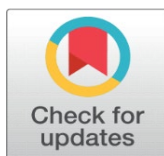
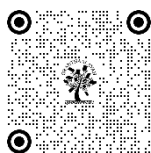


URBAN FLOOD RESILIENT LAND USE PLANNING A CASE STUDY OF SURAT CITY

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ABSTRACT

Disasters and the chances for growth that are brought about by individuals, societies, and nations are closely related. These growth potential lay the foundation for a natural disaster risk disproportion ("UNDP, 2004"). Natural disaster risk used to be primarily caused by human activity in the past. Asia still has a substantially higher level of actual hazard from natural disasters than other continents ("UNDP, 2004"). The role of land governance is very important in determining the overall growth structure and danger of natural disasters. Natural disaster risk vulnerabilities result by unsustainable urban development.

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1. INTRODUCTION

Disasters and the chances for growth that are brought about by individuals, societies, and nations are closely related. These growth potential lay the foundation for a natural disaster risk disproportion ("UNDP, 2004"). Natural disaster risk used to be primarily caused by human activity in the past. Asia still has a substantially higher level of actual hazard from natural disasters than other continents ("UNDP, 2004"). The role of land governance is very important in determining the overall growth structure and danger of natural disasters. Natural disaster risk vulnerabilities result by unsustainable urban development.

2. METHODOLOGY

The study has carried out for Surat through content analysis on the basis of secondary data, filed observations which are published and published speeches of flood experts and urban planners. Documents and published reports on land

use planning, land use zoning regulations, city and municipalities development plans, Master Plan, census data and other planning documents are considered for content analysis. Flood resilience reports published by disaster management authority, development authorities, and municipalities are also taken care.

3. REVIEW OF LITERATURE

(Fu, Meng, and Kalawsky, n.d.) studied "*Flood Risk and Resilience*" Flooding has been widely identified as a global hazard because of the scale and severity of harm it poses every year around the world. Flooding has affected two point three billion people worldwide, with an estimated economic loss of six hundred and sixty two billion US dollars in the middle of year 1995 and 2015. As a result of urbanisation, industrial development and climate change, the economic costs and damage to communities are expected to increase.

(Glavovic 2010) studied "*The Role of Land-Use Planning in Disaster Risk Reduction: An Introduction to Perspectives from Australasia*" The best way to minimise the possibility of catastrophe is to keep individuals out of the way of harm. Planning for natural hazards will contribute in a significant way in the recognition of disasters danger. On the basis of this recognition it take those decisions which provide protection for the community and create suitable. For increasing hazard awareness, it encourages society to work in a very pro active way.

(Gurran 2019)studied "*Land Use Planning*" It is widely found that a limited understanding of the hazards present in a given area, in addition to other vulnerability factors, has exacerbated risks of natural disaster. It becomes possible to reduce the risk of natural disaster by forecast and growth. It includes used land scheduling and development control regulations. Improvement should have been carried out, for example, for settlements along flood plains, on steep slopes vulnerable to landslides, and in areas prone to earthquakes. When we fail to improve it recognized a gap in the middle of growth, science studies, tragedy regulation and ecological societies, a inadequate threats knowledge, poor governance capabilities and abilities through structural and non-structural interventions in the reduction of disaster danger.

(Valdés, Helena Mollin; 2012) studied "*disaster risk reduction in Education sector*" It noted that the programme acknowledges that the goal of integrating DRR into the education sector cannot be accomplished simply by involving the sector in question alone or by carrying out occasional projects. While the Department of Pedagogy's mandate within the Ministry of Education is to establish the school curriculum, its approval also depends on the overall objectives of the Education Sector Plan, which is largely formulated by the Department of Planning and Finance and its content is more effective if connected to other sectors, such as nutritional health and hygiene and life-scale environment Similarly, while the budget for the building of new schools is distributed from the Ministry of Education's budget, the Department of Public Works also carries out the implementation of school construction.

(Gupta and Nair 2010) studied "*Flood risk and context of land-uses: Chennai city caset*" From the last few years our country has experience lots of flooding incidences, particularly in metropolitan cities. The disaster which took place in the year of two thousand and five in Mumbai reported in the form of mega disaster since (2005). Frequent floods are also recorded in the different cities of Bangladesh and Pakistan. Floods result from land runoff, the development of unhygienic environment, the materials accumulation at the time of flood downturn in stream channels, the rise in groundwater coinciding in the company of improved stream flow. It becomes possible that intense rainfall can trigger the flood related threats.

(Muneerudeen 2017) studied "*Urban and Landscape Design Strategies for Flood Resilience in Chennai City*" Tamil Nadu's capital Chennai exit in the form of city which is established in the souther eastern part of our country and is just six point seven metres above the average sea level. Because of this region climatic condition and equatorial storm large amount of rainfall is occurred in this region which sometimes become the reason of floods. It is the reason due to which Chennai is in a vulnerable position. The coastal tsunami which took place in the year of two thousand and four had a significant effect, and rapid urbanisation, followed by a decline in the natural land drainage capacity caused by invasions of marshes, wetlands and other ecologically sensitive and permeable areas, has led to the city's recurring flood events. The situation has been exasperated by channelized rivers and canals polluted by the presence of illegal settlements and waste. Natural and man-made water infrastructures have been polluted and have fallen into disuse, including monsoon water collection and storage facilities such as the Temple tanks and reservoirs.

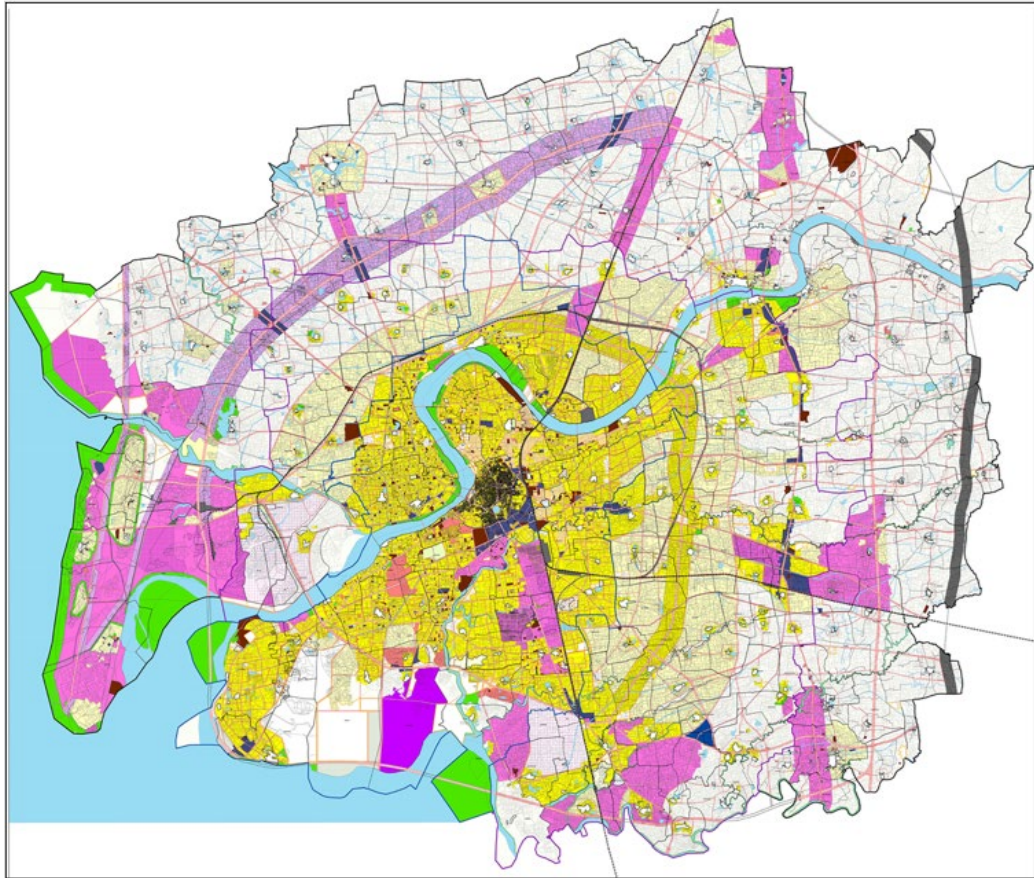
(Gajjar et al. 2013) studied "*A Framework of Urban Resilience Planning* " He noted that attempts to combat climate change also concentrate on the protection and management of land, reforestation and the creation of sustainable and renewable energy sources. Mitigation is also targeted by policies that facilitate increased usage of public transport,

ecologically sensitive methods of supply and disposal of water and low-carbon waste management systems. Mitigation follows a top-down policy enforced by national policies and sector-specific regulations on the transition to manufacturing, utilities or systems.

3.1. LAND USE PLAN OF SURAT-2035

Gujarat, a state in western India, has the significant city of Surat, which is situated beside the Tapi River. Surat, once famous for its silk weaving, is still a major commercial hub for textiles, and the New Textile Market district is crowded with fabric stores. Surat Castle, which overlooks the river, was constructed in the 1500s to protect the city from Portuguese colonists. The Dutch, Armenian, and English cemeteries nearby house ornate tombs from the colonial era.

Following are the chapters of Land use plan of Surat-2035.



Source: Master Plan, Surat-2035

3.1.1. DEMOGRAPHY

It describes the size, structure, and movements of populations over space and time. It is helpful to analyzing and predicting social, cultural, and economic trends related to population.

3.1.2. ECONOMY

It is the study of urban areas; as such the tools for economics to analyse urban issues such as crime, education, housing and local government finance.

3.1.3. TRAFFIC AND TRANSPORTATION

In this chapter deals with the current scenario of the transportation major networks, no of vehicles, travel behaviour, parking areas, policies and strategies.

3.1.4. SHELTER

The chapter of master plan deals with the study of no of population is houseless in city, slums, housing condition, projected housing units demand for the future coming population in the city.

3.1.5. INFRASTRUCTURE

This chapter in the Surat master plan deals with the existing facilities of water supply, quality, timing hours of supply, sewerage, drainage, all infrastructure network layout. Projected demand for water, sewerage, drainage, power.

3.1.6. SOCIAL INFRASTRUCTURE

It includes healthcare (Hospitals), education (schools and universities), and public facilities. According to the current scenario projected demand worked out with policies and strategies.

Solid waste Management

It is the collecting, treating, disposing of waste, medical waste, e-waste, and by construction. The chapter covers the projected demand of solid waste generation and plans, policies and strategies for the Surat City.

3.1.7. DISASTER MANAGEMENT

This chapter deals with the earthquake, cyclone, and floods prone areas in Surat. It is the organization and management of resources and responsibilities for dealing with all humanitarian aspects of emergencies, in particular preparedness. Strategies and action plans also have been discussed in Surat Disaster Management Plan 2018.

3.1.8. ENVIRONMENT

It is the most important aspects in deals with the climate, temperature, green covers in the city. The policies and strategies have been discussed in detail and land use have to be protect environment as well.

3.1.9. SPATIAL STRATEGY AND LAND USE PLANNING:

Spatial planning systems refer to the methods approaches used by the public and private sector to influence the distribution of people in spaces of various scales (SMP-2035). Spatial planning deals include land use, urban, regional, transport and environmental planning.

1) DEVELOPMENT REGULATIONS

It covers the different land use zones and use premises and controls applicable to SMP 2035. Development controls clearly mentioned in the specific chapter.

2) Monitoring and implementation of Master Plan

The Master Plan will be implemented through the application of bye-laws, through public investments, many of which will be shared with the governments. The implementation of the Plan will be subject to systematic and transparent monitoring.

3.2. THE SHORTCOMINGS

The disadvantages of master plans may include their inflexibility, expense, and the possibility that they may simply sit on a shelf and gather dust.

3.2.1. DATA INSUFFICIENCY AND CONTRADICTIONS

In Master Plan making there is lack of data information. Updated data is important to make master plan helpful for the successful completion of plan. Cities with master plans existing from earlier decades did not show better conformity compared to cities that adopted master plans later; over time, this conformity did not change or improve significantly either.

3.2.2. TONE OF THE DOCUMENT

The Surat Master Plan is a legally enforceable document, to provide clear guidelines on urban planning and infrastructure this document reads more like a policy document and not a clear legally enforceable. In this document there is planning norms, use zoning, use permissibility, density, FAR and Building controls.

3.3. WEAKNESS OF SURAT WITH RESPECT TO FLOOD RESILIENT

Sr. No.	Weaknesses	Surat
1	Land use weaknesses in reducing flood disaster risks	Intense economic activity and dynamic interactions characterize urban centers. To acknowledge the increasing importance of cities, the United Nations has included Goal 11 in its Sustainable Developmental Goals (SDGs). According to de Oliveira and Doll (2016), cities are important because they serve as centers for knowledge and innovation, which can lead to better city-wide climate and health governance. Coastal locations are home to the majority of urban zones. The population and the associated pressures on the coast are rising in tandem with the expansion of metropolitan centers. Anthropogenic factors such as the burning of fossil fuels, the usage of fertilizers, the introduction of sewage, industrial processes, tourism, overfishing, aquaculture farms, and maritime traffic pose multiple threats to coastal ecosystems, in addition to those caused by natural change. Surat, in the Indian state of Gujarat, is a historic port city on the banks of the Tapi River. The city of Surat was at its most prosperous in the sixteenth and seventeenth centuries, when its port was a thriving center of trade and commerce. The Mughal Empire's principal port was located in Surat. According to Rawlinson (1920), the English factory in Surat, which the British East India Company set up in 1612, is sometimes referred to as the "cornerstone" of the British Empire in India. This city's well-documented history of flooding is a direct outcome of its colonial heritage. Prior to the instrumental recordings, written history narratives and imperial gazetteers provided details of previous floods. Beginning in 1664 as a flood protection structure with gates that could be closed in the case of a flood, the British finished the building of the entire inner wall of the city in 1707. From 8.12 km² to 326.5 km² in 2009, the city area grew. Based on geomorphology, the city is separated into two zones: the coastal zone and the alluvial zone.
2	Master planning weaknesses in reducing flood disaster risks	Another program supported by ACCCRN, in addition to early-warning systems, is the Urban Health and Climate Resilience Centre, which recently opened in Surat. With the help of city officials, this institute will investigate how climate change affects people's well-being, paying special attention to the city's poor and vulnerable. To help the city better withstand illness outbreaks that could be worsened by floods and other climate change consequences, the center will also conduct disease surveillance in addition to providing information and training. Statistics on disaster losses and impacts, hazard models, exposure databases, and vulnerability information should all be part of the risk information that governments gather, manage, and disseminate. Concurrently, they should establish norms and procedures to guarantee transparency and openness, making sure that consumers can obtain the information they need while also being informed about its limitations and underlying assumptions. Because it is shaped by social, economic, and environmental vulnerability, extensive risk can be effectively mitigated through risk management and sustainable development practices; hence, it is imperative that risk information be generated in a way that is both understandable and actionable.
3	Building byelaws weaknesses in reducing flood disaster risks	Various methods are used to evaluate the susceptibility of structures. In order to understand the compressive and tensile strengths of a non-homogeneous building stock, thorough testing is necessary. The position and features of the building's columns and beams, the existence of horizontal bands, the building's load design, its configuration, its height, its age, its quality of construction, and so on are all factors that can determine the building's

		susceptibility. A building's location, general shape, size, and geometry have a significant impact on how it behaves during disasters. In order to prevent these drawbacks and choose a decent building layout, architects and structural engineers need to collaborate throughout the planning stage.
4	Building Code weaknesses in reducing flood disaster risks	Even with the city's rapid urbanization, Surat is still vulnerable to devastating floods. More rain is on the way to the city and the Tapi basin, making flooding a more serious problem as a result of climate change. How the Ukai dam is managed in the face of competing demands for water and flood control, the location and design of future city expansions (particularly onto floodplains), the presence or absence of a landfill in the Hariza industrial complex to mitigate the threat of flooding to high-value industries, and the rate of sea level rise are all factors that will determine the actual increase in flood frequency and intensity. The city has the ability to deal with flood hazards, and since the plague broke out in 1994, conventional infrastructure and services have been substantially upgraded in both quality and reach. Making critical infrastructure and services more resistant to flooding is part of this. A more robust strategy to deal with flooding has been acknowledged by the municipal corporation. Although the early warning system is effective, it might be far better if it relied more on information technology, used telemetered ground weather stations in addition to satellite-based weather monitoring, and used more sophisticated real-time flood models.
5	Urban Land policy weaknesses in reducing flood disaster risks	By analyzing past, present, and future urban growth patterns in relation to potential dangers, urban land use management processes can suggest a mix of policies, investments, and capacities that will result in development that is risk-sensitive. If a land use plan wants to keep development out of floodplains, for instance, it can suggest spatial growth methods to do just that. In a similar vein, development control tools like incentive zoning can prevent construction in flood-and earthquake-prone locations with a high liquefaction potential. Potential private investors can be better prepared to weigh the costs and benefits of developing property in certain ways when catastrophe risk information is disclosed in a greenfield site master plan.
6	Land administration weaknesses in reducing flood disaster risks	Land is an infinite resource. Land is the most important, precious, and special resource given to mankind by nature, as it provides the essential necessities of life to all homosapiens and living organisms on the planet. The land is the source, promoter, and sustainer of human life. The land is the source, promoter, and sustained of human life. Land establishes the foundations for all human activities such as living, working, and caring for one's body and spirit. In urban areas, land is a significant financial resource for local governments. Land for urban growth is also a valuable resource. On the basis of land management tasks, practises, and policies, it is concluded that, in light of the increasing pressures of urban growth, cities in developing countries need reliable and comprehensive information about their land markets. The town planning and valuation department, which has a regional office in Surat, is in charge of planning and development. This department, which was created in 1914, also advises the government on slum clearance, housing, traffic and transportation, regional planning, and other issues, as well as legislating(Dowall, 1995).
7	Land law weaknesses in reducing flood disaster risks	While the government is generally responsible for disaster management, citizens do not have an absolute right to safety in the event of a disaster. Public authorities do not necessarily have an obligation to act simply because they have the legal authority to do so, according to Bean, Staddon, and Appleby [79] (p. 61). That is to say, landowners are not guaranteed a right to prevent floods by means of mandatory regulations; rather, the protection against flooding is contingent on discretionary decisions made by government officials. Individuals' knowledge of their own disaster management duties and expectations of complete protection from all natural disasters provide a challenge to government-public relations efforts. The duty of each government in offering mitigation prospects of an occurrence is a major worry among inhabitants, as pointed out by Kano, Kelley, and Hashemi [86] (see also [60]). It is also important to consider how the public's duty of care evolves in light of the fact that climate change is making floods and droughts more frequent and severe. Questions arise over the justification for government interventions in pre-disaster planning, as well as the legal obligations of individuals and landowners on disaster prevention and preparedness.
8	Urban Planning Institutional weaknesses in reducing flood disaster risks	The urban poor are more likely to be vulnerable as a result of both post- and pre-disaster efforts. Since development projects contributed to the construction of buildings like bridges and schools that were subsequently damaged in disasters, it follows that insufficient developmental planning activities can increase the likelihood of disasters (e.g. Maskrey, UNDP-BCPR). Because of the high expense of promoting codes, most international agencies are reluctant to do so; as a result, the urban poor are often unable to participate in human settlement planning or rehabilitation projects (Stein, Sida). Furthermore, development

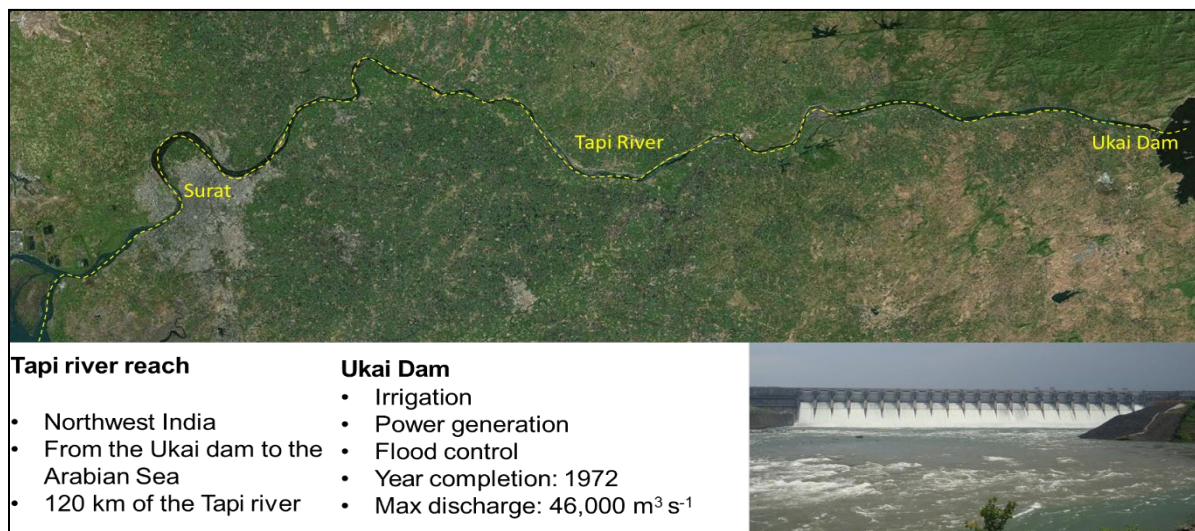
		projects rarely conduct EIAs and hazard impact analyses with regard to urban developments (e.g. Manock, IC). Issues with non-compliance, particularly within the housing and infrastructure ministries, are prevalent in nations where EIA is legally enforceable, such as Egypt (El-sheikh, Urban Training and Studies Institute). As an example, Rowell (CARE) cited a case in Delhi when a whole town was wiped out during the monsoons because a road was built through the last remaining watershed outlet, ignoring environmental assessments.
9	Urban Planning regulation enforcement weaknesses in reducing flood disaster risks	It is critical to upgrade private infrastructure and homes to resist floods, and to design land uses accordingly and to enforce development regulations based on risk categorization. Discourage development in areas prone to flooding, such tidal streams and beaches, by making comprehensive risk data easily accessible to the public. We need to look into options for group or municipal insurance that might be funded by a home tax fee. Increased respite time can be achieved through better early warning systems, and damage and loss can be minimized by better-informed community-level reaction contingency planning. It is important to teach city people how to effectively manage their lives with little disturbance by both individuals and groups. A part of being ready for the monsoon is making sure there's good two-way communication and updating the database of those who are old, sick, or otherwise in need of particular care.
10	District disaster management committee's weaknesses in reducing flood disaster risks	There are frequent earthquakes and floods in the area, ranging from mild to moderate in intensity. The area is vulnerable to a wide variety of natural disasters, including but not limited to earthquakes, floods, landslides, storms, fire mishaps, and road accidents. Numerous variables, such as a growing population, increased urbanization, narrow streets and byways, the fact that National Highway 44 cuts through the city, and the proliferation of concrete buildings, make the district more vulnerable. Given the above, it should come as no surprise that the National Disaster Management Act of 2005 requires the development of a strategy for the efficient handling of any kind of emergency. The duty of preparing the District Disaster Management Plan, in consultation with all relevant parties, has been assigned to the DDMA under this mandate.
11	City disaster management committees' weaknesses in reducing flood disaster risks	Natural catastrophes have long been a threat to India due to the country's distinct geoclimatic characteristics. Earthquakes, landslides, cyclones, droughts, and floods are all too common. Severe earthquakes can occur across 60% of the continent, flooding can cover more than 40 million hectares, cyclones can affect around 8% of the entire area, and drought can affect 68% of the landmass. On a yearly basis, catastrophes impacted almost 30 million people and killed an average of 4,344 persons between 1990 and 2000. There has been an enormous depletion of individual, communal, and governmental resources.
12	State disaster management committee's weaknesses in reducing flood disaster risks	All of the plans' catastrophe management cycles include risk-reduction actions as their weakest link, and these activities receive the least attention. Because risk reduction is a cross-sectoral issue, ten officials from the Odisha State Disaster Management Authority referred to the plans during the workshop as "response plans rather than risk reduction plans" since they were too broad to cover. That these agencies should "lay down guidelines to be followed by different ministries [...] for prevention of disaster or mitigation of its effects" is explicitly stated in the Disaster Management Act of 2005, which is at odds with this claim. 11 This is most likely caused by a lack of dedicated funds for risk reduction, which hinders investments in infrastructure and programs aimed at reducing the likelihood of disasters, as well as political and institutional reluctance in a nation where catastrophe response has been the standard for many years. Because providing response and aid after a disaster is perceived as yielding a political benefit, there are financial and political disincentives to engage in risk control efforts. 12 According to key informants, disaster response always takes precedence over risk mitigation due to the high level of public and media attention following such events.

4. TAPI RIVERFRONT DEVELOPMENT AND REJUVENATION PROJECT

The perennial Tapi River flows through Surat, India, providing water to the city's estimated 6.5 million residents. It is essential to the city's survival. At its final destination, where it reaches the Arabian Sea, it takes on a highly dynamic character. Consequently, it carries the salty tidal back flows from the city during high and low tides all the way to the Singanpore weir. Since 1976, when flood levels began to rise, SMC has prepared for this severe threat by developing a number of flood embankment schemes along the river. Slums that have sprung up along riverbanks, water management following the construction of the Singanpore weir, and the discharge of polluted sewage from storm water outfalls are

additional problems that require fixing. The banks of rivers have become home to numerous recreational facilities. Developing the project requires incorporating solutions to the difficulties and prior development efforts. Surat Municipal Corporation has embarked on the Tapi Riverfront Development and Rejuvenation Project to enhance the river's asset value for the benefit of Surat city. The project spans approximately 33 kilometres, from Kathore Bridge to the ONGC Bridge, and aims to develop the river in a holistic and comprehensive manner.

Figure Tapi River and the catchment area of Tapi



Sources: Google Image

The Concept Master plan emerges in the form of effort for the formulation of plan of a complete, possible, understandable and durable river edge full of pedestrian trails. The downstream is developed in the form of green and recreational space that can transform the existing neglected waterfront into a centre in support of cities communal activities. Construction of Embankments to strengthen River Edge of both banks (approx. Thirty three kilo meters on each side) with respect to the level of fifty year of flood return period given by CWPRS.

- The Tapi Shuddhikaran Project is being included in order to clean up the river.
- Land was reclaimed for use in leisure activities.
- Regarding the availability of land and activity mapping, a comprehensive zoning of the master plan has been completed.
- Placing an emphasis on a number of different green places, such as gardens, recreational parks, nature parks, and so on.
- The construction of public amenities along the riverfront, in addition to the establishment of potential entry points.
- The construction of a continuous promenade. This will include a pedestrian and bicycle track.
- The improvement of access to the riverside through the strengthening of certain existing roadways is being considered.
- The construction of new roadways that are being suggested in order to enhance connectivity along the riverfront and through the river.
- Develop a specialized road network along the riverfront by combining the plans for current roads with those for proposed roadways.

Water availability and quality, Dominant sectors of employment and economic development, and the Riverfront Project are all aspects of "The Surat Resilience Strategy" that could be affected in a direct way. Home affordability, management of ecosystems and the environment, social cohesiveness, health system scaling, and regulation of connectivity and mobility services.

5. DISASTER RESILIENT LAND USE PLANNING

It develops into a shared practice that defines and controls land use for the benefit of societal, economic, and communal efficiency and security. Centralized and decentralised planning methods are being used to apply it management at national, regional, state, and even municipal levels. Planning criteria established at the state level oversee the sub-state's aligned development phase in pursuit of overall growth objectives. The government officials will continue to make preparations, albeit at a lower degree of detail. Typically, regional plans are put in place to safeguard rural areas, while local plans are prepared for urban and suburban areas. The emphasis of these rules is on urban and suburban areas, with a passing reference to rural regions. Unplanned development has occurred due to factors such as fast economic growth, land scarcity, inadequate or non-existent land use planning, and poor compliance mechanisms.

Communities have adapted to hazard risks through indigenous awareness, avoiding high-risk areas or adjusting settlement and construction patterns to the local environment. It is possible to see the results, or lack thereof, of land use policy in most nations' urban centers. The International Federation of Surveyors reports that over 70% of development occurs outside of official planning frameworks (FIG 2010), and that 30% of developing-world urban populations reside in informal settlements or slums. Current trends in land use planning in a variety of disciplines, including agriculture, water resources, urban planning, coastal zone management, environmental protection, and natural resource management. Legal and legislative frameworks have not been adaptable enough to incorporate changing planning priorities or public feedback into development, even as land use planning principles have progressed from a singular focus to many objectives. Discordant policies have resulted from a lack of cohesion among various sectoral rules and regulations and their connections to larger socio-economic development plans (for example, those pertaining to land, agriculture, urban development, the environment, and coastal zone management). Its implementation in India mirrors many of the issues encountered by industrialized countries.

6. CONCLUSION

Developments and constructions made to a landscape cannot be reversed. Departments and agencies should work together to restore lakes and other bodies of water to their natural condition by preventing further development on or contamination of the water and by removing any existing development. The high population density, extensive infrastructure, and financial resources concentrated in urban areas make them more susceptible to hydro-meteorological disasters. Both on a global and a local scale, in the form of slum housing, poor waste management, and local atmospheric phenomena are worsening disaster hazards and their consequences. One important part of managing flood disasters in cities is being prepared to deal with a calamity. In the context of water alleviation, natural flood management through wetlands, increased housing, better building and sanitation standards, and open space preservation, the land use problem takes on added importance.

CONFLICT OF INTERESTS

None .

ACKNOWLEDGMENTS

None.

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