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Research Article

Survey of Existing Water Resources and Water Quality of Surat-Navsari Region under Development in Context to the Twin City Proposal

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Abstract

Surat is registered as the fastest growing GDP in India. With this due consideration the adjacent city Navsari has been identified as a twin city by Government of Gujarat. This paper is complete survey of the Surat – Navsari region in context to the population, occupation, income, type of land,its utilization, and various resources. This sort of cluster development in residential and industrial sector is going to help achieve the goal of twin city sooner than expected. The development of a region demands water as water being the main essence of life. Identifying the water resources for sustainable development is of prime importance.

Keywords: *Sustainable, Water Resources, Ribbon development, Navsari Region*

1. Introduction

Surat is registered as the fastest growing GDP in India. Considering this growth, Navsari has been identified as a twin city and Surat-Navsari region is on development. This sort of cluster development in residential and industrial sector is going to help achieve the goal of twin city. The development of a region demands water as water being the main essence of life. Identifying the water resources for sustainable development is of prime importance.

This is considered as the first concrete step towards establishing Surat-Navsari as a twin city by 2025 which would have an estimated population of 1.25 crore. The entire area is overseen by the Surat Urban Development Authority (SUDA) and a Gujarat state government organization in charge of town planning, development, transport and housing.

The authorities of the local civic body and SUDA have started looking at the mega development of the 60 km area connecting Surat and Navsari. As said by an official of SUDA, "This sort of cluster development in residential and industrial sector is going to help achieve the goal of twin city sooner than expected,"

As the water is more important for people and due to the limited water resources in the Surat-Navsari region the concept of Surat-Navsari Twin city may get affected or failed. There are many regions where the availability of water is below par; that means they are not getting water constantly or there is not much water to drink and use. For that proper planning and execution is required to avoid the unavailability of water resources in the twin city region.

The objective of our project is to solve the problem collectively, traditionally, economically, qualitatively, so as to fulfill the minimum demand of water for the long time. This objective can be achieved by increasing the water resources by different surveys and proper methods.

2. Proposed area under consideration

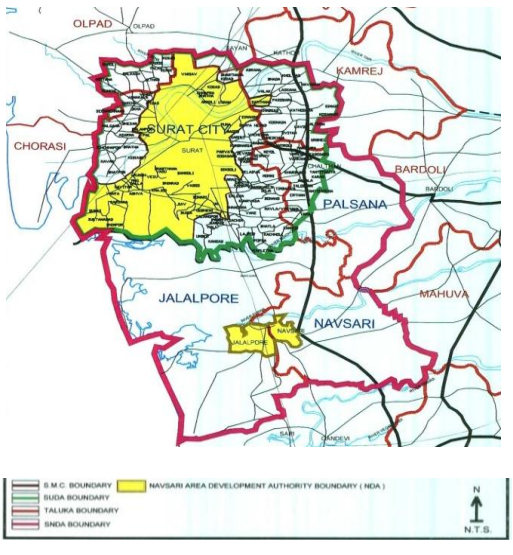

Figure 1 Boundaryof the area under study

Figure1 shows the boundary of the area under study.
In figure black line showing the area under surat municipal corporation boundary, green line indicate SUDA boundary, dark brown line indicate taluka boundary, Red line indicate SNDA boundary, yellow highlighted area indicate Navsari area development authority.

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Yellow highlighted area is the fully developed region of surat and navsari. The area between these two cities is yet under development.

2.1Existing Scenario of population growth of four decayed

Table 1: Details of the population and decadal growth rate

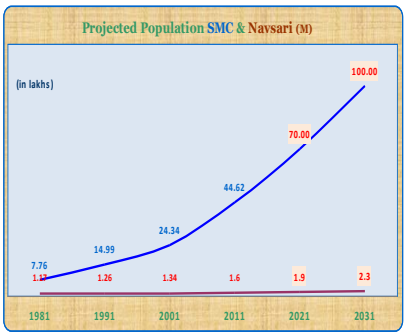
Surat (SMC)			Navsari(M)	
Year	Popu-lation	Decadal growth rate	Popu-lation	Decadal growth rate
1981	7,76,583	----	1,06,410	--
1991	14,98,817	93.17	1,26,089	14.00
2001	24,33,835	62.37	1,34,017	6.35
2011	44,62,002	83.32	1,60,100	19.40
2021	75,00,000	60.00	1,90,000	20.00
2031	100,00,000	45.00	2,30,000	20.00

Courtesy: Surat Urban Development Authority

The above table shows the past, current and future population of the Surat and Navsari region and also defines the overall growth rate of cities.

Forecasting the population growth helps in assuming the water supply demand per capita per person. Its graphical representation is shown in figure 2.

2.2 Graph representation of projected population



Courtesy: Surat urban development authority

Figure 2: Projected population

The above figure2 indicate tremendous population growth from 2001 to 2011.Figure also indicate the projected population of the Surat-Navsari region of 2031.

2.3 Covered area

SUDA vide its letter date. 30.11.2009 sent the proposal to the UD&UHD for the constitution of Surat – Navsari Urban Development Authority for the area admeasuring 2050 Km^2.

Table 2: Detail about area

Name of region	Area Km^2	No. of villages
SUDA	722	95
Navsari ADA	8.55	------
Navsari Taluka	263	70
Jalalpur Taluka	925	72
Palsana Taluka	147	32
Total (approx.)	2050	269 (174)

Courtesy: Gujarat Village Dictionary 2001

These five regions covers total area of 2050 km^2 and has around 269 number of villages which are covered for the development of twin city.The details of which are indicated in Table 2.

2.4 Total number of water bodies

Table 3: Detail about water bodies (lake, river, canal, sprinkle, etc.)

Name of Region	No. of water bodies (lake, river, canal, sprinkle, etc.)
SUDA	1
Navsari Taluka	6
Jalalpur Taluka	1
Palsana Taluka	7
Total (approx.)	15

Courtesy: Gujarat Village Dictionary 2001

Table 3 gives detail about the water bodies existing in these areas or in nearby Areas like river, lake, pond. By which we can conclude the approx water storage capacity.

2.5 Amount of rainfall

Table 4: Amount of rainfall

Name of Region	Amount of rainfall (in mm)
SUDA	2135
Navsari Taluka	1219
Jalalpur Taluka	2412
Palsana Taluka	2054
Total (approx.)	7820

Courtesy: SUDA and NADA Website

This table contains average rainfall data about major district and talukas covered by the region.

2.6 Rainfall Graph

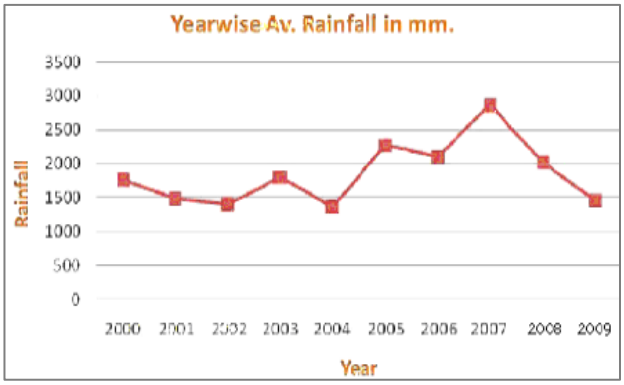


Figure 3: Navsari rainfall graph 2000-2009

2.6.1 Description of rainfall graph

Figure 3 shows yearly rainfall variation of Navsari region. So we can conclude that the yearly average rainfall is not constant, showing the considerable variation in yearly rainfall that may affect the overall water supply and daily consumption uses.

Figure 4 shows the yearly rainfall variation in Surat region. It is not showing very large variation in annual rainfall so it may not affect the water supply and uses. But increasing population and industrialization will affect the future water demand.

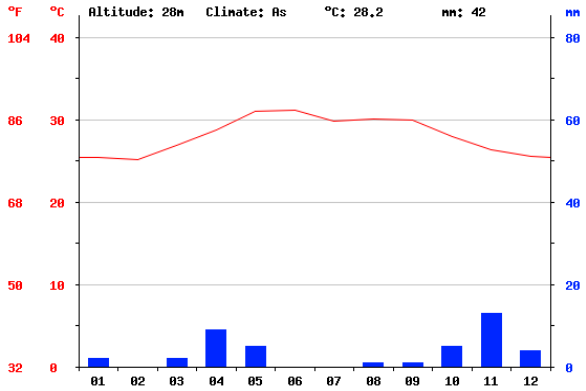


Figure 4: Rainfall graph of surat 2001-2012 Courtesy: SUDA and NADA Website

2.7 Daily water consumption

Population, industrialization and many other factors are playing major role in the daily water consumption. The given below graph shows the daily average water supply of surat region which is increasing simultaneously day by day.

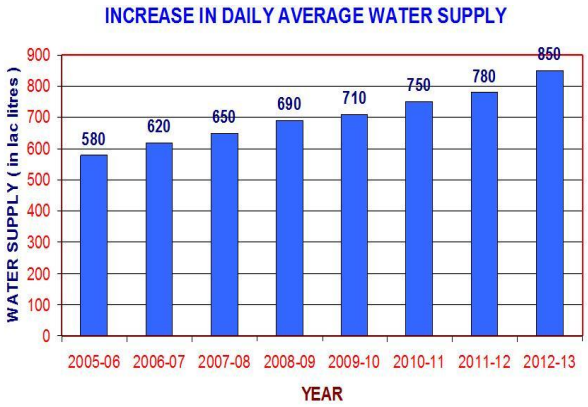


Figure 5: Increase in daily average water supply

3. Region under Survey

The area of Surat-Navsari region is very large to be survey, so it's little bit difficult to conducting the survey work which gives every detail about the whole region. So we will going to survey limited area of this large region so that we can analyze the each and every small detail about that region.

3.1 Area of application

3.1.1 Total survey region

From below figure the area under red border shows the total area of Surat- Navsari region and the white border shows the total area under this survey. These areas are divided into North, South, East and West zone for detailed survey. The satellite image of these survey zones are shown in figures 7,8,9 and 10.

Courtesy: Google Earth

Figure 6: Surat - Navsari region

3.1.2 North region

Figure 7: North Region Area

3.1.3 South region

Figure 8: South Region Area (Courtesy: Google Earth)

3.1.4 East region

Figure 9: East Region Area

3.1.5 West Region Area:

Figure 10: West Region Area (Courtesy: Google Earth)

4. Result analysis

4.1 Number of villages in region:

Table 5: List of Villages

List of villages	
Sachin	Umber
Lajpur	Pali
Kpletha	Nandod
Dabhel	Dalki
Vesma	Parujan
Vijalpor	Simalgam
Kasabpar	Magob
Kabilpore	Parsoli
Delwada	Nimlai
Bhinar	Machhad
Dipla	Karadi
Asubdar	Wada
Tavdi gam	

Courtesy: From Survey

These villages are covered into the survey region of proposed area; there are mainly total 25 numbers of villages and several other small villages are covered in the proposed region.

4.2 Area and waterbodies of villages

Table 6: Area and water bodies of villages

Name of villages	Area (km^2)	Total number of water bodies (Lake,river, canal etc.)
Sachin	15.12	10
Lajpur	5	10
Kpletha	3.2	10
Dabhel	4.50	10
Vesma	6.61	10
Vijalpor	3.67	10
Kasabpar	2.34	10
Kabilpore	5.7	10
Delwada	6.5	10
Bhinar	10.27	10
Dipla	9.69	10
Asubdar	4.18	10
Tavdi gam	7.22	10
Umber	4.8	10
Pali	1.8	10
Nandod	5.0	10
Dalki	1.61	10
Parujan	9.85	10
Simalgam	5.23	10
Magob	10.38	10
Parsoli	4.91	10
Nimlai	7.57	10
Machhad	10.39	10
Karadi	15.87	10
Wada	3.41	10

Courtesy: Gujarat Village Dictionary 2001

The above table 6 provide the detail of area(sq. km) and number of water bodies existing in villages.

4.3 Saline land in region

There are still some region in between Surat - Navsari region that consist most of saline land and water also because of the nearness to the shore line. Because of that these lands are not very use full for any kind of activity like farming, infrastructure development, etc.

Table 7: Saline land regions

No.	Name of the villages
1.	Umber
2.	Pali
3.	Nandod
4.	Dalki
5.	Parujan
6.	Simalgam
7.	Magob
8.	Parsoli
9.	Nimlai
10.	Machhad
11.	Karadi
12.	Wada

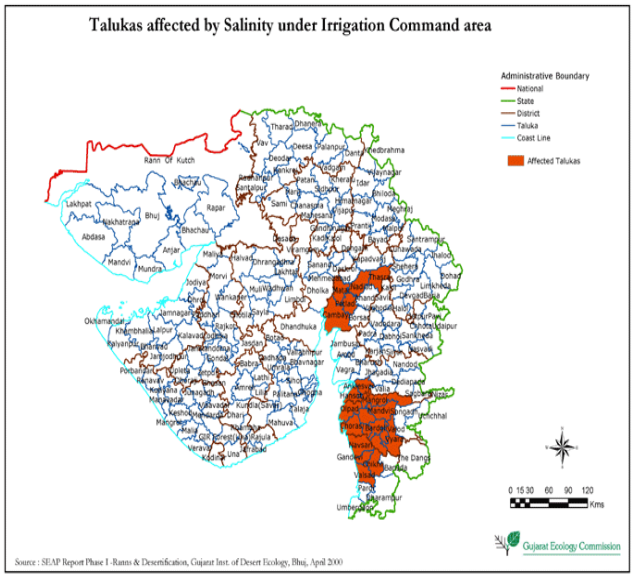


Figure 11: Saline region

The above figure11 shows the saline area of under study region.

Figure 12: Saline region

The above Figure shows the saline area near seashore.

5. Survey Report

5.1 List of villages

Pali	
Source of water :-	Boring
Population :-	1700 to 1800 (watters) 7000 to 8000 (total)
Type of land :-	Agriculture
Yearly income :-	15000 /-
Type of drinking water :-	Sweet water
Daily consumption :-	500 lts/unit
Quality of water :-	Salty
Vegetation :-	Good
Occupation :-	Farming
Name of Sarpanch :-	Arunbhai c. desai

Umber	
Source of water :-	Boring
Population :-	2000– 2200
Type of land :-	Agriculture
Yearly income :-	60000 – 70000 /-
Type of drinking water :-	Sweet water
Daily consumption :-	700-800lts/unit
Quality of water :-	Good
Vegetation :-	Good
Occupation :-	Farming
Name of Sarpanch :-	Shailesh R. Patel

Lajpore	
Source of water :-	Boring
Population :-	7920
Type of land :-	Agriculture and non-agriculture
Yearly income :-	15000 /-
Type of drinking water :-	Sweet water
Daily consumption :-	650 lts/unit
Quality of water :-	Good
Vegetation :-	Average
Occupation :-	Farming
Name of Sarpanch :-	Ashok fakir

Kapletha	
Source of water :-	3 Boring,
Population :-	4200 to 4500
Type of land :-	Agriculture
Yearly income :-	50000/-
Type of drinking water :-	Sweet water
Daily consumption :-	------- (30/- per month)
Quality of water :-	Good
Vegetation :-	Good
Occupation :-	Farming and job
Name of Sarpanch :-	Abdul

Vesma	
Source of water :-	Boring, waterworks, wells
Population :-	9000 to 10000
Type of land :-	Agriculture
Yearly income :-	----------
Type of drinking water :-	Sweet water
Daily consumption :-	----------
Quality of water :-	Good
Vegetation :-	Good
Occupation :-	Farming
Name of Sarpanch :-	Dhiru M. patel

Kasbapar	
Source of water :-	Boring, 4 waterworks
Population :-	2000 to 3000
Type of land :-	Agriculture
Yearly income :-	----------
Type of drinking water :-	Sweet water
Daily consumption :-	----------
Quality of water :-	Good
Vegetation :-	Good
Occupation :-	Farming
Name of Sarpanch :-	Amit R. Hadpati

Tavdi	
Source of water :-	Boring
Population :-	5000
Type of land :-	Salty
Yearly income :-	----------
Type of drinking water :-	Sweet water
Daily consumption :-	----------
Quality of water :-	Good
Vegetation :-	poor (only seasonal)
Occupation :-	Labor, Farming
Name of Sarpanch :-	Nirmala R. Rathod

Nadod	
Source of water :-	Boring, Canal water
Population :-	1680
Type of land :-	Agriculture and salty
Yearly income :-	60000 to 70000/-
Type of drinking water :-	Sweet water
Daily consumption :-	----------
Quality of water :-	Good
Vegetation :-	Good
Occupation :-	95% Farming, 5% job
Name of Sarpanch :-	Dilip M. Rayka

Dalki	
Source of water :-	Boring
Population :-	250
Type of land :-	Agriculture
Yearly income :-	> 40000 /-
Type of drinking water :-	Sweet water
Daily consumption :-	----------
Quality of water :-	Average
Vegetation :-	Good
Occupation :-	Farming, Job
Name of Sarpanch :-	----------

Delwada-Vadoli	
Source of water :-	Boring
Population :-	1150
Type of land :-	Agriculture and salty
Yearly income :-	----------
Type of drinking water :-	Sweet water
Daily consumption :-	----------
Quality of water :-	Average
Vegetation :-	Good
Occupation :-	Farming
Name of Sarpanch :-	Chetna R. Patel

Bhinar	
Source of water :-	Boring
Population :-	2200
Type of land :-	Agriculture and salty
Yearly income :-	30000 to 35000/-
Type of drinking water :-	Sweet water
Daily consumption :-	----------
Quality of water :-	Good
Vegetation :-	Good
Occupation :-	Farming
Name of Sarpanch :-	Nayna B. Patel

Nimlai	
Source of water :-	Boring
Population :-	1100 to 1200
Type of land :-	Agriculture
Yearly income :-	----------
Type of drinking water :-	Salty
Daily consumption :-	----------
Quality of water :-	Poor
Vegetation :-	Poor
Occupation :-	----------
Name of Sarpanch :-	Manubhai

Dipla	
Source of water :-	Boring, Waterworks
Population :-	1160
Type of land :-	Agriculture and salty
Yearly income :-	17000 to 18000/-
Type of drinking water :-	Sweet water
Daily consumption :-	----------
Quality of water :-	Good
Vegetation :-	Good
Occupation :-	Farming and job
Name of Sarpanch :-	Amrut K. Patel

Parujan	
Source of water :-	Boring
Population :-	2500
Type of land :-	60% salty
Yearly income :-	----------
Type of drinking water :-	Salty
Daily consumption :-	----------
Quality of water :-	Good
Vegetation :-	Average
Occupation :-	28% Farming, 72% labor work
Name of Sarpanch :-	Bhangiya B. Hadpat

Aloora	
Source of water :-	Boring
Population :-	562
Type of land :-	Agriculture and salty
Yearly income :-	----------
Type of drinking water :-	Sweet water
Daily consumption :-	----------
Quality of water :-	Good
Vegetation :-	Good
Occupation :-	Farming, Job, 5% NRI
Name of Sarpanch :-	chetna R. Patel

5.2 Water sample test results

Table 5.2 Water sample test results

Name of	PH	Hardness	Chloride	TDS
Bhinar	7.23	400	44.98	900
Pali	7.76	230	289.91	530
Lajpur	7.6	685	789.75	1120
Dipla	8.10	135	39.98	30
Kasbapur	7.28	615	89.97	640
Dabhel	9.60	175	32.48	6240
Parujan	8.38	80	32.48	2000
Kapletha	7.87	250	379.89	2100
Nadod	7.71	280	202.44	2630
Dalki	7.55	495	342.39	3620
Parsoli	8.04	190	37.48	1180
Vadoli	7.83	380	212.43	2590
Vesma	7.88	205	39.99	270
Tavdi	7.67	610	349.90	4000
Umber	7.80	145	54.99	550

The water sample of the regions under study have collected and analyzed for the parameters such as pH, hardness, chloride, TDS. The results of which are indicated in Table 5.2 .

5.3 Land use

Table 5.3 Calculation of proposed area

Calculation of proposed area (230.8235 sq. km)		
	Area (sq. Km)	Area (%)
Residential	91.7270	45
Commercial	4.07647	2
Industrial	14.267645	7
Public & semi-public	14.267645	7
Recreational	26.497055	13
Transportation& communication	22.450585	11
Agriculture	30.573325	15

Above table 5.3 shows calculation of proposed area using UDPFI (urban development plan formulation and implementation) guidelines.

Conclusion

From the survey conducted in the Surat Navsari region it can be seen that the saline land which as such cannot be used for agriculture has a potential to be developed into a residential zone with all basic amenities. Majority of the land in this region is used as an agricultural land. Survey reveals that some of the land in Navsari region is saline, which is neither used for agricultural neither as residential. It finds high potential of development with the increasing population growth. To meet the water requirement along the existing water sources rain water harvesting approaches can be practiced both in the form of artificial lake as well as ground water recharge. The development in the saline land will justify the twin city concept and sustainability of the project.

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