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## The Project

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A **City-Linking and Water-Retention Project** is proposed for the twin-cities of Bharuch and Ankleshwar. The project proposal seeks to:

- **Prevent salinity ingress** by constructing a water retention structure
- **Establish a new link between the twin cities** of Bharuch and Ankleshwar by building a structure across Narmada
- **Prevent flooding** of low-lying areas and promote development of the riverfront by constructing **Embankments**
- **Supplement the development in the twin-cities** by augmenting existing infrastructure and developing new infrastructure facilities

The city of Bharuch was an ancient port on the Gulf of Khambhat at the mouth of the Narmada River whereas Ankleshwar was developed to house the industries in the area. Due to rapid growth, the boundaries of the two cities are now separated only by the river. However, the two cities supplement each other in more than one ways.

The proposal seeks to construct a water retention structure and develop both the banks of river Narmada. In addition, a new link is proposed to solve the problems of traffic connectivity between Bharuch and Ankleshwar and preserve Golden Bridge. The retention structure across the river would prevent salinity ingress, resolve the water requirement for industries, towns and villages and revitalise the fishing industry in the region. Establishing the missing link between Dahanu and Dwarka coastal highway would reduce the distance between Dahej and Surat by about 40km. The development of riverfront would recreate the pilgrimage importance of this historic city and create tremendous potential for Bharuch in tourism sector. In addition, the fishing industry would also benefit from the retention of the water.

## The Twin-Cities

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The city of Bharuch was an ancient port on the Gulf of Khambhat at the mouth of the Narmada River. Initially a trading centre, Bharuch has developed into a major textile-producing city with a municipality established in 1852. The gradual shifting of water channel from the banks of Bharuch coupled with siltation of the riverbed ended port operations. Later, the closing of the textile mills in Bharuch further reduced the economic strength of the city.

In recent years, location and access to water, natural gas and electricity have encouraged industrial development in nearby areas. An economic revival of the city has been taking place due to the growth of these areas. Today, the city is a service centre to these industries. Though Bharuch does not have any industrial units within its municipal limits, it provides a large part of housing and other related services to nearby industries. However, major industrial

development has taken place on the other side of the river in Ankleshwar. Bharuch also capitalises on the development of major industries in Jhagadia and Vagra, and a port in Dahej. Its strategic location between Baroda and Surat has made the city a regional market centre. Bharuch is also a district headquarter and this adds to its strength as an important city in the region.

Since all the industries are located outside the municipal boundary of Bharuch, they make no tax contribution to the infrastructure used by their employees. As a result, the city finds it difficult to improve its amenities and quality of life in the older part of the city. The old city, with ancient fortification and raised undulating hills, has spectacular scenic beauty overlooking the river. This part of the city is still picturesque with its vernacular architecture, resulting from hundreds of years of rebuilding over earlier settlements. British colonial extensions came up on the west side of the city, while the railway station, on the east. The rail connection to the city was established in 1911 on the Bombay - Ahmedabad line. The newer part of the city has continued to develop northwards between the railway station and the old city. Bharuch is once again at the brink of another economic revival.

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## Current State of the Twin-cities

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**Development:** The current state of the city shows many problems and deficiencies in the way the city continues to develop. Growth of the city in last 15 years has been rapid, mostly due to pressures generated by incoming residents from the surrounding industrial areas. The main street connects the railway station and bus terminus to the old part of the city and has developed into a commercial street with growing traffic, shops, businesses, hotels, cinema halls and restaurants. The street, however, lacks pedestrian paths and organised parking spaces in many areas.

**Transport:** The railway station of Bharuch works as a dry port for the industries around the city. Finished goods and raw material is transported between Dahej port and Bharuch by road, after which the rail network is used for further distribution within the region. The rail and road hub has started to cause traffic problems for the city. The location of the inter-city bus terminus close to the railway station contributes further to the traffic congestion within the city. The city has no public transport system and the people have to rely auto-rickshaw service or private transport. All this has been steadily adding to the congestion and pollution levels.

Ankleshwar, on the north side of the river, is accessible by an old railway bridge (subsequently converted to a road bridge) with a new railway bridge alongside. The old bridge, having served for over 120 years, is inadequate in width and insufficient in strength to work as a major transport link with Ankleshwar. Similarly, goods movement to Ankleshwar needs to be diverted to a bridge on the highway, several kilometres away from Bharuch.

**Slums:** The slums along the riverfront are primarily inhabited by fishermen. While slums elsewhere in the city consist of increasing number of migrant labourers, that base themselves in Bharuch in search of jobs in neighbourhoods industrial estates. A few slums have been relocated, however without any significant up-gradation. Thus, slums no longer suffer from flooding, however they continue to remain slums.

**Water Supply:** Narmada is the main source of water to Bharuch, Ankleshwar and the nearby industrial areas. Due to salinity ingress from the sea, water supply to these areas is inadequate and usually brackish. A few bore-wells in the area also suffer from high salinity levels since it is the Narmada waters that recharge the ground water table in the area.

**Drainage:** City infrastructure provisions require up-gradation and augmentation. Inadequate storm-water drainage facilities become apparent during the rains, especially in the old city, where water logging force residents to use boats. The undulating topography of the city is the

cause for this problem, especially since natural drainage channels and collection ponds have been filled up over time causing the water to run off to low-lying areas of the city. Slums have grown along the drainage channels and riverbanks are subjected to periodic flooding during rainy seasons. For the municipality, this translates into an annual emergency flood evacuation and rehabilitation task.

**Sewerage:** The sewerage system in the entire city is either through septic tanks or soak-pits. Even the newer housing colonies developed by the Gujarat Housing Board or other agencies allow the effluent from the septic tanks to flow into drains. The new housing colonies pose an additional problem for the municipality since they develop outside the municipal limits without a comprehensive development plan and are handed over to the municipality for maintenance.

**Pilgrimage:** The historic city of Bharuch was identified as a pilgrimage centre. Towns such Shuklatirth and Kabirvad are situated at short distances from Bharuch. The pilgrimage activity can be attributed to the religious importance of Narmada. However due to lack of good transportation network and safe and planned riverfront access, Bharuch is loosing its pilgrimage importance.

## Components of the Project

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To summarise, the region faces many significant issues that require immediate attention. The project addresses these issues and proposes to derive solutions as follows. The project proposal includes the following components:

- **A water-retention structure** across Narmada to check the salinity ingress in the river
- **A New Link** between the twin-cities of Bharuch and Ankleshwar
- Construction of **Embankments** to protect the riverbanks and prevent flooding of the low-lying area of the city
- **Land and Infrastructure Development** of the banks of the river to provide riverfront commercial and recreational areas

**Water-retention Structure:** A water-retention structure is proposed across Narmada to check the salinity ingress in the river. It is envisaged that the barrier should prevent the entry of backwater from the sea into the river, as well as facilitate the release of Narmada water into the sea. The right composition of the water would support the growth and sustenance of aquatic life.



*Background:* Narmada is the only source of water for residential and industrial use in the sub-region. The small quantities of ground water drawn by a few bore-wells also depend upon the rainfall and water levels in the river. The availability of huge volume of water due to the presence of Narmada has been instrumental in rapid development of Bharuch and Ankleshwar.

The fresh waters of Narmada support a variety of fresh water aquatic animals and fishes. In addition, the backwaters from the sea mix with the fresh waters of Narmada to create a habitat that supports rare animals and fishes. These fresh water and seawater animals and fishes constitute an important part of the food of those residing near the banks of Narmada.

*Recent Development:* In recent years, salinity in Narmada water has risen sharply. Preliminary investigations reveal that the gradual inward shift of coastline and erection of the Sardar Sarovar Dam in the upstream could be responsible for the phenomena. The dam prevents the flow of fresh water whereas backwaters from the sea, with high salt and mineral content, raise the salinity levels in the stretch of the river near Bharuch. Since the erection of Narmada Dam

in the upstream, the fishing industry is in doldrums.

*Problem Issue:* Since the water supply for industrial and residential requirements of Bharuch and Ankleshwar depend entirely on Narmada, salinity ingress in Narmada has resulted in increased salinity in the drinking and industrial water. High levels of salts in drinking water is a potential health hazard and saline water supplied to industries requires intensive treatment before it can be used. High salinity has disturbed the habitat of aquatic animals in the river. As a result, there has been a drastic reduction in the quantity and variety of catch by the fishermen.

**A New Link:** A new link is proposed between the twin-cities of Bharuch and Ankleshwar. The new link would eliminate the bottleneck due to the Golden Bridge and enable high-speed movement of people and goods between the two cities.



The Golden Bridge across Narmada was designed to serve as a railway bridge in 1880. However, in 1952 it was converted into a road bridge and since then has been serving as virtually the only link between the cities of Ankleshwar and Bharuch. The bridge has been under operation for over 120 years.

Today, it is unknown whether the bridge will be able to serve for long. Increased salinity of Narmada water could threaten the life expectancy and existence of the bridge. In addition, the width of the bridge is insufficient to handle the increasing traffic between Ankleshwar and Bharuch.

To provide faster and safer link between Bharuch and Ankleshwar, it is envisaged to build a new road bridge across Narmada. The new bridge should be designed for very heavy loads and oversized vehicles since a lot of heavy industrial vehicles carrying oversized containers move between the two cities.

**Embankments:** The project proposes to build embankments on the banks to prevent flooding of the low-lying area of the city. It is envisaged that embankments will safeguard the banks from erosion and provide protection against annual floods.



*Background:* The eastern part of the city has a continuous embankment to prevent flooding of the low-lying areas. However, the western part, earlier used as a port by the fisherman and ships, has no embankment to train the river and is, thus, prone to annual flooding.

*Recent Developments:* The western part of the city has transformed into a residential area due to ending of port operations. Silting of the riverbed has rendered the port unusable.

*Problem Issues:* The existing embankment, on the eastern part of the city, is not able to contain the floods due to cracks and openings. In addition, there is no embankment on the western part of the city to prevent the entry of river waters in this area. Due to annual flooding, sustainable development is not taking place in these parts of the city. Every year, the Municipality carries out emergency evacuation and rehabilitation.

**Land and Infrastructure Development:** The project proposes to develop the riverfront to provide commercial, recreational and much-needed open space for the industrial twin-cities. The project proposes to develop city-level infrastructure to supplement the development in the twin-cities. This



would include components such as Storm Water Drains and Interceptor Sewers.

*Background:* A particular stretch of Narmada riverfront is characterized by colonial structures. This stretch has evolved over hundreds of years of rebuilding. The bank of the river, in this stretch, is still publicly accessible and is used extensively by the fishermen. However, rest of the riverfront on both the banks of Narmada is characterized by haphazard growth and unplanned development. Private properties abutting the river prevent public access to the riverfront. Besides, the undulating terrain of the region assists in natural drainage of the rainwater and recession of floodwaters. The natural drainage pattern diverts all the flow in to the river.

*Recent Developments:* Extensive development has taken place on the riverfront due to lack of centre city land. This new development abuts on to the river and restricts public access to the riverfront. Moreover, the existing infrastructure is unable to support this development. This results in insufficient supply of water and overflowing storm-water and sewerage lines. Since all the industries are located outside the municipal boundaries of Bharuch, they make no tax contribution to the infrastructure used by their employees. As a result, the city finds it difficult to improve its amenities and quality of life in the older part of the city.

*Problem Issue:* The potential of the riverfront to provide recreation facilities is not being harnessed. No new infrastructure provisions have been made to supplement the new development.

## Benefits

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The benefits of this project are numerous and widespread. Some of the benefits are listed below:

**Reduction in salinity ingressión:** One of the main benefits from the project is reduction in the salinity ingressión in Narmada. Reduced salinity would in-turn reap other benefits such as:

*Availability of fresh water supply:* Reduced salinity in Narmada means reduced salinity in water supply to the residents and industries of Bharuch and its neighbouring areas.

*Recharging of ground water aquifers:* Ground water aquifers in the region will get recharged with fresh water.

*Qualitative and quantitative improvements in agriculture produce:* Ground water quality would also improve with salinity reduction in Narmada. Availability of fresh water with reduced salinity would lead to increase in agriculture produce in the region along-with significant improvements in quality.

*Revival of fishing industry:* Fishing industry will be revived due to re-creation of a habitat suitable for many fresh water fishes and animals. This will provide livelihood to poor fishermen.

**Faster and safer transportation links:** Creation of a new, faster and safer transportation link between the twin-cities would initiate a series of development along these corridors. The administration can invite private bodies to create the new link against toll rights for a specific period.

**Flood management:** New ghats would be built at strategic locations to manage flooding in low-lying areas, eliminating the need of annual rescue operations during floods.

*Access to the river:* New embankments can be designed to include ghats to provide safe and planned access to river at strategic points along the length of Narmada. Embankments would assist in flood management and reduce soil erosion.

**Revenue generation:** Increased potential and activity would attract further revenue-generating investments such as *Tourism*. Safe and planned access to the river would play a major role in development of tourism for pilgrimage and water sport activities.

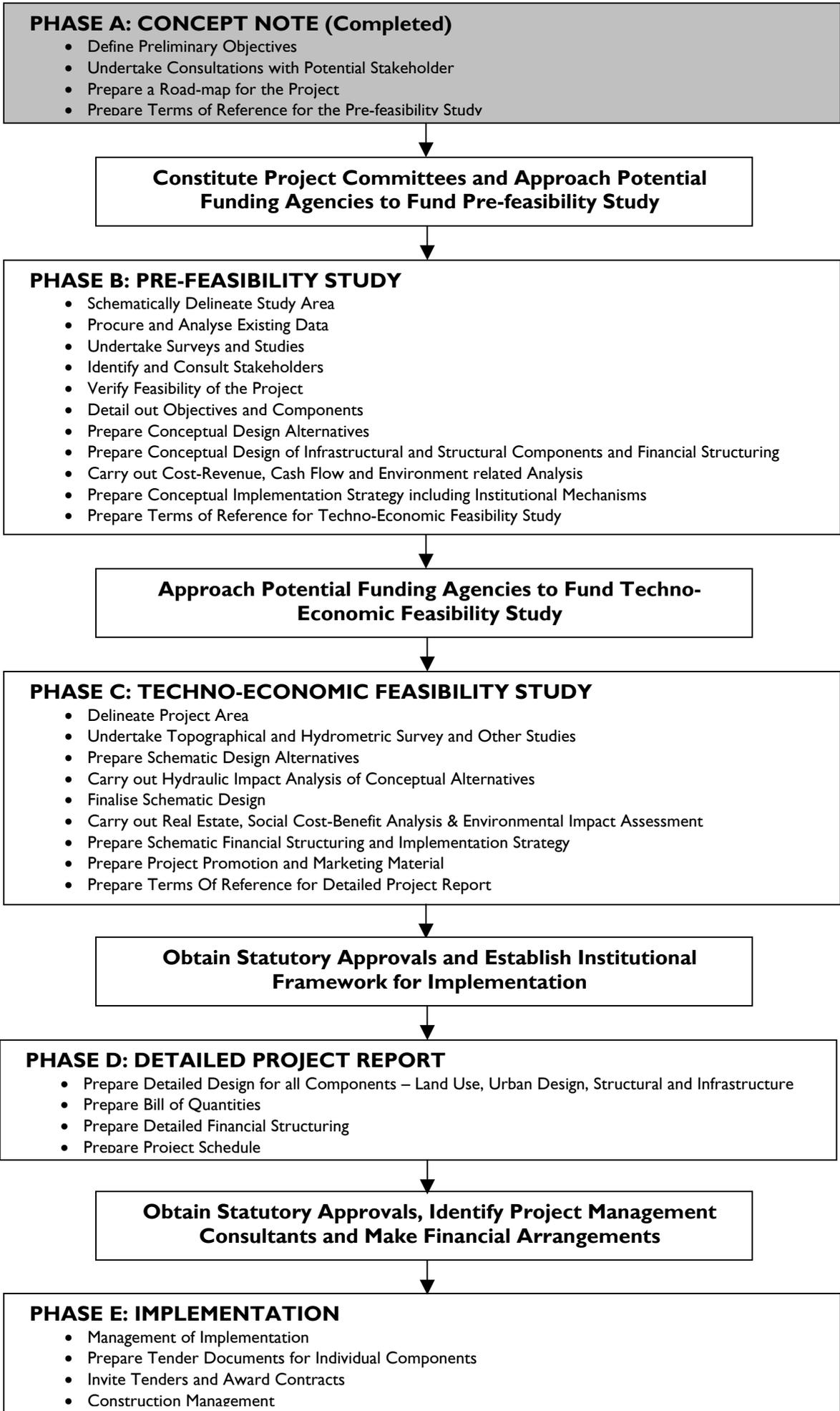
Besides the above listed benefits, the project would provide *employment opportunities* to thousands and lead to *beautification of the twin-cities*.

## **Project Development**

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To derive a comprehensive solution to the above stated issues in a systematic manner, the project should be developed and detailed out through a stage-wise process as described in Project Development.

The first stage, Concept Note, identifies various studies required to carry out the Pre-Feasibility Study of the Project. The Project Review Committee constituted should approach various funding agencies to fund the Pre-Feasibility Study. The Pre-Feasibility Study would analyse existing data and detail out the Objectives and Components of the project. It would also include Terms of Reference for the Techno-Economic Feasibility Study. The Techno-Economic Feasibility Study would involve various surveys and studies to verify and detail out the Components of the project. Various Statutory Approvals should be obtained from governmental and public organisations. Besides, an Institutional Framework should be established to commission the Detailed Project Report that would involve Terms of Reference for the preparation of the Detailed Project Report. The Detailed Project Report would involve final detailed drawings and plans for implementation of the project. On obtaining final statutory approvals and securing the necessary funds, the project would enter the Implementation Stage.



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# Pre-Feasibility Study

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A detailed Pre-feasibility study shall be carried out to establish the feasibility of the project on the basis of study and analysis of existing data and to identify studies and surveys required for the Feasibility Study. The Terms of Reference and Methodology for the Pre-Feasibility Study are as follows:

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## Terms of Reference for Pre-feasibility Study

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### Activity I: Schematically Delineate Study Area

Delineate a stretch along the banks of the river as Project Study Area. This area would be the focus of all area level studies and surveys. The study area, on both the banks, should preferably include major slums, open / unoccupied land on the riverfront, government land, major infrastructure installations between the bank of the river and the nearest major road.

### Activity I: Procure and Analyse Existing Data

Procure all relevant existing data, available with Bharuch and Ankleshwar Municipality or other relevant departments (water supply, drainage, land revenue etc). Significant secondary data and information would be required to carry out the pre-feasibility study. Some of these would cover entire Bharuch-Ankleshwar sub-region, whereas some other may cover only the identified Project Study Area (refer Annexure-1). The list of data and studies required is as follows

#### For Bharuch-Ankleshwar sub-region:

- Satellite Image
  - High-resolution Satellite Image (IKONOS)
- Transportation Network
  - Existing studies for traffic between Bharuch and Ankleshwar
  - Origin Destination Surveys
  - Road Network
- River Hydraulics
  - Annual rainfall data for Narmada Catchments
  - River Inflow data
  - Gauge Discharge data
  - Flood data (including flood levels)
  - Water Discharge data from upstream dam
- Tidal Data
  - High Tide and Low tide levels
  - Composition of sea-water
  - Formal and Informal activities
- Environment and Ecology

- Vegetation
- Water and Air Pollution
- Chemical effluents and their sources
- Physical Infrastructure
  - Drinking Water: Demand, Source and Supply Network
  - Sewage: Generation and Disposal Network
  - Storm Water: Drainage Network
- Social Infrastructure
  - Parks, Gardens and Open Spaces
  - Community Centre
  - Hospitals
  - Schools
  - Theatres, Auditorium and Amphitheatre

### **For Project Study Area:**

- Topographical and Cadastral
  - Development Plan
  - Final Plot Plans for all Town Planning Schemes abutting on to the river edge
  - Topographical Survey
  - Details and location of SOI Benchmark
- Transportation Network
  - Road Network (with road widths)
- River Hydraulics
  - Hydro-metric Survey
  - Structures within and across Narmada
- Slums and Informal Activities
  - Location and population density
  - Socio-economic survey
  - Location and activity details for Informal Markets
- Land Ownership and Land Use
  - Ownership status of land parcels (public or private ownership)
  - Land Use (Residential, Commercial, Industrial etc.)
- Geo-Technical
  - Soil Type and Quality
  - Sub-soil data
- Heritage Structures
  - Location, Type, Age, Structural and Use data for Heritage Structures

### **Activity 3: Undertake Surveys and Studies**

Carry out various surveys and studies (such as socio-economic survey and land-valuation study through random-sampling methods) as identified in the Concept Note or as required then

### **Activity 4: Identify and Consult Stakeholders**

1. Identify people who would benefit from the project and who can be instrumental in successful completion of the project as Stakeholders
2. Prepare Draft Project Pre-feasibility Report containing collected information, data and its analysis
3. Organise a Consultation Meeting with the identified stakeholders to invite suggestions and to detail out project objectives and components
4. Document and analyse the proceeding of the Stakeholder consultations

### **Activity 5: Verify Feasibility of the Project**

1. Carry out detailed analysis of procured data and various surveys and studies
2. Verify feasibility of the project on the basis of the analysis

### **Activity 6: Detail out Project Objectives and Components**

1. Detail out Objectives and Components of the Project
2. Identify Tentative Project Area and Prepare a Base-map

### **Activity 7: Prepare Conceptual Design Alternatives**

1. Prepare Conceptual Design Alternatives
2. Prepare Conceptual Designs for Infrastructure and Structural Components
3. Prepare Financial Structuring

### **Activity 8: Carry out Cost-Revenue Analysis and Cash-Flow Analysis**

1. Work out conceptual costs and revenues of the project
2. Prepare Project Phasing Strategy to
3. Carry out Cash-Flow analysis to determine the financial requirements at various stages of the project

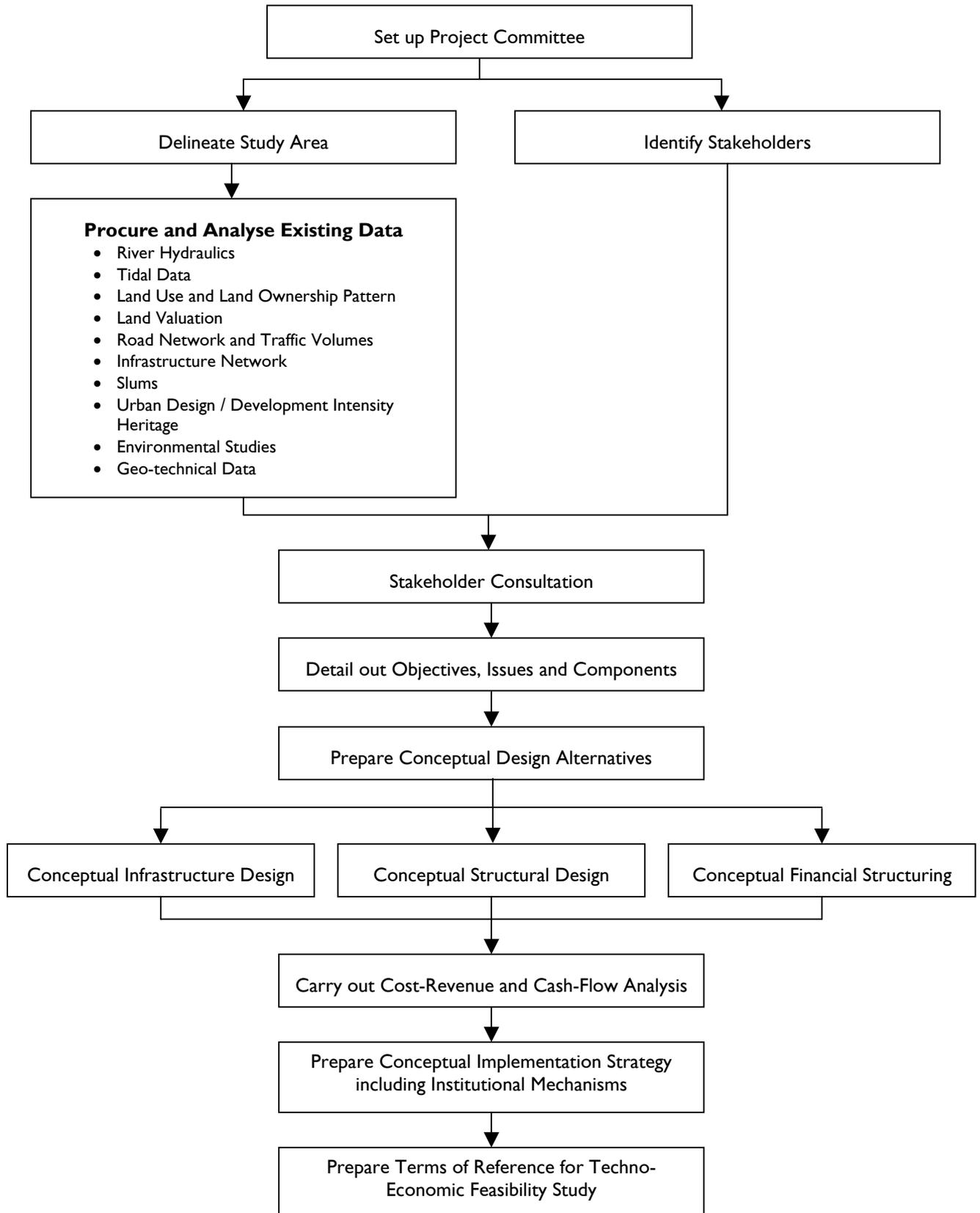
### **Activity 9: Prepare Conceptual Implementation Strategy including Institutional Mechanism**

1. Identify strategy for successful implementation of the project
2. Identify institutional mechanism to implement the project

### **Activity 10: Prepare Terms of Reference for Feasibility Study**

1. Identify various studies required to carry out Feasibility Study and define the specifications and methodology for data collection and survey activities. The studies may include:
  - Topographical Survey of the Tentative Project Area
  - Hydrometric Survey of the riverbed
  - Hydraulic modelling for the existing riverbed condition and for different predetermined flood levels. At a subsequent stage hydraulic modelling for different schematic design alternatives will also be required
  - Land Use Survey / Urban form studies / Development Intensity studies
  - Road Network and Traffic Volumes
  - Existing Infrastructure Network– water supply, sewerage and storm water network
  - Survey of Heritage Structures on the riverfront
  - Slum survey – number estimates, locations, economic activities and socio economic profile
  - Land Ownership Pattern
  - Land Valuation
  - Existing and Potential Environmental Issues

## Methodology for Pre-feasibility Study



## Project Finance

Studies such as the pre-feasibility study and the techno-economic feasibility study require professional consultancy services. The agencies funding the initial stages may be offered concessions in the subsequent stages of the project. A broad estimate of costs likely to be incurred at various stages and a break-up of Pre-Feasibility Stage are as follows:

**Table 1: Estimated Cost of Total Project**

Sr. No.	Task	Cost
		( Rs. )
1	Pre-feasibility Study	1,000,000
2	Techno-economic Feasibility Study	7,500,000
3	Detailed Project Report	15,000,000
4	Implementation - including construction	1,000,000,000
<b>Total</b>		<b>1,023,500,000</b>

**Table 2: Estimated Cost of Pre-feasibility Study**

Sr. No.	Task	Cost
		( Rs. )
1	Procure and Analyse Existing Data	200,000
2	Undertake Surveys and Studies	100,000
3	Identify and Consult Stakeholders	100,000
4	Verify Feasibility of the Project	50,000
5	Detail out Objectives and Components	50,000
6	Prepare Consptual Design Alternatives	250,000
7	Prepare Conceptual Design of Infrastructural and Structural Components and Financial Structuring	100,000
8	Carry out Cost-Revenue and Cash-Flow Analysis	50,000
9	Prepare Conceptual Implementation Strategy including Institutional Mechanism	50,000
10	Prepare Terms of Reference for Techno-Economic Fesibility Study	50,000
<b>Total</b>		<b>1,000,000</b>

## The Next Step

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### Constitute Project Committees

The Concept Note defines the project, its objectives and components and lays out the road map for further work. Thereafter, following tasks shall be carried out before commencing work on Pre-feasibility Study:

- Constitute a High Level Advisory / Review Committee who will meet once every three to four weeks and advise / review, work and facilitate the project
- Constitute a Working Committee to work on day-to-day basis on the project.
- Identify and Approach various governmental, non-governmental and private funding agencies to fund the Pre-Feasibility Study

**The Advisory / Review Committee:** The committee should consist of

- BCEF representatives
- Political Leaders
- Representatives of Industrial Associations
- Current and Ex- Government Officials
- Renowned Professionals
- Eminent citizens
- Representatives from Non-Governmental Organisations

This committee should have easy access to government departments, industrialists, professionals and others as and when required. One of the first tasks of the committee would be to invite potential stakeholders and introduce the project through a presentation on the concept note.

**Potential Stakeholders:** The project envisages serving the residents of the twin-cities. Successful implementation would require all those interested in the project to come together and work closely. Therefore, all the sections of the society, departments within the government and other non-governmental organizations need to collaborate on this project. Potential stakeholders would include:

**Government:**

- Municipality
- Irrigation Dept.
- Railways
- Water supply and sewerage board
- PWD
- Transport Department
- Revenue Dept.

- Gujarat Industrial Development Board (GIDB)
- Gujarat Urban Development Company (GUDC)
- Gujarat Industrial Development Corporation (GIDC)
- Oil and Natural Gas Commission (ONGC)
- Finance Department
- Environment Department
- Tourism Dept.
- Village Panchayats

**Private:**

- Industries of Ankleshwar and Bharuch
- Citizens of Ankleshwar/ Bharuch regularly commuting between these towns
- Industries facing water crises
- Real Estate developers

**Others:**

- Local Political Leaders including MLA's
- Prominent NGOs
- Farmers

**Funds for Pre-Feasibility Study:** The Project Steering Committee should approach potential funding agencies to fund the pre-feasibility study for the project. The estimated cost of pre-feasibility study is Rs. 10,00,000 (Ten lakhs only). Since, in addition to the construction of a water-retention structure, the project proposes development of city level infrastructure services and development of the riverfront for commercial use and tourism, investors from respective fields should be interested in the successful implementation of the project. Thus, potential funding agencies would include

- Gujarat Infrastructure Development Board (GIDB),
- Gujarat Urban Development Corporation (GUDC),
- Ministry of Tourism,
- Real Estate Developers of Bharuch and Ankleshwar,
- Bharuch and Ankleshwar Municipalities

On availability of funds, a detailed Pre-Feasibility should be undertaken. The Methodology and Terms of Reference for the Pre-Feasibility study have been listed under "Pre-Feasibility Study" section.