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Analysis of Water Availability, Supply System and Consumption in High Rise Residential Areas in Jaipur City

Satish Kumar Sharma
Research Scholar,
Deptt.of Geography,
University of Rajasthan,
Jaipur, Rajasthan

Abstract

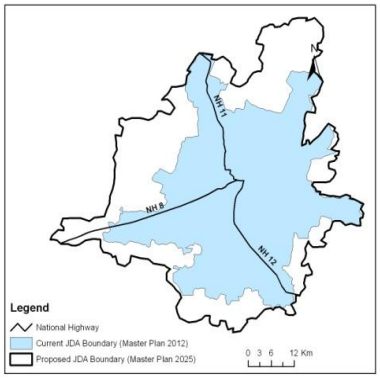
Water is a resource which cannot be produced or added as and when required by any technological means. The immense demographic expansion due to migration from surrounding villages, leads to urban sprawl. This is being decongested by the vertical living in metropolitan areas. The vertical growth of any city demands a well knit supply system and certainly a frequent availability of portable water as the per capita consumption rises with rise in room density vertically .The paper studies the availability, supply system and consumption of water in its various concerns in the high rise residential areas of Jaipur city. The increase and spatial distribution of urban area housing the ever increasing population has been dealt in the paper taking legislative wards as unit.

Keywords: High Rise, Wards, Vertical Living, Room Density, Urban Sprawl.

Introduction

The city gradually expanded its municipal frontiers to meet the demands of the increasing population. The inadequacy of the walled city to provide additional housing facilities to a very large number of growing people led to many new colonies in the outlying areas. After the ten fold increase in no. of ward at present the total no. of wards are 91 within 8 zones.This tenfold rise in wards requires the government to adopt state of an art system for the growing population in terms of water supply and subsequently sewage and garbage disposal.

JDA BOUNDARY 2011-2025 **Municipal Wards 2019**



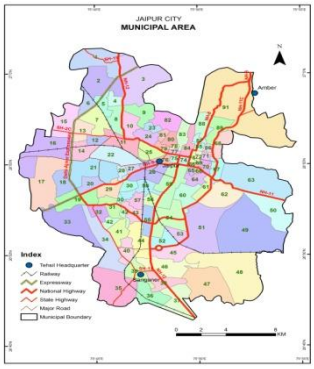
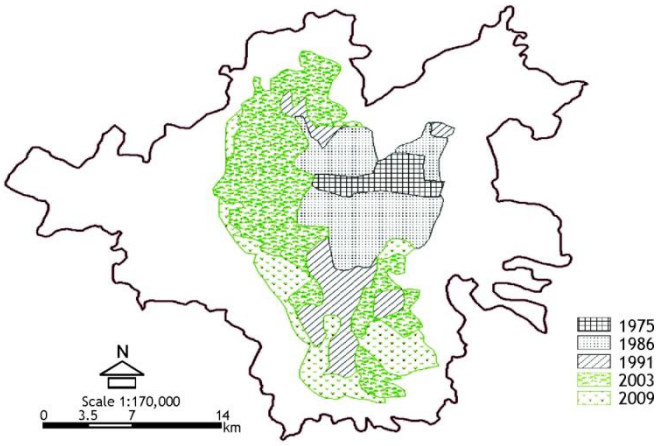


Fig:1 Fig:2

Source: Jaipur Development Authority 2018.

Expansion of the City

Fig:3
Urban growth: 1975-2009



Source: JDA Master plan 2011

The city has been gradually expanding its municipal frontiers to meet the demands of the increasing population. It is obvious that the walled city can no more provide additional housing facilities to a very large number of people as its area is restricted by the enclosing wall. Resultantly many new colonies have come up in the outlying areas.

In the nineteen thirties, five "development" colonies – Adarsh Nagar, Ashok Nagar, Bani Park, New Colony and Civil Lines were set up. The Adarsh Nagar colony was constructed particularly to house the post-partition refugees from Pakistan. Another colony, Civil Lines, was constructed in order to provide residential facilities to senior Government officials.

After the 1948 Congress session at Jaipur, the foundations of Bapu Nagar and Gandhi Nagar were laid in the space used for the session. The S.M.S. Highway was extended beyond Gandhi Circle in 1958 and today elegant buildings stand on both sides of this road. Most of these come under the community service zone of the city. Tilak Nagar along with the new Rajasthan University campus emerged during the nineteen fifties. The early sixties witnessed the rise of Jhotwara as an industrial area.

With the establishment of the Rajasthan Housing Board in 1970, two new housing colonies have come up at Jawahar Nagar in the east and Nahri ka Naka in the west, while another colony is planned to be developed in Van Vihar. Moreover, new housing colonies for low income group are being set up near Ajmer Road, Station Road, Tonk Gate and Galta Road, — some of these with the financial assistance of the Rajasthan State Co-operative Housing Finance Society ltd.

These new colonies because of their spaciousness, have, a special attraction for the middle income and higher income groups of population. As a result the process of growth is faster in the newer colonies than in the walled city. In fact an increasing number of people are shifting to these localities either to their own houses or to some rented accommodation. The changing social structure, and particularly the gradual disintegration of the joint family system, also appears to be a catalyst for the demand of new houses

At present on the basis of census 2011 the municipal corporation has been divided into eight zones comprising of ninety one wards inhabiting 30,46163 people.

Table:1

S.no	Zone	Wards	No. of Wards
1	Vidyadhar Nagar	1,2,3,4,5,6,7,8,9,10,11,12,13,14, 23,24,25,79,80,81,82	21
2	Civil Lines	15,16,17,18,19,20,21,26,27,28, 30,56,57,58,76	16
3	Sanganer	35,36,37,38,39,45,46,47,48,49, 50,52	12
4	Mansarovar	29,31,32,33,34,40,41,42,43, 44,45	11
5	Moti Doongari	51,53,54,59,60,61,62,64,65	9
6	Hawa Mahal(East)	63,66,67,68,69,70,71,72,73, 85,86	11
7	Hawa Mahal(West)	74,75,77,78,83,84	6
8	Amer	87,88,89,90,91	5
	Total no. of wards		91
	Total population		30,46163

Source: Jaipur Development Authority 2018

Review of Literature

Since antiquity elevation had been the sole criterion and an accepted parameter to name a building a high risee. The connotations of HRBs had been variable over time as indicated by Alexander (1977).

High-rise buildings are exceeding the level of a tree in its natural surroundings i.e. higher than 12-15 meters.

A rebirth of the freedom loving adventurous through of man marked the way of industrial revolution in 1851. Hence the advent of concrete during 1870 and its use in structures became insurmountable. Charles, (1981) stated that the production of concrete helped reconstruction of the whole cities sabotaged during world war II hence solved the problem of an urgent need for adequate and affordable shelters for millions of people who become homeless. This led to the beginning of a new era in cityscape in Europe and America with High Rise Buildings.

High Rise Buildings require special engineering due to its height which becomes a sole criterion for getting differentiated with conventional low and medium rise buildings. The specially engineered building poses a significant impact during evacuation, (Scott 1998)

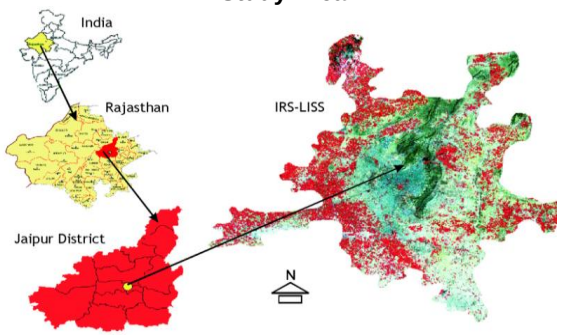
The 20th Centurycity was largely an outcome of unselfconscious competition amongst individuals and architects designers in order to capture a market for their services. The advent of state of an art technology in the construction industry for the maximization of profits hence their dexterity in constructing High Rise Buildings. (Kurata, 2001)

Kurata, 2001, Comprehensive City Planning Urban (Design, (Japan International Cooperation Agency), 7.

Bertaud (2011) Urban sprawl is the result of low FSI policies in India as the city region is an outcome of decrease in rent and prices in contrary to limiting regulation of FSI and land use.

To supply the water equally to each house and to stop the water theft practice by people[Shaik. Kaja Rahamtulla et al, 2011] various technologies have been invented using embedded system[E.Vinothiniet al, 2014].

Fig: 4
Study Area



Jaipur is situated amidst the Aravali hill ranges at an altitude of about 430 metres above mean sea level and lies on latitude $26^0 55'$ north and longitude $75^0 50'$. Koeppen climate classification BSh. The greenery around the city belies the fact that this is the capital of Rajasthan – a desert state. The hill ranges girdle the city from three sides, thus leaving only the southern region for further expansion.

Jaipur is directly linked with several large towns inside and outside Rajasthan by road, rail and air. It is an important railway junction on the Delhi-Ahmadabad railway line . Besides, National Highways Eight and Eleven run through the city of Jaipur , while Highway One links Jaipur with Kota- the industrial city of Rajasthan.

The climate of the city is dry and the temperature fluctuates between 25^0C TO 41^0C in summer and and between 6.5^0C to 25^0C in winter. The average annual rainfall is 62 cm. While the average humidity in July is 80%. This approximately 240 years old city has been known for its splendid architecture, christened as Pink City

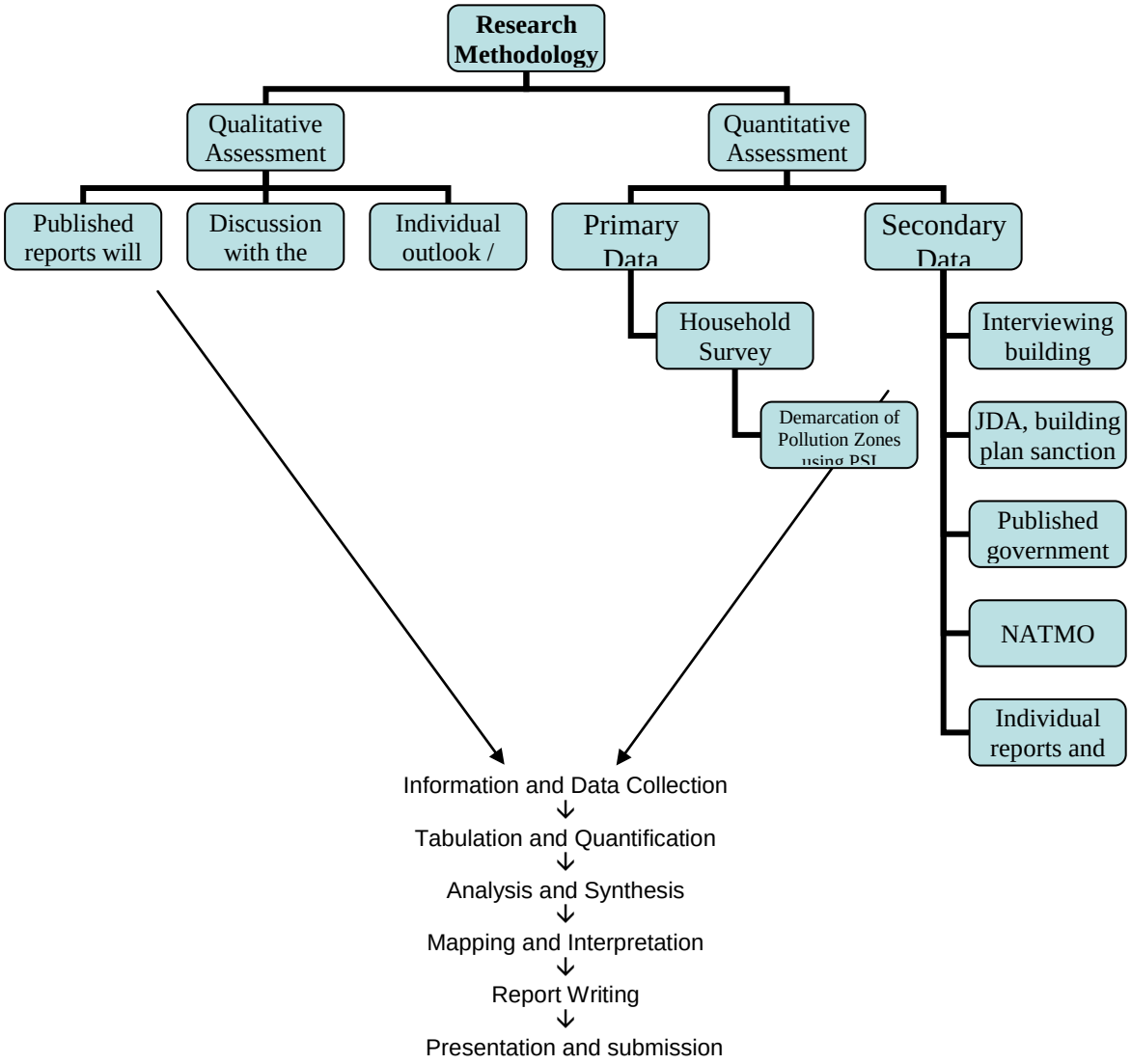
Objective of the Study

To analyse water availability, supply system and consumptio in high rise construction areas of jaipur city

Data and Methodology

Ward boundaries are generated with Arc GIS 10.2 and Erdas Imagine 2011 Initially Google Earth application followed by LISS-4 /PAN -temporal and multi-resolution satellite data for the interpretation of images pertaining to 2012-13 and 2016-17 Both secondary and primary data has been used. Classified decadal record of the ward wise residential and commercial buildings constructed between 2012-13to 2016-17 from Jaipur Municipal Corporation and Jaipur Development Authority

Location of all the high rising residential building will be determined using GPS. Spacing of such HRBs will be analysed in terms of neighbourhood civic amenities.



Discussion

Source of Water

Historical Perspective

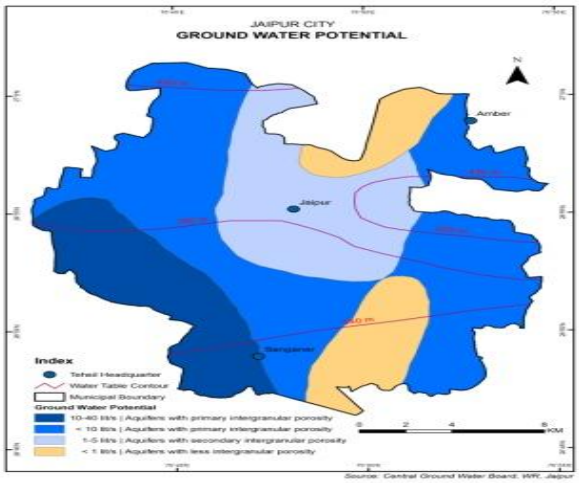
Water was considered as a plentiful resource till the beginning of the 20th century but now it is considered as a scarce resource and in few places people are facing water crisis situation.

Jaipur city has limited fresh water resources since antiquity and according to population projections the current scenario will further led to water crisis**.** In 1873 Amanishah Headworks was installed with a capacity of supplying 10 lac gallons of water per day. Subsequently its capacity was increased threefold.

On account of ever increasing demand for water, another scheme was launched in 1931, involving a coast of Rs. 32.95 lacs. Thjis project of Ramgarh Bandh – situated in the vicinity of the city was meant to fulfil the requirement of 15000 people. Its initial capacity was limited to 22 lac gallons per day. Later however it underwent two gigantic expansion schemes in 1955 and 1963 respectively. As a result of these schemes the daily supply from Ramgarh Bandh has gone upto 75 lac gallons.

Ground Water Potential

Fig: 5



The above figure reveals the groundwater potential in the studied area

Existing Supply Arrangements

Due to inadequate municipal water supply, exploitation of underground water is the next alternative and this has led to depletion of the water table (*Gopagani and Bhole,* 2009).

The unprecedented increase of urban population 24.88 percent according to the census year 2011in the city caused a negative impact on the whole urban environmental scenario and it is beyond the capacity of the administration to fulfil the increased demand for supply of purified water. Ground water is dropping at the rate of 1.7 meter per year and the gap in demand and supply of water further amounts to groundwater extraction.

The present water demand in the Jaipur city is 462 MLD. The supply remains 374 MLD and the deficit of 90 MLD remains a challenging task at the disposal of state government.

Salient Features of the Existing Water Supply

Table:2

Total Municipal Area	467sqKM
Area Connected by Piped Water Supply	215sqKM
Population of City 2011	30.07lacs
Present Population	31.12lacs
Population connected with water supply	29.70lacs
Present Water demand	462MLD

Source: ICRIER(Indian council for research on international relations 2015

Water Production and Supply

Table:3

From Bisalpur System	275MLD
From Tube wells (1900Nos.operated on rotation)	97MLD
From single point tube wells (117nos)	2MLD
Total supply	374MLD
Total deficit	90MLD

Source: ICRIER(Indian council for research on international relations 2015

Details of Water Distribution System

Table: 4

Length of Pipeline Network	23500KM
Installed Pumping Sets	12100KW
Service Reservoirs	95
Clear Water Reservoirs	78
Pumping Stations	85
No. of Water Supply Zones	162
Per Capita water supply (average)	125LPCD

Source: ICRIER(Indian council for research on international relations 2015

Water Connections

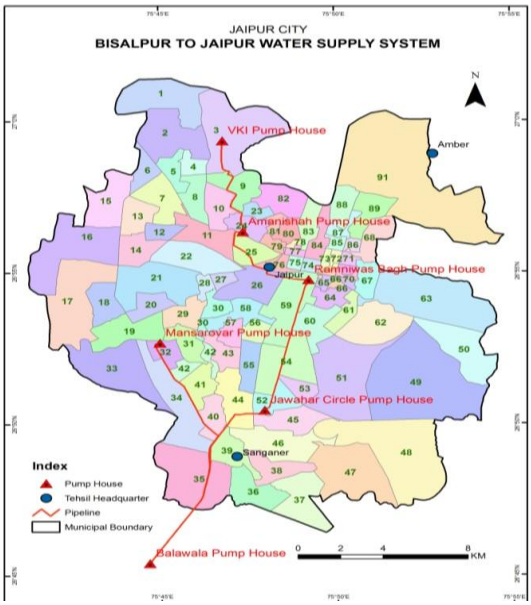
Table: 5

Total Connections	390893
Working Connections	352393
Metered Connections	384058
Domestic Connections	329093
Non Domestic	51246
Industrial Connections	3719
Public Stand Post	1170

Source: ICRIER(Indian council for research on international relations 2015

Drinking Water Supply Scheme of Jaipur City

Fig:6



Self compilation by author

Water supply system: Bisalpur

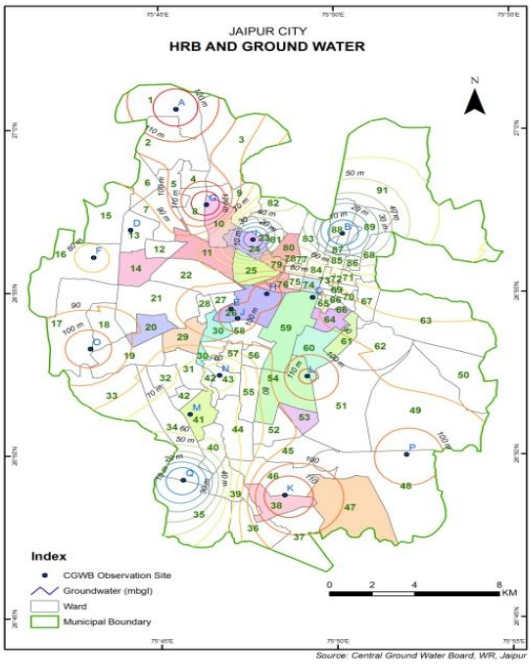
The above figure gives a glimpse of the transportation of portable water in the Jaipur city.

Six water transfer pumping stations are operated for transfer of Bisalpur water at designated head works. The system is operated and monitored on Supervisory Control and Data Acquisition *(SCADA)*. Water from tube wells is collected in local head works and transferred to required areas. Moreover the consumers are benefited from local head works through Clear Water Reservoirs, Pumping Stations, Service Reservoirs and Distribution system. Old city area, Walled city is made accessible from distant pumping stations located at Amanishah, Ramniwas Garden and Laxman Doongri Head works due to absence of local storage reservoirs. There is intermittent water supply and the average duration is from 120-90 minutes per day. The quality of water is regularly monitored.

Raw water is pumped from Bisalpur dam to filter plant 400 MLD at Surajpura. After the filteration and chlorination is done the treated water is transferred to rural areas and jaipur city upto Balawala pumping station. Central feeder pipeline runs from Balawala to jawahar circle, Ramniwas bagh, Amanishah, Shastri nagar, Vidyadhar nagar, VKI area. Jawahar circle to Mahesh nagar, Triveni nagar, Barkat nagar. Rambagh to jyoti nagar, Civil lines, Shanti nagar.

Likewise western feeder canal from Balawala to Mansarovar, Shyam nagar,Vidhyut nagar, Khatipura, Jhotwara. The following map depicts the pipeline transmission system of the Jaipur Municipal Area.

High rise buildings and groundwater contours
Fig:7



The above figure depicts the concentration of high rise buildings and contour lines of ground water availability. The maximum concentration in the present decade lies the wards 24,25,57 i.e Moti doongari ,Civil Lines and Bani Park respectively. The water availability in the said wards is within 100m depth approx.

Suggestion

The following suggestions and recommendations are made based on the field study and subsequent observations:

Research and Development to explore the feasibilities for waterless urinals and low flush systems should be given priority in order to save large amount of water annually

Rainwater harvesting structures should be made mandatory in high rise buildings.

The water collected through such structures can be used for gardening processes, car and floor washing and etc. the multi-storied residential buildings can be served by their own water treatment plant, sewerage treatment plant (STP plant) for hygienic disposal of sewerage, gas bank, own power station, provision for re-cycling of waste water, rain water harvesting, development of solar power panel, landscape gardening, imaginative layouts etc. It will not only reduce the pressure on the municipal civic services but also can serve the building dwellers at their satisfactory level and above all can maintain urban environmental quality

To maintain the sustainabilility of urban environment, policies and byelaws should be made in the fitness of present urbanism. The Registered and organized real estate builders should be prioritized in allowing the high rise constructions. The concerned authority should be equipped with enough powers in taking strict actions against the defaulters. Strict vigilance against monetary and political influence should be institutionalized. The nature of land should be examined properly before construction of any multi-storied tall residential apartment in terms of the infrastructural facilities and municipal civic services. The urban environment in terms of greenery, sewerage, solid waste management etc.should be taken proper care.

The improper urban morphology should be checked by paying attention to road alignments and building lines, height of the building in relation to the width of the road on all sides, structural safety and scrutiny of the building plan, minimum open space at ground in relation to the height of the building, parking provision, earthquake resistance, fire services within the building premises etc.

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