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## Changing Environment versus Urban Development: A Case Study

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**Abstract :** Largeness of Ukai Project can be felt only by standing on the top of the dam, taking views around and fathoming the mind shaking depths downstream and feeling the charging breeze coming from miles off the mighty reservoir. Project is standing tall on mythological soothing river called 'Tapti'. Not only soothing, its tamed water is so useful making this project a multipurpose project in nature and biggest one so far constructed in Gujarat. Untamed water of river carried devastation potential, which was minimized, during post project era. Large projects are taken more as a threat than giver of arrays of benefits in the form of direct irrigation and power and series of indirect benefits. Most of the times, looking globally and large dams have proved as saviour. The changing environment has forced the managers at every level and at every sector to think and act differently. Water managers are forced to look beyond stored water and throwing the excess down the drain after milking the water for various purposes. Change in environment is a broad term under which comes the climate in its micro and macro form. Thus climate change will touch water resource projects at every level from the water at its source till its destination via project setup. However three stages are important i.e water in catchments, its handling at project in the form of storage and lastly downstream journey. As seen in the cases of water resource projects in India environment / climate change has least affected the normal working of projects? Changing environment in its visible presence in the form of global warming which melts to the average rise in temperature has hardly shown its effect in the form of drying of river or excessive of run off so as giving alarming trend to worry immediately. However variances which are overall felt may be given benefit of doubts, till global warming shows marked presence. However changing environment (not so climatic) in the downstream of major projects has warned the water managers and planners to think and act otherwise. As extremities in the form of floods has dramatically affected the lives of people in the flood plains downstream covering Surat city. Ukai project is one such project where on the downstream side lives of the people of Surat city is largely dependent on the flood releases. Haphazard urbanization of flood plains in the absence of adequate laws, awareness and coordination has made the situation for the time being worse. This paper highlights the pros and cons of matter, analyses challenges and suggests the actions so as to make the development and urbanization in flood plains sustainable.

### INTRODUCTION

Tapi River is also known as Tapti. Mythologically Tapi was daughter of Sun (Surya). Legend goes as River Tapi was created by the sun to protect him from his own warmth. Tapi basin through which the river Tapi flows is interstate basin running through three states of western India, bounded by hill ranges and large forest cover. The annual rainfall for the upper, middle, and lower Tapi basins for an average year ranges from 631.5 mm to 1,042.33 mm. Giving good amount of useful runoff and same time high floods. The Tapi basin consists of mainly black soil. The coastal plains

in Gujarat have alluvial soil with black soil on the surface.

Going through salient features of the project <sup>1</sup>(As Annexure I), its catchment, handling of project flood routing, paper deals with highlighting what are environmental and climatic changes. How and where they are going to affect the water resource projects. Paper touches the most crucial part of the project which is downstream. Downstream is where the skill of the water managers are tested, challenges posed due to urbanization and development of flood plains, mitigations and adaptation.

Looking at the size of the Ukai project as compared to other projects of the Gujarat, thus making this project a unique in its features and imparting benefits. In light of changing environment this paper touches the issues related with floods routing to be carried out with state of art support system recently being developed. Paper also touches the issues of haphazard development and encroachments on natural drainage of downstream areas, which ultimately affects in getting the things normalized after sudden spates and normal releases through dams. Paper also speaks about the myopic view points and thinking perspective of people along with discussing the unbalanced and swayed role of media. Paper also discusses the challenges before water managers and priorities.

#### **TAPI RIVER BASIN AND ENVIRONMENT / CLIMATE CHANGE**

Peculiarities of this basin<sup>2</sup> are,

- Location wise situated in the northern part of the Deccan Plateau.
- Catchment of basin spreads over an area of 65,145 km<sup>2</sup>.
- The basin lies between east longitudes of 72° 38' to 78° 17' and north latitudes of 20° 5' to 22° 3'.
- It is bounded on the north by the Satpura range, on the east by the Mahadeo hills, on the south by the Ajanta range and the Satmala hills and on the west by the Arabian Sea. Bounded on the three sides by the hill ranges.
- The culturable area of the basin is about 4.29 Mha.
- The forest cover is about 25% of the area in the basin.

The annual rainfall for the upper, middle, and lower Tapi basins for an average year is 935.55 mm, 631.5 mm, and 1,042.33 mm respectively.

Catchments are the places where the major area of basin belongs to. Let us see catchments in light of environmental and climatic changes. Environment is made by manmade activities and climate is natural, which is ultimately affected. However both of them are interdependent like human activities will change environment which will put its effect on climate. Looking at Ukai project catchment things are not worse or alarming. However, in the time to come, unattended state of affairs will lead to the worsening of situation in the form of expansion of wetland farming, drying of wetlands, increased exploitation of forest woods, degradations, cultivation near river banks, siltation of rivers, converting forest into grass lands for grazing in turn increasing GHG gases and loss of genetic pool and bio diversity.

#### **UKAI FLOOD ROUTING<sup>1</sup>**

##### **It's Uniqueness and Typicalities**

During monsoons, the Tapi River is frequently in spate and floods occasionally cause havoc in the plains of lower reaches. In the post-monsoon period, the discharge in the river is quite low, say of the order of 300 cumecs. In the basin, rain storms typically move from east to west; this also is the general flow direction in the basin. Most floods occur during the period July to September, though occasionally they may occur in the second week of October. The maximum number of floods has been found to take place in the month of August.

Floods were a frequent phenomenon in Tapi River at Surat before the Ukai Dam was constructed. During 1876 to 1970, danger level was crossed at the Hope Bridge, in Surat on 19 instances. This implies a frequency of once in every five years. High floods were experienced during three consecutive years from 1882 to 1884. There was a very high flood in August 1944 and actually two almost similar flood peaks occurred in the same week. A heavy flood, only slightly lower than that in 1944, was experienced again in 1945. Consecutive large floods were also observed in 1958 and 1959.

Heavy floods were witnessed in 1968, 1969, and 1970. The floods of September 1959 and August 1968 were catastrophic. The floods of 1994 and 1998 also caused considerable damage to the Surat city and other low-lying areas on the downstream.

**Flood Forecasting Set Up**

Being interstate basin CWC has established 16 rain gauge stations in catchment of Ukai Project. Inflow forecasts for Ukai dam are being issued for a peak discharge of 1000 cumecs (35315 cusecs) and above irrespective of water level in the reservoir. Three situations are defined like normal, high alert and emergency. These are based upon rainfall recorded in 16 key rain gauge stations in catchment and water levels in reservoirs. Prescribed form like N,H & E are used respectively by CWC.

**RECENT ADDITIONS AS AN AID TO FLOOD MONITORING**

**Automated Gate Operation**

22 gates of Ukai dam have been automated and based on the data provided by the CWC, the dam authorities will regulate the release of water. This computerized system will remove chances of manual errors. Managers will be able to open the gates to release the water smoothly.

**Mobile DG set**

As a one of the four power alternatives, 125 kva mobile generator set is provided at the top of the dam. This is equipped with very smooth switch over system. Easy to run and operate.

**Telemetry System at Ukai Dam**

Authorities have decided to equip Ukai dam with satellite-based telemetry system. This will provide

Pre Project			
SN	Year	Peak Flood – Lakh Cusecs	Peak Outflow – Lakh Cusecs
1	1944	9.00	
2	1945	7.22	
3	1958	6.20	
4	1959	13.16	
5	1968	15.00	
6	1969	8.56	
7	1970	13.14	
Post Project			
8	1994	8.87	5.08
9	1998	10.53	6.99
10	2006	12.05	9.10

the authorities information about inflow of water into the dam 24 hours in advance, enabling them to plan efficiently the release of water into Tapi River. This system is likely to be operational by 2011 monsoon.

### **DOWNSTREAM RIVER AND SURAT CITY**

Surat city is having an Area 326.51 sq.km. Catering to population about 42 lacs . It is contributing 4% towards GDP. Here 33% of the nation's total manmade fibre production is done. There are more than 6,00,000 power looms, 60,000 Shops & Establishment in trading activity. 75% of the nation total rough diamond cutting & polishing is done here in more than 25,000 diamond processing units. Major industries like Essar Steel, Reliance, ONGC, L & T, GAIL, KRIBHCO Shell, NTPC, GSPC, Torrent Power are located here.

Like Mumbai Surat city is too attracting people from far flung underdeveloped Indian states. Which results in overcrowding of areas and large pressure on services city is designed to provide. Open spaces and natural drainage areas including part of rivers are illegally occupied and they become breeding ground for pollution and filth, resulting in constricted waterway. Similarly sea coast areas are reclaimed causing further influx of sea inward. This all results in poor drainage conditions and during rainfall water not able to follow its legal authorized natural route , results in stagnant pool. Overall effect is flooding. Problems are more compounded when rivers in spate do not accept the extra surface flow, part of which should also go down underground. More time is taken to subside the floods but not before the damages are done.

### **WHAT IS CLIMATE / ENVIRONMENTAL CHANGE**

Looking to the Ukai project effect of climate is not found to be so alarmed affecting inflow of water in the reservoir. Whatever changes are felt in the inflow of water is not giving rising or falling trend.

As generally happens in India in perennial rivers the monsoon and off monsoon flow is not largely affected by climatic change but it is more affected by manmade factors like diverting water, basin habitations and urbanization. Similarly environment or climate is not going to affect the very running and monitoring the projects like flood routing and gate operations. In this context downstream channel which is river and river flood plains becomes important in light of climate and environmental changes.

### **EFFECT OF CLIMATE CHANGE ON UKAI PROJECT AND SURAT CITY**

Looking flood plains in general and in light of Ukai project, it is seen that Surat city, which is originally settled on the bank of river Tapi and downstream of Ukai project has shifted towards the flood plain and now major part of the city is resting over flood plains. Immediately after city the river Tapi merges with Arabian sea. Climatic change in terms of sea level rise pushing the masses towards inland is not at all pronounced. Similarly rise in overall temperature of the city or en route river upstream is not at all so pronounced thereby affecting the drying up of channel and depriving people.

Environmental changes ( though not in broad sense) will be applicable here in surat city. Which mostly comprises shifting of population more towards river and occupying the flood plains due to its in built potential. This phenomena has resulted in reduction in drainage area , reduction in natural flood plain storage in turn little rainfall in the city results in large inundation. Thus man made environmental change is affecting the city rather climate change.

### **ENVIRONMENTAL/CLIMATE CHANGE AND URBAN DEVELOPMENT : CHALLENGES**

First let us see, though flood plains are recurrently affected by floods, flood plains are preferred places for socio – economic activities due to its developmental potentials i.e easy access to natural

resources , fertile land for agriculture services provided by eco-system.

Before foraying into the regime of challenges, let us see the present scenario, looking to the current developmental pattern of the Surat city , it is seen that adverse impacts are being ignored, natural flood plains and wetlands are undervalued. Some are benefitted at the cost of others. There is a loss of natural flood plain sand natural protective barriers. Natural resources are being traded for short term economic gains.

There is no law pertaining to flood plain development and restricting encroachments.

Religious places are allowed to develop in the very reach and inside slopes of rivers. Even big temple can be spotted within river reach.

Permissions are given to housing societies and industrial developments in the flood plains. Even clusters of big farms have been allowed by the city authority to develop.

Lack of awareness and people are not accustomed to the concept of flood plains. Even knowledge about the city and surrounding topography is meager. Little hoax about the floods make the people restless and they tend to hoard the essentials and these essentials vanish from the market. Dams are public assets made out of public money. Common public is not even aware of the property thus they own, leave behind its working, usefulness and collective duty towards such assets.

There is natural tendency to be near the river. Displaced and shifted population tends back to be at original shifted place. Even houses shifted and dismantled from the banks are re located at their original place.

## **MITIGATION AND ADAPTATION**

As said mitigation is the effort to reduce loss of life and property by lessening the impact of

disasters and adaptation is an ability to adjust to new information and experiences. In the foregoing para challenges are covered, which water managers, public and government are facing jointly and simultaneously. Any effort for mitigation and adaptation is not a sole prerogative of either public or various authorities. It is a joint effort to be taken up on participatory basis. This can be viewed under following headings.

**IFM** : Integrated Flood management approach would help in maximizing the net benefit from flood plains, reduce loss of lives from flooding, reduce flood vulnerability and risks. Preserve ecosystem and their associated bio-diversity. It has a capacity to address new challenges with sustainable development; it gives wider focus and policy options. Very important part of it is multidisciplinary and multi sectoral approach. Truly said it is river basin approach. Functions of IFM are three pronged , during pre floods ( information and data collection, flood proofing buildings, proper drainage arrangements), during floods ( forecasting, evacuation and relief, pollution control and flood fight and post floods ( rehabilitation , flood insurance , liability for flood loss, assessment of losses due to floods, land use planning, flood plain zoning)

**Bye laws:** role of law is very important. Law defines institutional roles and responsibilities. Protects rights and even obligations. Law provides mechanism for dispute management. Role of the flood manager is to implement flood management policies within the given legislative framework.

**Public Participation:** whatever efforts are done, they are ultimately for public. Each individual has an individual liability and responsibility which comes as joint effort in the form public participation when large masses joins. Public participation removes doubts and disputes. Benefits ultimately reach to the needy in quantity, quality and time.

**Awareness campaign:** without awareness people live in darkness. They do not know about the

floods how they originate from where they originate and what route they follow. A little geography will help public to know much more about the floods. Responsibility of spreading awareness lies with government owned and operated public media. Role of the public is to be sensitive, receptive and reactive. Awareness campaign by government can make public knowledgeable about these modern days temples and develop sense of owning it and even running it in participative way. Days are not far when legislations will empower the public in running and maintaining these temples.

**Role of Media:** Role of media is important in giving the right and balanced picture to the public, rather catering them with one sided half cooked information igniting the negative emotions during disasters.

### **PRIORITIES**

Though this paper deals with the city of Surat of Gujarat state. However following may be the priorities before water managers anywhere. Planners and end implementers in general while dealing with floods and downstream channel handling along with urbanization.

1. Real time flood forecast system must be developed at the earliest possible.
2. Rule levels should have flexibility and should not be rigid and scope for change should be there. Authority must be free to change the rule levels.
3. Development in flood plains cannot be stopped however damages in flood plains must be minimized.
4. There must be proper operation of reservoirs.
5. Flood Plain Development Authority must be created
6. Similarly River Development Authority must be constituted.

7. Public awareness program must be initiated for educating laymen.
8. Disciplining media.

### **CONCLUSION**

Environmental changes are different from climatic changes. Environmental changes are more due to human oriented activities, which ultimately affect the climate and marked climatic changes are observed. In and around Ukai project human activity oriented environment changes are more predominant over climatic changes. Changes due to climate are not so visible requiring immediate attention. Every irrigation project is unique comes with site specific technical and social aspects. Looking into the location, physiological, hydrological and geographical aspects, Ukai project is a unique project which comes with its own hugeness and typicalities and project of such scale are required to be viewed with same broad outlook and perspective. Downstream of Ukai project is where environmental changes are visible. Development of flood plains is a must and requires multidisciplinary approach. Lack of laws is giving free hands to all. Hence there must be proper laws for developing flood plains. Challenges must be carefully studied and analyzed before going for mitigations and adaptations. Holistic approach in running the water resource project is educating masses; involving and making them part of system. Evolving more transparent, public oriented participative attitude and transforming this attitude in practice.

### **REFERENCES**

**Ukai M & R Manual** (for Salient Features and food routing arrangements )

**CWC website** (for details about Tapi basin)

**Random** Surfing of net.

**Annexure I**

**SALIENT FEATURES OF UKAI PROJECT**

District	Surat
River	Tapi
Total Catchment Area (sq.kms)	62225.00
Net Catchment Area (sq.kms)	62225.00
Average Rainfall (mm)	785
Maximum Discharging Capacity Spillway (cumecs)	49490
Crest RL (in m)	91.14
Outlet Sill Level (in m)	78.78
Full Reservoir Level (in m)	105.16
Highest Flood Level (in m)	106.99
Free Board (in m)	6.10
Top of Dam RL (in m)	111.25
Submergence Area (in ha)	60075
Live Storage in M.cu.m.	6729.90
Height above foundation of earthen dam (in m)	68.58
Total length (in m) Earthen Dam	4926.83
Gated or Un gated	GATED
No. of Gates	22, 15.544m x 14.782m