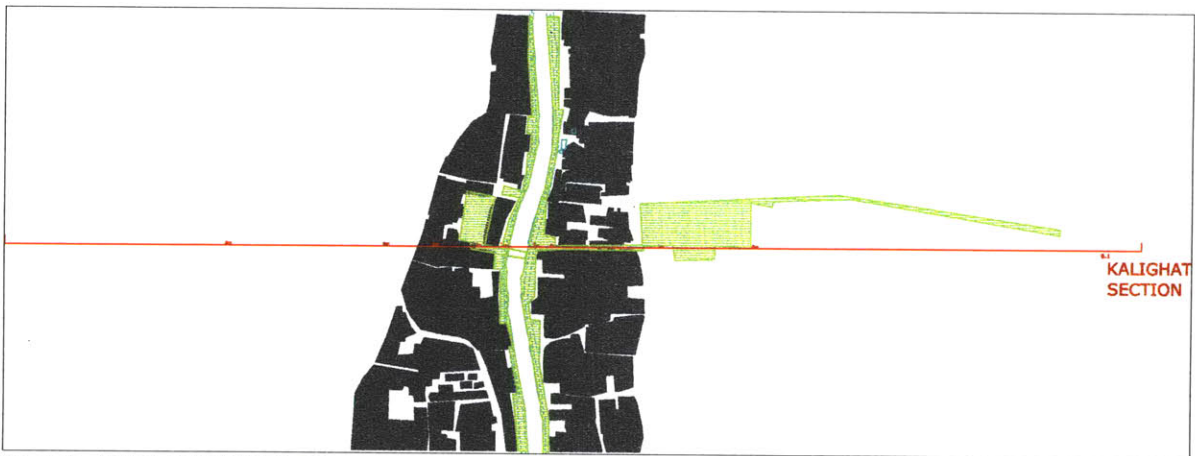
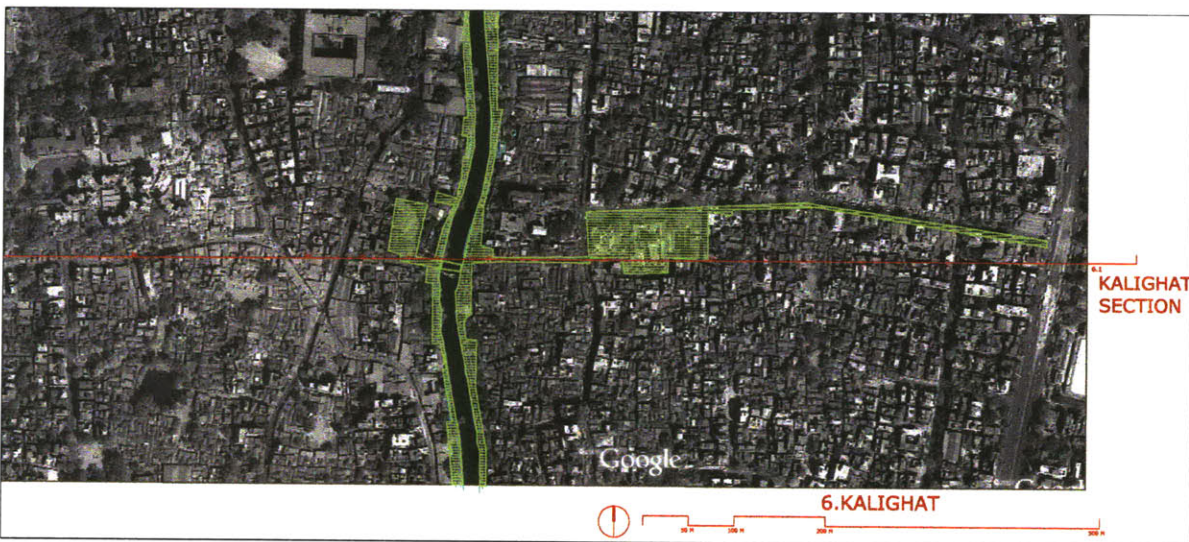


Fig 4.23: MAPS OF TRANSECT 6



### 6. TRANSFORMED KALIGHAT SECTION



Fig 4.24: CONFLUENCE WITH CHETLA BOAT CANAL

## 6. TRANSFORMED KALIGHAT SECTION

### 7. JUDGES COURT ROAD



The section shown alongside, shows the Alipore prison. The strategy is to change the barren nature of the prison landscape to a more ecological one of water collecting and storage. Moreover , the publicness of the edge is maintained using walkways as shown.

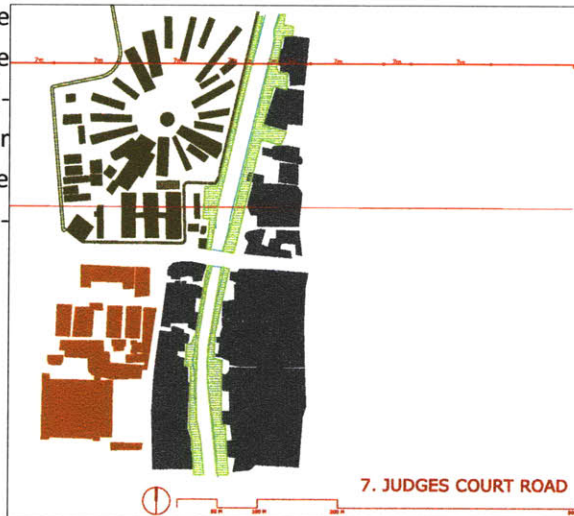
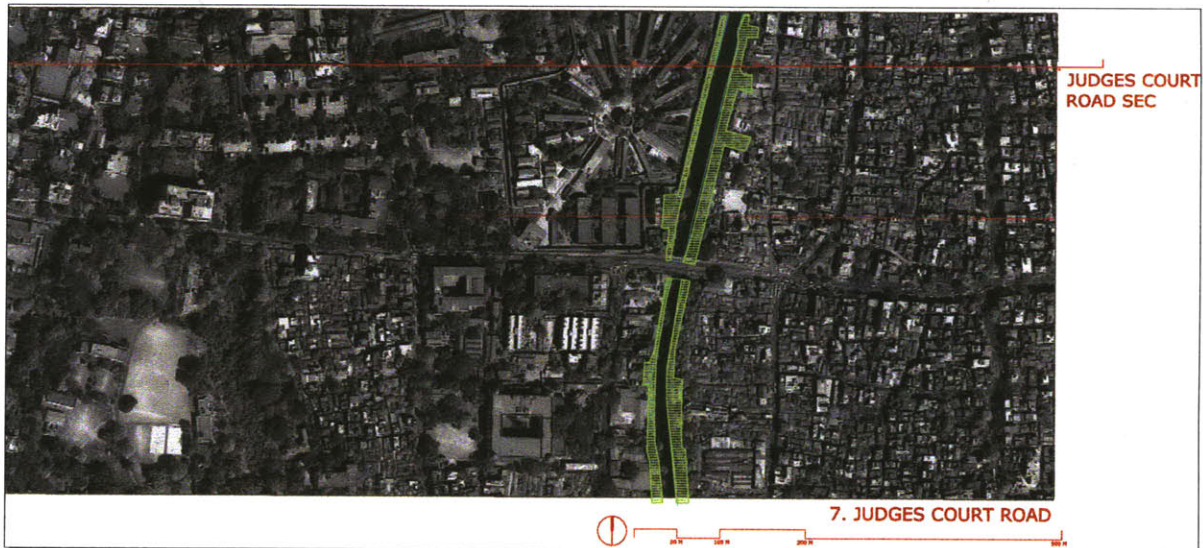


Fig 4.25: MAPS OF TRANSECT 7



7. TRANSFORMED SECTION- Judges Court road

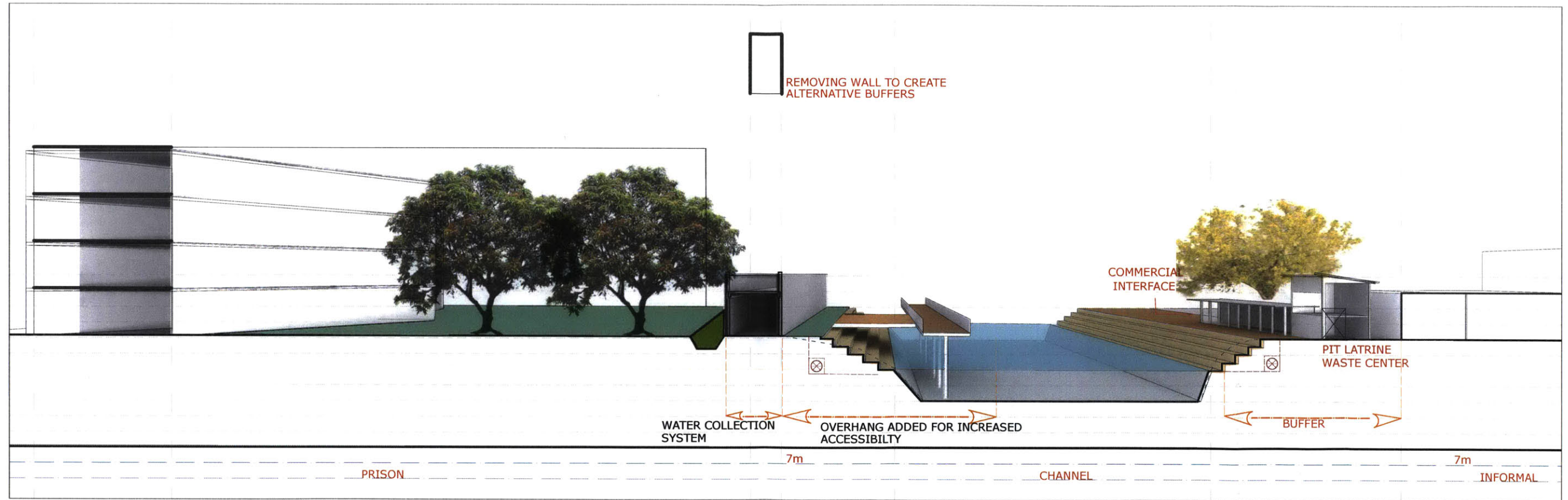


Fig 4.26: SECTION AT JUDGES COURT ROAD

## 7. TRANSFORMED SECTION

### 8. ALIPORE

The two sections alongside deal with different conditions

- 1. Section 1 shows a new public park in the place of the large unused area in Alipore.
- 2. section 2 shows how the cemetery has been woven within the new buffer. The ghat typology here transcends religious boundaries.

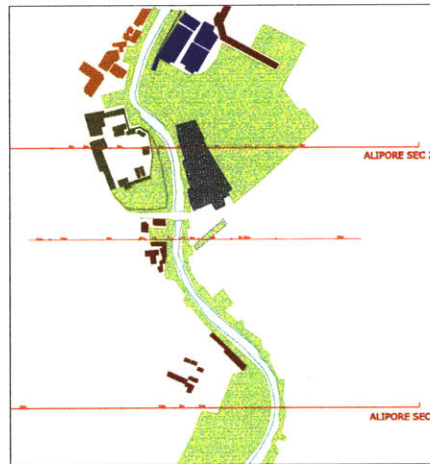
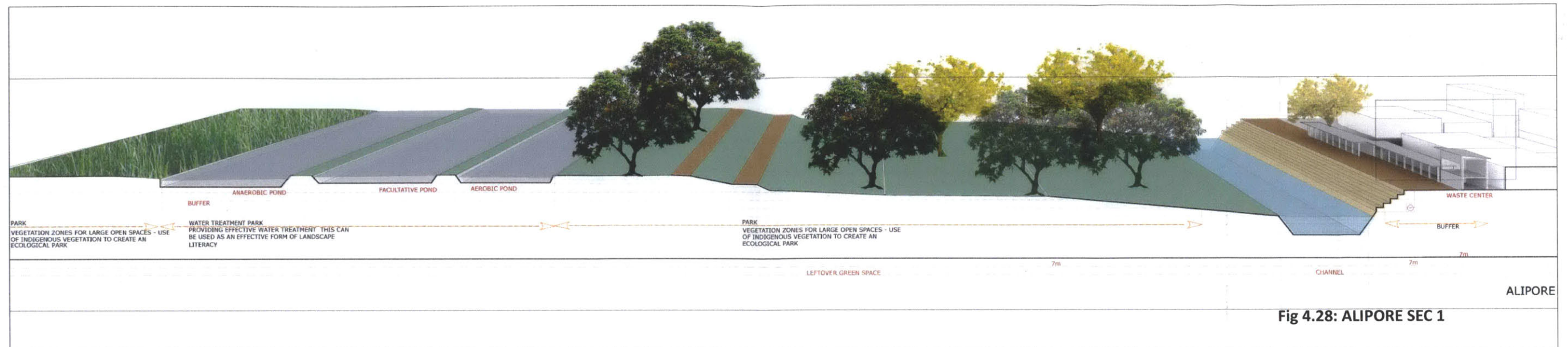


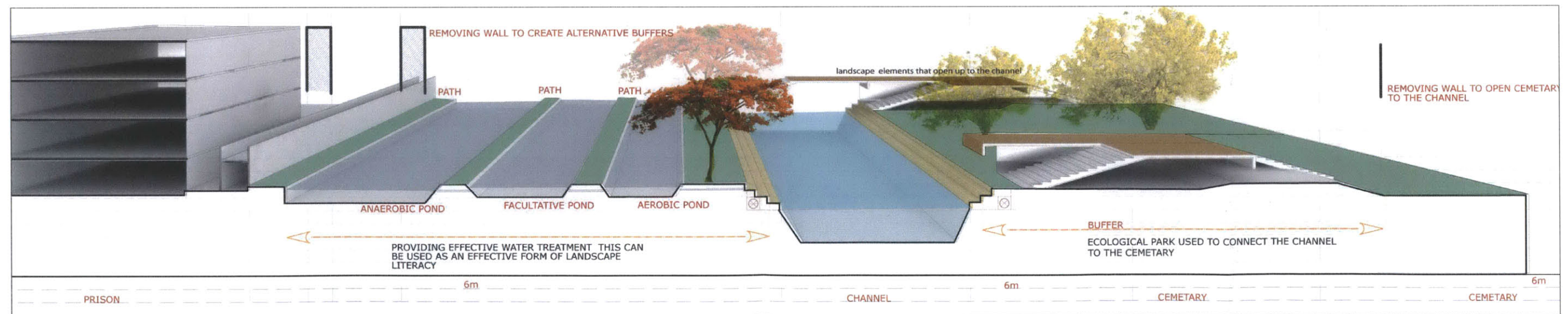
Fig 4.27: MAPS OF TRANSECT 8



### 8. TRANSFORMED ALIPORE SECTION 1



### 8. TRANSFORMED ALIPORE SECTION 2





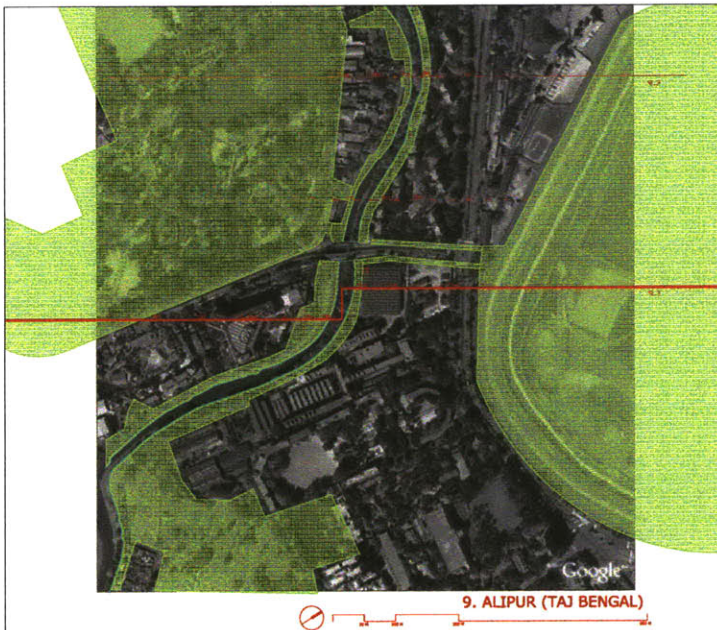
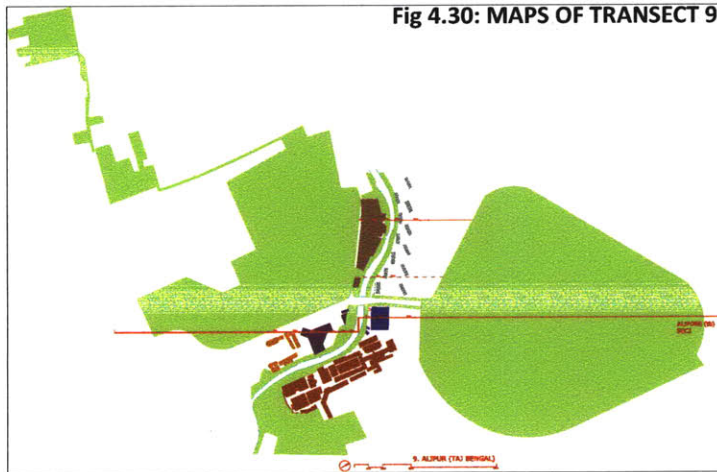
## **8. TRANSFORMED ALIPORE SECTION**

### 9. ALIPORE NEAR TAJ BENGAL

The transect at Alipore cuts across the very exclusive high end hotel complex of Taj bengal and informal settlements at the other end. The image of the hotel is used to create a new horticultural garden that can be maintained by the hotel.



Fig 4.30: MAPS OF TRANSECT 9



### 9. TRANSFORMED SECTION- Alipore (Taj bengal)

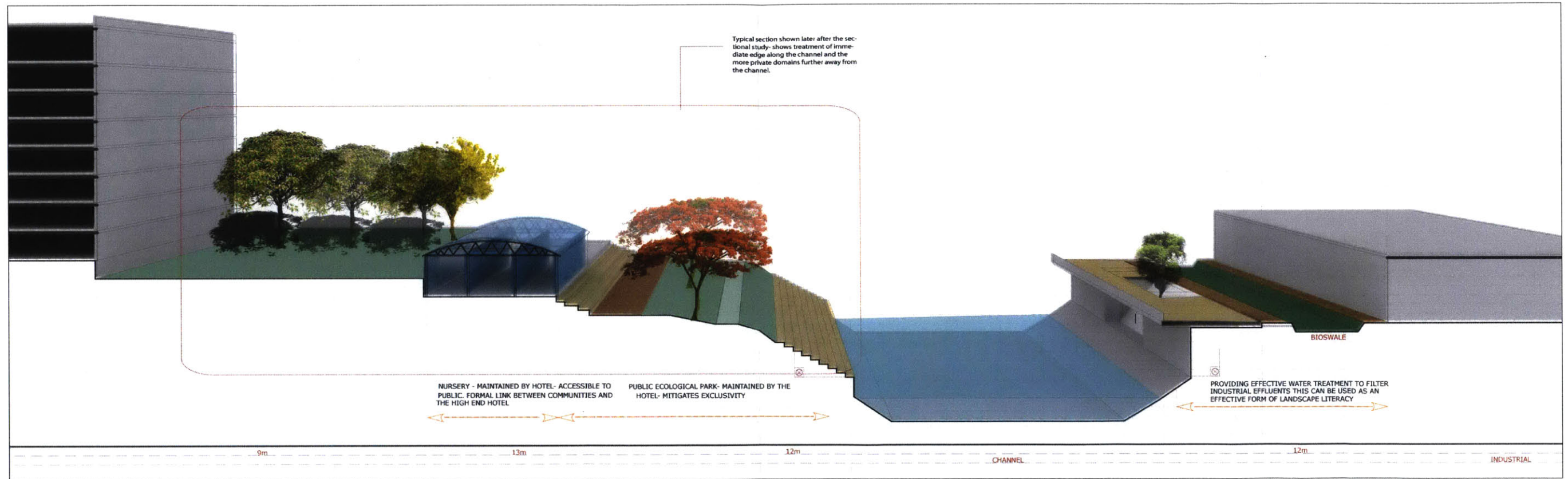


Fig 4.31: SECTION THROUGH TAJ BENGAL

## 9. TRANSFORMED SECTION

### 10. KHIDIRORE

Here, the high rise residential development become part of the linear landscaped corridor; as do the informal markets.



Fig 4.32: MAP & IMAGE OF TRANSECT 10



9. TRANSFORMED SECTION- KHIDIRPORE

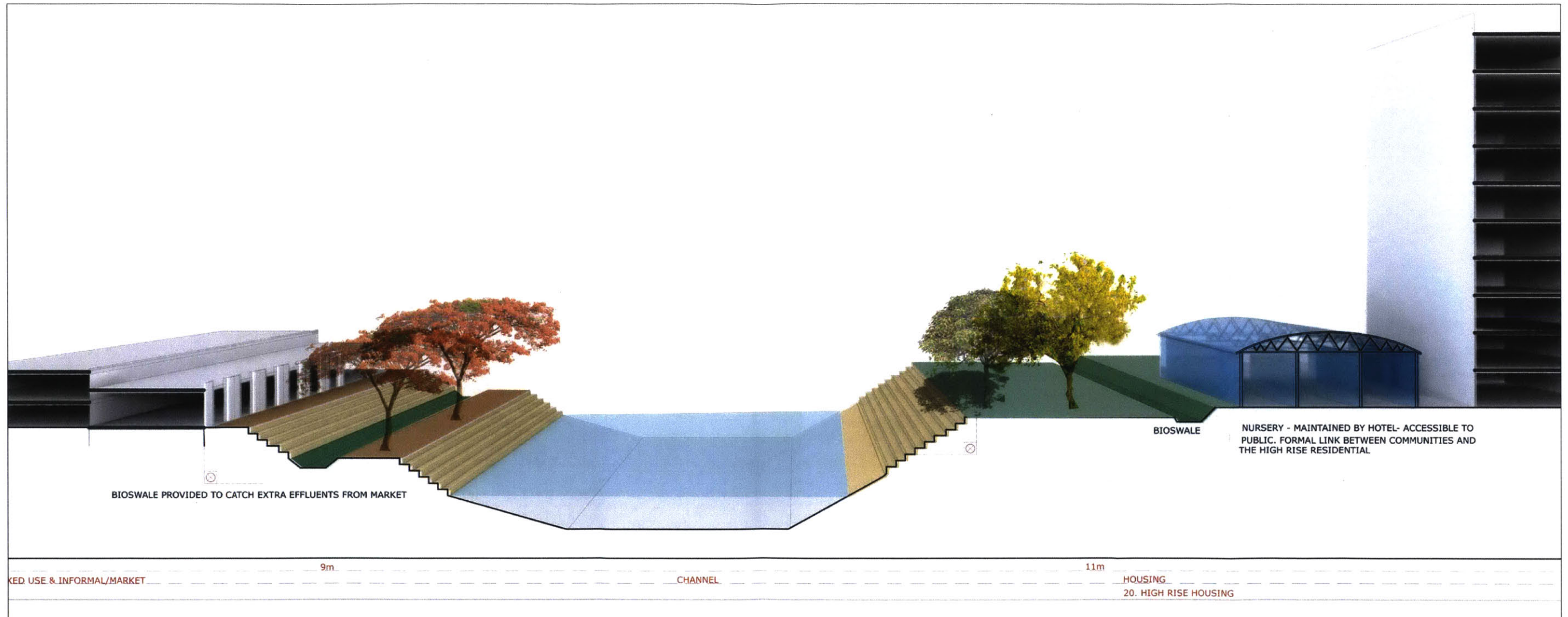


Fig 4.33: SECTION AT KHIDDERPORE

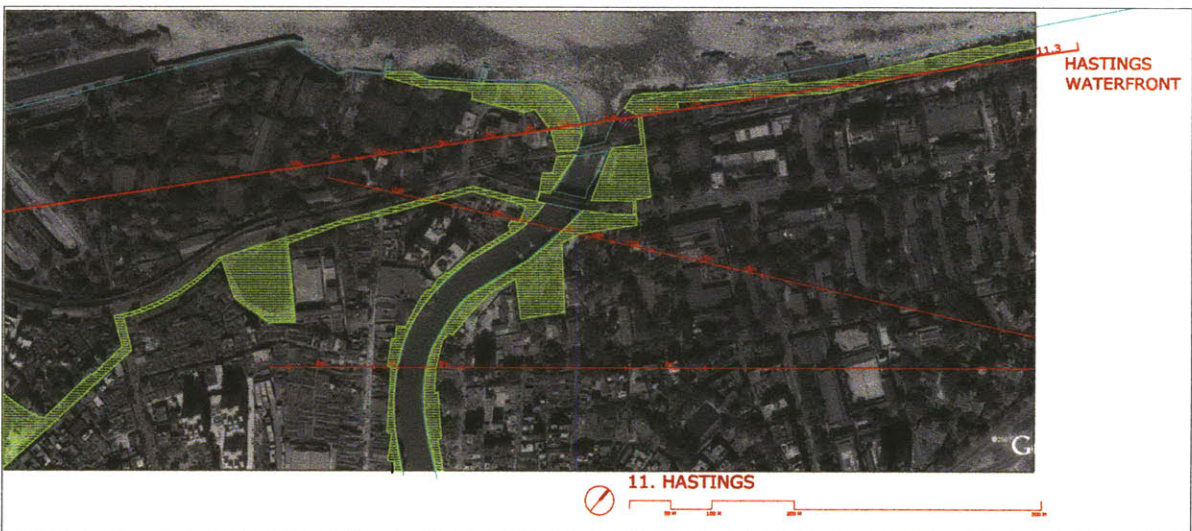
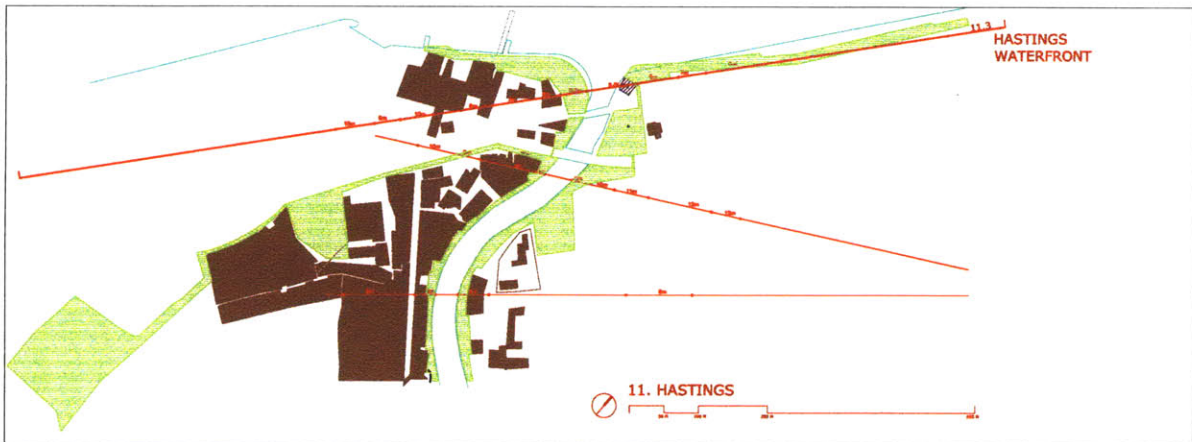
## 10. TRANSFORMED SECTION

### 10. HASTINGS

Hastings marks the point where the channel meets the Hughli. It signifies the end to the narrative. Here, a new walkway carries one beyond the edge of the banks, where the two waters, of the river and the channel merge.



Fig 4.34: MAP & IMAGE OF TRANSECT 11





11. TRANSFORMED SECTION- EXTENDING THE ADI GANGA.....

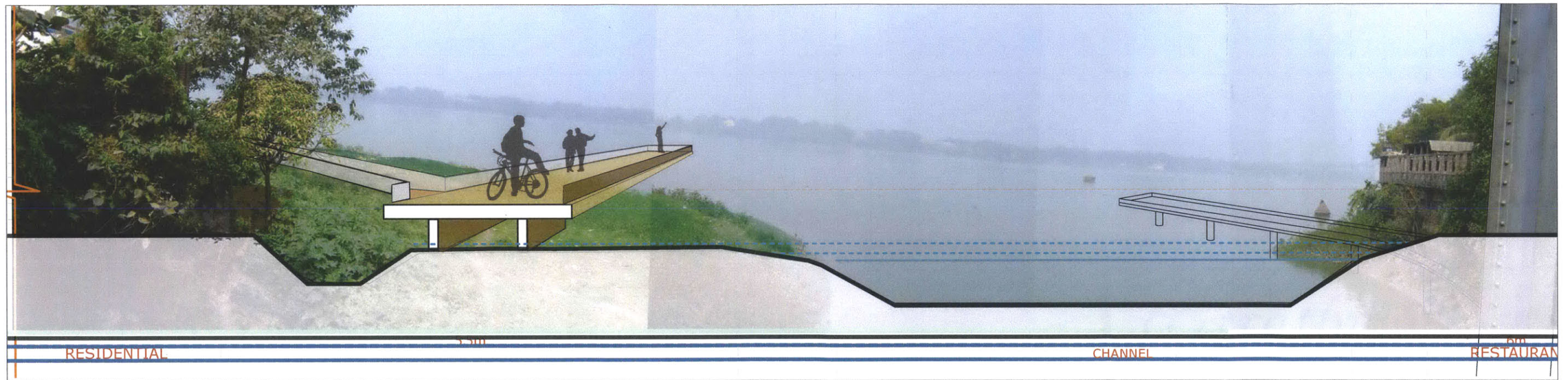


Fig 4.35: SECTION AT HASTINGS WATERFRONT

## **11. TRANSFORMED SECTION**



TYPICAL LANDSCAPE TREATMENT

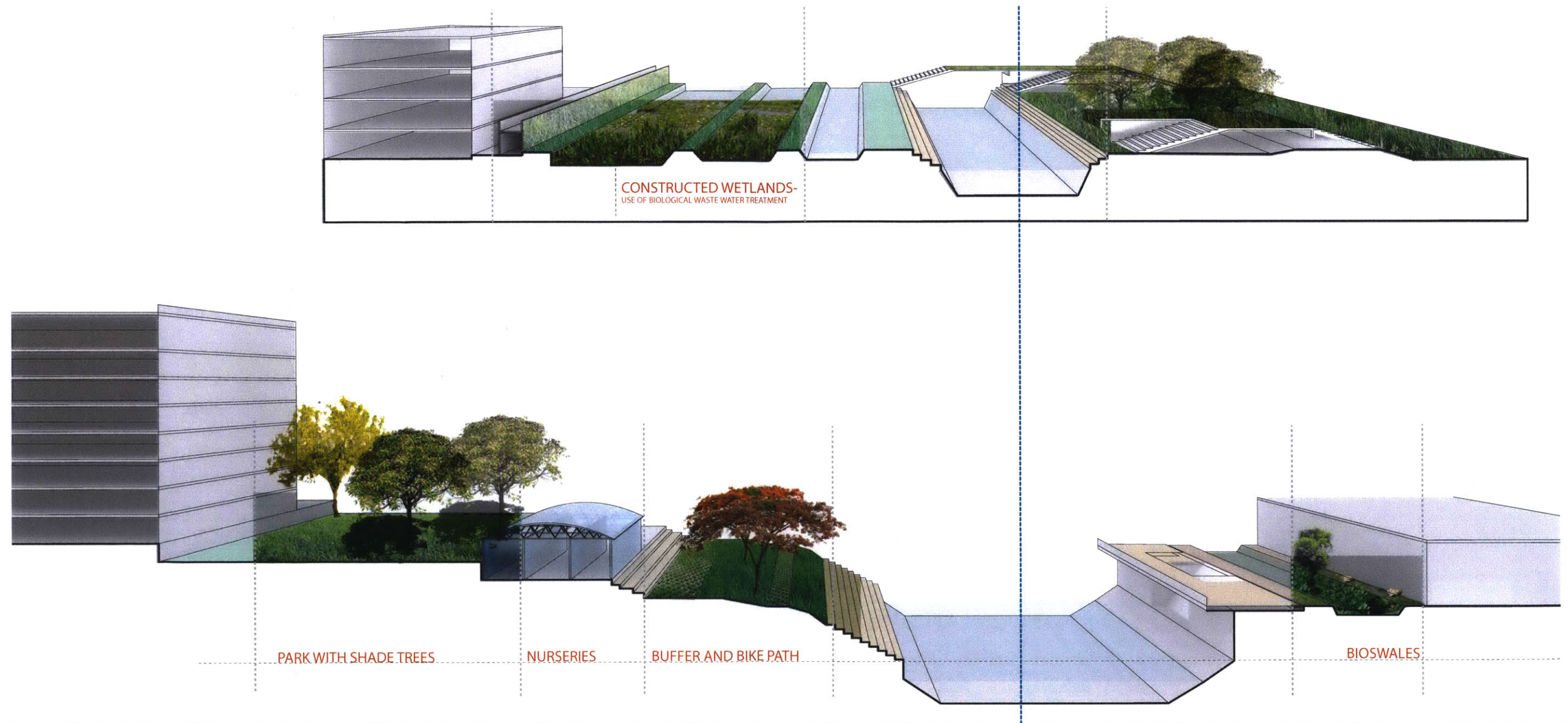


Fig 4.36: SECTIONS TO SHOW LANDSCAPE TREATMENT OF TYPICAL SECTIONS

**CONCLUSIONS:**

In *River of Love, In an Age of Pollution*, Haberman states:

Yamuna today is both a river of delights and a river of troubles...She is concurrently a goddess and a (now polluted) river. She has an infinite side and a finite side, what one devotee called her "supernatural side" and her "natural side," and another her "inner face" and her "outer face". Thus she is simultaneously unmanifest and manifest, powerful and vulnerable, big and small.....

The environmental activist as karma yogi must in effect learn to see everything in the world concurrently with two very different eyes: one trained on the finite and one on the infinite. The eye trained on the finite is the eye of compassion. It focuses on the small, the fragile, the ever-changing tangible. From the perspective of this eye, the Yamuna is in trouble, she is polluted, unhealthy and pleading our help.

The eye trained on the infinite is also the eye of knowledge. It focuses on the big, the indestructible, the eternal world beyond immediate manifestations. This is the transcendent dimension of divinity that is beyond the contingency of everyday life. It involves a humble recognition of the majestic power of the goddess as the very source of life. Within the perspective of this eye, time is vast. Yamuna cannot be polluted indefinitely and will flow on into the future with or without human presence on the planet" <sup>1</sup>

In recognizing the two eyes, one that focuses on the finite and the other infinite, Haberman states that the key to the saving of the Yamuna is in keeping a balance between the two worlds. In a related, yet still somewhat different way, this thesis has sought to see with two eyes, one focused on the tangible and the other on the intangible qualities of the Adi Ganga channel in Kolkata.

As with the environmental activist, the urbanist too must see the polarities - structure and meaning, the quantifiable and the non-quantifiable. In doing so the urbanist's role becomes that of a choreographer, who must maintain a dynamic balance and an equi-poise, who must orchestrate everyday city functionality with a human meaning

The thesis attempts not only to recognize the importance of the intangibles associated with the Adi Ganga but also focuses on the tangible significance of its role in today's Calcutta. The proposal stresses on recalibrating the balance between the finite and infinite, the tangible and the intangible. It attempts to restore the channel, long buried in a burdensome memory and a dysfunctional present, to its original role in both people's imagination and in their everyday life.

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### **The Balancing Act – An Outline for Change**

The Adi Ganga, in this “Age of Pollution”, faces issues of “Profanity” (as discussed in the early sections)- of pollutants, neglect and, poverty. These issues need to be dealt with in the background of its intrinsic “Sacredness”. In a dance of balance and poise, meaning needs to be leveraged for material improvements.

The strategy proposed in this thesis, recognizes this fact, and uses the religious landscape for gaining social and ecological advantage.

In the sectional designs presented, new urban components plug into existing commercial, cultural and religious land-uses, creating spaces that benefit the public, pilgrims and the city.

The sections are so designed as to create symbiotic and mutually beneficial relationships between the abutter and the physical channel. The strategies create potential spaces of economic opportunity - for shops and artisans, as well as green infrastructure amenities for local residents, pilgrims, and, eventually, tourists.

The ghats and the designed riparian flood plain become urban components of the strategy and are used to enhance these symbiotic relationship.

While the regional, linear and lateral designs seek to provide the channel with access, legibility, identity, and structure; the sectional interventions help increase the meaning and image of the channel depending on the edge condition. The consistency of the buffer is nuanced by the change in the treatment of the edge condition.

Through these interventions, the channel seeks to gradually assume increasing significance in the everyday fabric of city life. Although links are re-established between the channel and the city, the channel remains temporarily cut-off from the larger sewage and drainage system of the city, giving the it time essential to incubate and recharge itself. With the exception of the interceptor sewer, the strategy works autonomously using localized small-scale interventions, instead of city-wide interventions. This is based on the premise that small-scale interventions will serve to create a ripple effect and bringing significant changes on larger zonal and city scale.

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In summary, the thesis looked at the history of the channel to ascertain reasons for the decline of channel to its present state of neglect and decay. The historical analysis revealed how the channel had cut-off from its larger setting. Moreover, it showed how there has been a shift in the manner in which the Adi Ganga and other water channels have been perceived and identified over time. History also revealed the inherent dichotomies of the channel: the sacred versus the profane, the continuous versus the fragmented and the natural versus the artificial.

The geographical analysis qualified these oppositions in a very tangible way - the sacred temples co-exist with the polluted river, the continuity of the channel was maintained in a fragmented setting and a historically natural landscape exists in a constructed and congested urban setting. The channel, nevertheless, continues to flow ignored seemingly defying time and logic.

The proposal attempts to transform the dichotomies of Sacred vs. Profane; Continuous vs. Fragmented; and Natural vs. Artificial into creative conjunctions of Sacred AND Profane; Continuous as well as Fragmented; and Natural YET Artificial – to return it to its original pre-eminence as an integral and valued part of present day life and seeks to perceive the channel as a plain where these identities can co-exist and yield new definitions.

This attempt, if successfully nurtured, could be particularly advantageous in the urban landscape of India where several holy rivers have turned into unholy drains. It could be applied to other channels and provide a framework of analysis – that identifies where the channel can be reconnected. Moreover, in the absence of effective governance and astute policies, these strategies and methods illustrate how channels can be treated on a urban scale without region wide or policy- heavy interventions.

#### END NOTES

1. David Haberman, *River of love in an Age of Pollution* (Los Angeles: University of California Press, 2006),

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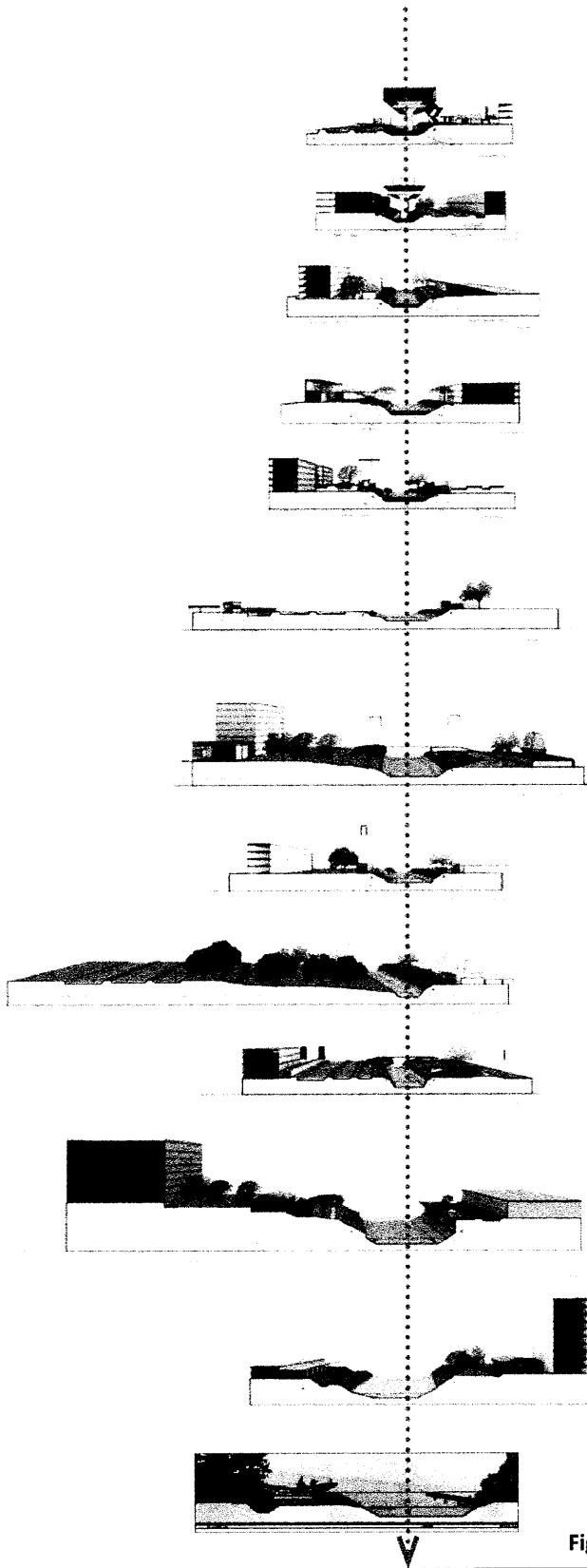


Fig 4.35: TRANSFORMED CHANNEL

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## BIBLIOGRAPHY

- Alley, Kelly. *On the banks of the Ganga: when wastewater meets a sacred river*. Ann Arbor: University of Michigan Press, 2002.
- Bandyopadhyay, Sunando. "Location of Adi Ganga Palaeochannel, South 24-Parganas, West Bengal." *Geographical Review of India*, 1996: 93-109.
- Bannerjee, Samik. *Calcutta 200 years: a Tollygunge Club perspective*. Calcutta: The Club, 1981.
- Bayly, C. A. *Indian Society and the Making of the British Empire*. Cambridge: Cambridge University Press, 1988.
- Bhattacharya, Durgaprasad. "Calcutta: Misconceived Tercentenary." *Economic & Political Weekly*, Vol. 25, No. 37, 1990: 2041-2042.
- Biswas, Ranjan. *Rivers of Bengal: A Compilation*. Kolkata: West Bengal District Gazetteers, Higher Education Dept., Govt. of West Bengal, 2002.
- Bose, P. C. "Calcutta Sewage and Fish Culture." 1944. 443-454.
- Bose, Shivashish. *Adaptive and Integrated Management of Wastewater and Storm water Drainage in Kolkata*. paper, Kolkata: Jadavpur University, 2007.
- Cederlöf, Gunnel. "Fixed boundaries, fluid landscapes." *The Indian Economic and Social History Review*, 2009: 514-540.
- Chakraborty, Satyesh C. "The Story of a River Port." *Kolkata Port trust Anniversary*. Kolkata: IIM, Calcutta, 2004. 1-12.
- Chandra, Satish. *Historiography, religion, and state in medieval India*. New Delhi: Har-Anand Publications, 1996.
- Chattaraj, Shahana. *Eviction or Inclusion? The politics of Resettlement in Calcutta's Squatter Settlements*. Cambridge: Massachusetts institute of Technology, 2000.
- Chattopadhyay, Swati. *Representing Calcutta: modernity, nationalism, and the Colonial uncanny*. London: Routledge, 2005.
- Christopher Key Chapple, Mary Evelyn Tucker, ed. *Hinduism and Ecology*. Cambridge: Harvard University Press, 2000.
- Chyutin, Michael, and Bracha Chyutin. *Architecture and utopia : the Israeli experiment*. Aldershot, England ; Burlington, VT : Ashgate Pub., 2007.
- CommonLII. "CommonLII." *Indian Legislation*. [http://www.commonlii.org/in/legis/num\\_act/ra1989121/](http://www.commonlii.org/in/legis/num_act/ra1989121/) (accessed February 6, 2010).
- Cullet, Philippe. "Water Law in India." *IELRC Working Paper*, 2007: 1-20.
-

Dasgupta, Keya. *Genesis of a Neighborhood The mapping of Bhabanipur*. Occasional Paper, Calcutta: centre for Studies in Social Sciences, 2003.

dasgupta, Keya. *Mapping Calcutta*. Archive Series, Calcutta: Centre for Studies in Social sciences, 2009.

D'Souza, Rohan. "Colonialism, Capitalism and Nature: Debating the Origins of Mahanadi Delta's Hydraulic Crisis." *Economic and Political Weekly*, 2002: 1261-1272.

—. *Drowned and dammed : colonial capitalism, and flood control in eastern India*. New Delhi: Oxford University Press, 2006.

Dutta, Krishna. *Calcutta: a cultural and literary history*. New York: Interlink Books, 2003.

Edwardes, Michael. *The Battle of Plassey and the Conquest of Bengal*. New York: Macmillan, 1963.

"Executive Summary, Master plan for Sewerage and Drainage." Executive Summary, Master plan for Sewerage and Drainage (accessed 04 15, 2010).

Ghosh, Labonita. "Much Battle." *India Today*, October 30, 2000.

Ghosh, Suprekas. "The Urban pattern of Calcutta." *Economic Geography*, 1950.

Group, Nagarik Mancha and Shalti Research. *the city demolished mapping demolitions in kolkata, 1990 onwards...* 5 5, 2010. <http://koldemo.wikidot.com/s-tolly-nullah>.

Guha, Ranajit. *Guha, Ranajit. 1963. A rule of property for Bengal; an essay on the idea of permanent settlement. Le Monde d'outre-mer, passé et présent. 1. sér.: Études, 19. Paris: Mouton. Paris: Mouton, 1963.*

Haan, Arjan De. *Urban Settlers: migrant Workers and Industrial Capitalism in Kolkata*. Cambridge: Cambridge University Press, 1997.

Haberman, David. *River of love in an Age of Pollution*. Los Angeles: University of California Press, 2006.

Hill, Christopher V. "Water and Power: Riparian Legislation and and Agrarian control in Colonial Bengal." *Environmental History Review*, 1990: 1-20.

Holwell, J. Z. *Interesting Historical Events, Relative to the Provinces of Bengal and the Empire of Indostan, pt.3*. London: T Becket and P.A. De Hondt, 1771.

Ilopoulou, Despina. "The Uncertainty of Private Property: Indigenous versus Colonial Law in the Restructuring of Social Relations in British India." *Dialectical Anthropology*, 2001: 65-88.

Iqbal, Dr. Iftekhar. "Towards an Environmental History of Colonial East Bengal: Paradigms and Praxis." *Journal of the Asiatic Society of Bangladesh*, 2005: 501-518.

Jr, James Wescoat. "Waterscapes & Water Conserving Design." *Landscape*, 2009: 84-87.

Kundu, Dr Nitai. *The case of Kolkata, India*. Kolkata: Institute of Wetland management &

---

Ecological Design , 2003.

Mann, Harald Fischer Tine and Michael, ed. *Colonialism as Civilising Mission*. London: Wimbledon Publishing Company, 2004.

Metcalf, Barbara Daly, and Thomas R Metcalf. *A concise history of modern India*. Cambridge: Cambridge University Press, 2006.

Metcalf, Thomas R. *Ideologies of the Raj*. Cambridge: Cambridge University Press, 1994.

Mukherjee, Jenia. "How a Canal Changed a City and how a City Changed a Canal: Erie Canal and Tolly's Nullah in Comparative Light." *Nature's Sake!* November 27, 2008. <http://justjenia.blogspot.com/2008/11/how-canal-changed-city-and-how-city.html> (accessed December 20, 2009).

Mukherjee, Radhakamal. *The changing face of Bengal, a study in riverine economy*. Calcutta: University of Calcutta, 1938.

Pal, Anirban. "Scope for bottom-up planning in Kolkata." *Environment & Urbanization*, 2006: 501-520.

Racine, Jean. *Calcutta 1981: the city, its crisis and the debate on urban planning and development*. New Delhi: Concept Pub. Co, 1990.

Ramaswamy, V. "Environmental Problems In Metropolitan Calcutta Municipalities." *Environmental Problems In Metropolitan Calcutta Municipalities*. September 18, 2005. <http://mail.sarai.net/pipermail/test1/2005-September/006265.html> (accessed January 20, 2010).

Ray, Mohit. "Citizens Voice for Adi Ganga." *VASUNDHARA FOUNDATION CONCERN FOR ENVIRONMENTAL RIGHTS*. January 2, 2010. <http://vasundhara.webnode.com/news/citizens-voice-for-adi-ganga1/> (accessed January 20, 2010).

—. "High Court's Judgement and After.." *VASUNDHARA FOUNDATION CONCERN FOR ENVIRONMENTAL RIGHTS*. January 2, 2010. <http://vasundhara.webnode.com/news/high-courts-judgement-and-after-/> (accessed January 20, 2010).

Richards, John F. *Land, Property and the Environment*. London: Routledge, 2007.

Riley, Ann L. *Restoring streams in cities: A guide for planners, policy makers and citizens*. Washington DC: Island Press, 1998.

Roy, Ananya. *City Requiem, Calcutta: Gender and the politics of poverty*. Minneapolis: University of Minnesota press, 2003.

Saha, P. "Assessment of Water Quality of Tolly's Nullah by Water Quality Index (WQI)." March 2005. <http://www.ieindia.org/pdf/88/88EN101.pdf> (accessed April 02, 2010).

Sen, Swagata. "Eviction changes little at Tolly's nullah." *The Statesman*, December 25, 2002.

---

Singh, Satyajit. *Taming the Waters: The political economy of large dams in India*. Delhi: Oxford University Press, 1997.

Sinha, Pradip. *Calcutta in urban History*. Calcutta: Firma KLM, 1978.

Sukanta Chaudhuri. *Calcutta: the Living City*. Calcutta;New York: Oxford University Press, 1990.

Thorpe, Edgar. *The Pearson General Studies Manual 2009*. New Delhi: Dorling Kindersley, 2009.

Travers, Robert. *Ideology and Empire in Eighteenth Century India*. Cambridge: Cambridge University Press, 2007.

Unknown. *wikipedia*. February 24, 2010. [http://en.wikipedia.org/wiki/Whig\\_history](http://en.wikipedia.org/wiki/Whig_history) (accessed March 23, 2010).

Ward, Lee. "Reexamining the Roots of Anglo-American Political Thought ." In *The Politics of Liberty in England and Revolutionary America*, by Lee Ward, 1-10. Cambridge: Cambridge University Press, 2004.

wikipedia. *Black Hole of Calcutta*. December 20, 2009. [http://en.wikipedia.org/wiki/Black\\_Hole\\_of\\_Calcutta](http://en.wikipedia.org/wiki/Black_Hole_of_Calcutta) (accessed January 31, 2010).

—. "Tryst with destiny." *Wikipedia*. April 6, 2010. [http://en.wikipedia.org/wiki/Tryst\\_with\\_destiny](http://en.wikipedia.org/wiki/Tryst_with_destiny) (accessed April 18, 2010).

—. *wikipedia*. <http://en.wikipedia.org/wiki/Bonbibibi> (accessed April 20, 2010).

Wilson, C R. *The early annals of the English in Bengal (Volume1)*. London: W. Thacker & Co., 1895.

---