OPEN ACCESS
Quick Response Code:
Website: https://wgges.us

Manuscript ID:
IJWGAFES-2026-030216

DOI: 10.5281/zenodo.20280790

DOI Link:
https://doi.org/10.5281/zenodo.20280790

Volume: 3
Issue: 2
February
Year: 2026
E-ISSN: 3066-1552

Submitted: 06 Jan.2026
Revised: 10 Jan.2026
Accepted: 05 Feb. 2026
Published: 28 Feb. 2026

[1]Ph.D. Student, Department of Geography, Akurdi College, Pune, Maharashtra, India
Email: sulesudhatai@gmail.com

[2]Principal, Shankar Rao bhelke College, Nasarapur, tehsil bhor, Pune, Maharashtra, India
Email: tshitole@yahoo.com

Address for correspondence:
Sugandha A. Sule
Ph.D. Student, Department of Geography, Akurdi College, Pune, Maharashtra, India
Email: sulesudhatai@gmail.com

How to cite this article:
Sule, S. A., & Shitole, T. A. (2026). Impact of human Intervention in river Basin: A Case Study of Waghire Odha in Pimpari Chinchwad City, Maharashtra. International Journal of World Geology, Geography, Agriculture, Forestry and Environment Sciences, 3(2), 72–77. https://doi.org/10.5281/zenodo.20280790

Impact of human Intervention in river Basin: A Case Study of Waghire Odha in Pimpari Chinchwad City, Maharashtra

Sugandha A. Sule[1], Dr. Tushar A. Shitole[2]

Abstract

Urbanisation changes the hydrological system by creating impermeable surfaces. The growth of urban areas near rivers is a critical global concern. The river is particularly important in the creation of settlements. It alters the overall channel geometry, channel pattern, and riffle pool sequence, in other words, all flow and shape characteristics. The Waghire River is a major tributary of the Pavana River in the Mula basin. The source's height is 693 meters, and the stream is ranked fourth. Cross-sections were gathered at these places to track changes in the area, using remote sensing data from 1990 to 2020.It has been observed and discovered that rural land use along the Waghire River has altered, as evidenced by changes in the channel's morphometry, slope, and cross-sectional area. The majority of the change occurred as a result of construction and the creation of concrete roadways in the channel, resulting in a more than 50% reduction in channel width at this location.

At the outset, we can assert that the process of urbanization is the most important prerequisite for the region's development, but it must be controlled by locals so that the region's development through urbanization does not disrupt the river's state of equilibrium.

Keywords: *River Waghire, Channel morphometry, Human intervention, land use.*

Introduction

Urbanization is rapidly increasing throughout the world. The migration from rural areas to cities is inevitable as economy is now more industrial and service based and not agro based as in past. Further rural infra-structure is not adequate to provide the increasing population. As a consequence slums are increasing resulting in random expansion of cities and towns keeping aside town planning obligations of development. With increasing urbanization, the problems associated with it are more visible. One such challenging problem is urban encroachment.

Intervention is a term used to describe the advancement of structures, roads, railroads, improved paths, utilities, and other development, the placement of fill, the removal of vegetation, or an alteration of topography into such natural areas as floodplains, river corridors, wetlands, lakes and ponds, and the buffers around these areas.

Constructed encroachments within river corridors and floodplains are vulnerable to flood damages. Placing structures in flood prone areas results in a loss of flood storage in flood plains and wetlands and heightens risks to public safety. The extent of encroachment, the cumulative effects of impervious cover, and the degree to which natural infiltration has been compromised can also contribute to the instability of the stream channel.

Review of Literature:

It has opined by most of the environmentalist and geomorphologies that we can stop the development but the effects of the urbanization can be controlled by some or other way. Cooke and Doornkamp (1990) has said that the most obvious manifestation of urban development is an increase in impervious cover and the corresponding loss of natural vegetation, land clearing, soil compaction, riparian corridor encroachment and modification to the surface water drainage network all typically accompany urbanization often quantified in terms of the proportion of boon area covered by imperious surfaces.

The study worked out by Gilewska (1964) focuses on the effects of hydraulic geometry of the Ekulu River in Enuku south eastern Nigeria the three section of river properties upstream of the town within the town and downstream of the town-urban hydrological routine due to urban drainage human traffic across the river banks. Gidding (2005) opined that landscape changes associated with urbanization have been showed to after flow regimes of stream that in turn after channel morphology aquatic habitat and biological communities in order to mitigate the effects of urbanization on biological communities, it, is, important to understand the hydrologic links between these infractions.

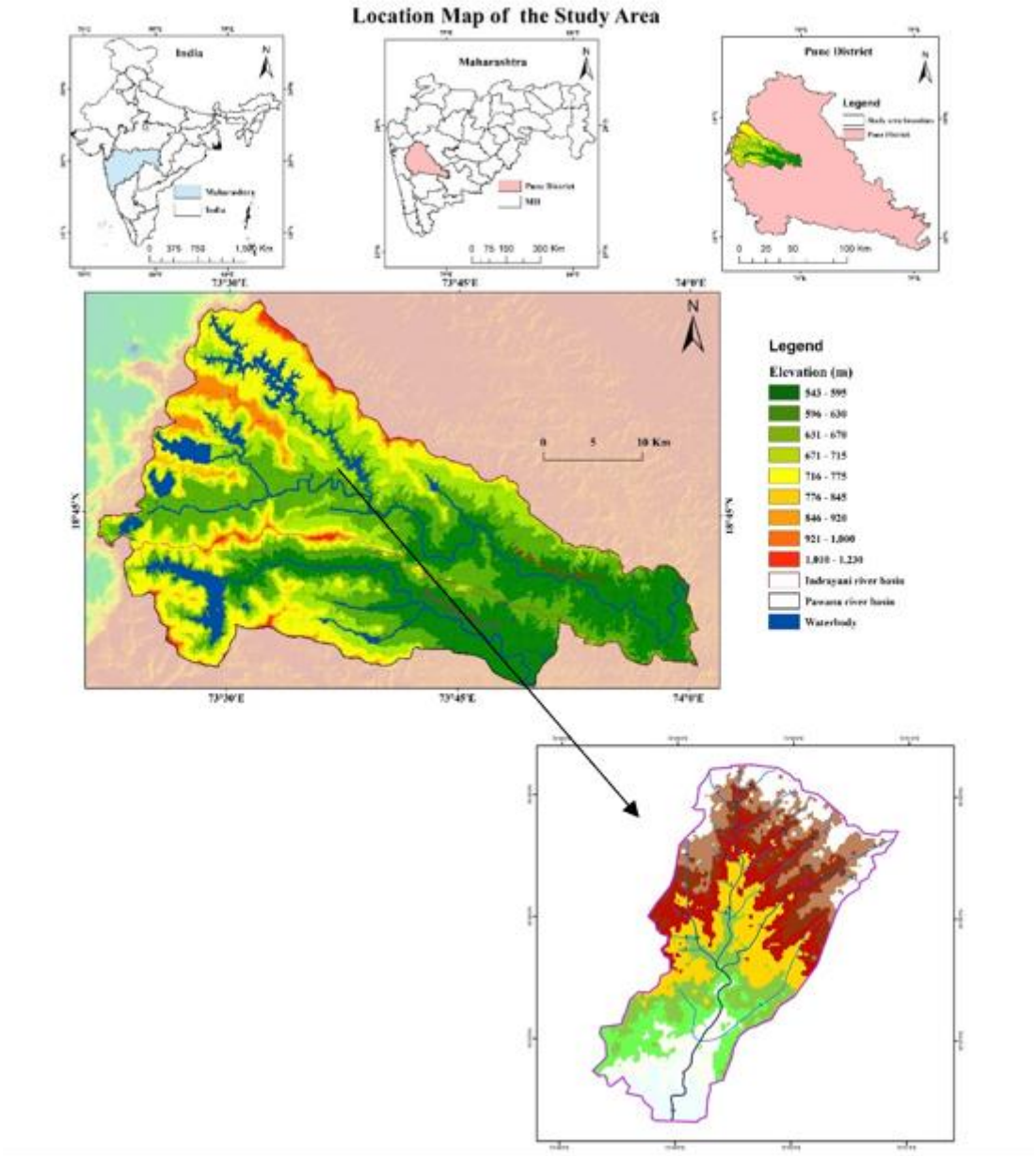
Stream bank vegetation significantly the morphology of streams in the piedmont region of the rivers allowing us to determine the combined influence of riparian vegetation and urbanization on channel morphology (Kale and Gupta, 2002). Rajgopalan (2005) in his environmental studies discussed the severe environmental degradation due to urbanization in which example of river Meethi and Dharavi slum is focused. Many others have also discussed many more aspects of urbanization on changing hydraulic geometry of river.

Objectives:

1. To study the channel morphology of Waghire Odha.
2. The observation of the construction in river channel last 3 decades.
3. To study the impact of urbanization on river channel morphology.

Study Area:

The River Waghire is one of the left bank tributary of river Pavana basin and it is a right bank tributary of River Mula. River Waghire has originate nearhills of Bhosari MICD area and kasarwadi in Pimapari chinchad city. Waghire basin spread over 11.2sqkm. study area located at the height of 613 meters ASL. Latitudinal extent is 18^0 35' N to 18^0 37' N and longitudinal extent is 73^0 83' E to 73^0 84' E.



Material and methods

To find out the impact of varying degree of urbanization on the morphology of Waghire odha is observed with the following points

- Field survey has been carried out to find out the effect of urbanization on channel morphology.
- Field measurement has been taken in the channel.

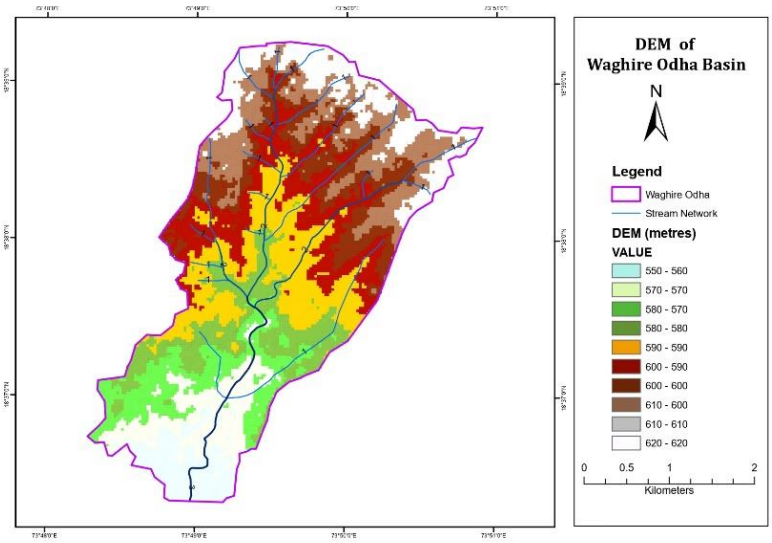
- Cross section and geomorphic sketches of area have been prepared.
- SRTM data

Following methodology is used for this research paper

- Demarcation of Waghire Basin from Survey of India toposheet No. 47 F/14
- Digitization is completed with the help of Global Mapper v15.1 software and ArcMap 10.3 software.
- Land use and Land cover Map and Change detection Analysis is done using ERDAS IMAGIN 2014
- Various maps are prepared.
- Review of literature is carried out from different sources.
- Detailed morphometric analysis of the Basin is carried out.
- Detail Geomorphic Survey and cross section of River Waghire at MIDC area Site along Pimpari Chinchwad City.

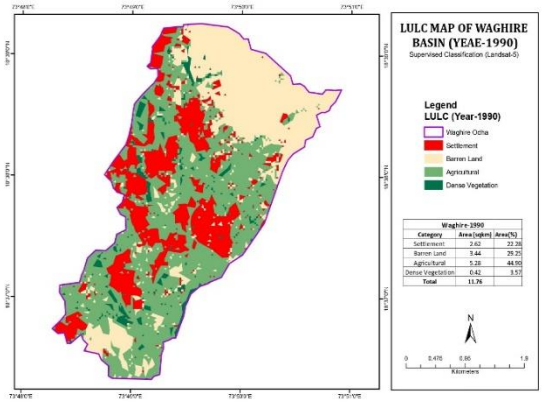
Waghire odha is left bank of tributary of Pavana River. It is a 3rd order stream out of which 19 are the first order, 3 are the second order and is a 3er order. It joins pavana near Kasarwadi in Pimpari Chichwad.

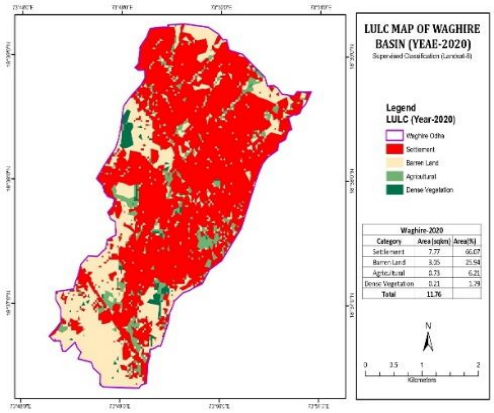
Stream Order	Stream No (Nu)	Stream length(km)
1	19	16.4185
2	3	5.9121
3	1	3.0033
Total	**23**	**25.33**



Supervised Classification (LANDSAT 5) and Change Detection

In 1990, this watershed area was occupied by water bodies 00%, Vegetation 3.57%, Agriculture 44.90%, Settlements 22.28% and barren land was 29.25% of the total area. Vegetation, Water Bodies, Agriculture and Barren Land together account nearly 62.1% area whereas remaining is occupied by human settlement, 37.9% area. In 1990, watershed area occupied by settlements like MIDC area, kasarwadi. During last 30 years a rapid growth of urbanization has been observed towards source region. Agricultural activities are limited.





In 2020 Water Bodies 7.6 %, Vegetation 1.79%, Agriculture on 6.21%, Settlements 66.07%, and Barren land 25.94% are observed in Waghire odha watershed area. The physical features occupied nearly 27.74% and human activities were present on 72.26% of the total land. Around 2020 settlement area has increased by 8.94%, i.e. as compared to the area

1991. It is observed that the southern and eastern part area newly developed residential area.

- **Spatio-temporal variation in Land use and Land cover**

Comparative LULC of Waghire basin area (1990 and 2020)

Sr. No.	LU LC	Area 1991 (Hectare)	1991 (%)	2020 (Hectare)	2020 (%)
1	Water Bodies		0.24	22.05	7.06
2	Vegetation	21.29	11.92	644	360.57
3	Agriculture	0.79	0.03	23.94	0.91
4	Barren Land	39.26	41.36	1188.36	1251.92
5	Settlements	37.91	46.45	1147.41	1405.89
6	Water Bodies	21.29	0.24	22.05	7.06

- **Non Existing Streams in Waghire basin area**

The drainage network analysis of waghire basin was carried out. The result indicates reduction in stream number. Rapid growth of urbanization is responsible for loss of 15 first order streams out of 19 during this period. 2 second order streams are now not in existence due to construction as well as slope alteration and mining activity. From 1970-80 to 2020 only 21.87 % streams are safe in concern area. This shows that around 79.13% streams are non-existing streams.

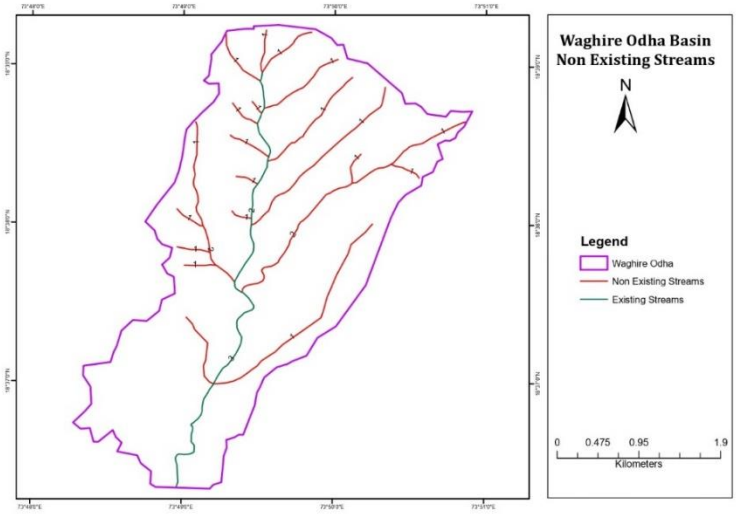
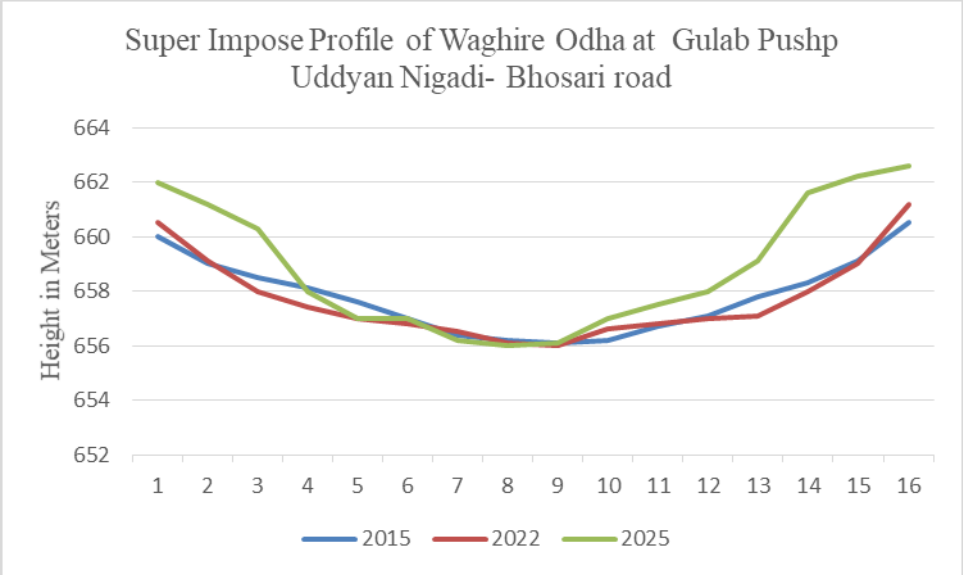


Fig: non existing Streams of Wahire Odha

Pic: Encroachment in channel

Fig: - Super Impose Cross profile of Waghire Odha



Bank width in 2015 is 16 m. which is reduce in 2022and remain 13 m. ans on year 2025 it is only 9 meters. Cross section along the waghire odha in bhosari is taken at Yashwant rao Gulab Pusshp Uddyan near Magar Stadium. Place where maximum built-up is observed as are of the representative section.

Urban expansion along the river shows changes in width and depth of the channel. Most of the building construction or a type of the encroachment settle along the natural levees of the river or the active flood plain. This basin observed for the more than 10 years, which shows that the width of the channel is reduce by 6 m. whereas depth is increase from 1.7m to 0.9m. Width depth ratio is not proportional.Banks are also of the compact material and hence encroachment is on larger scale which leads to restrict the width

Results and Discussion

- The concern is that urbanisation has destroyed more than 90% of its tributaries of waghire odha. Only the main 3rd order stream is left.
- During 10 years of studies 6 meter of with is reduce and remain 9 meres only.
- Impervious Surfaces such as roof tops, roads, driveways, and parking lots reduce soil infiltration capacity and increase runoff by introducing more water into streams than before urbanisation. It raises flood maxima, which alter channel

morphology in a variety of ways, including changes in channel cross-sections, bed materials, channel unit types, and riparian vegetation.

- Streams have a geomorphic tendency to recover from the temporary disturbances caused by urbanization.
- Stream Waghire shows the morphological changes in upstream hydraulic geometry, as a result of interventions. Bankfull width of the channel is decreased and depth is increased though out of his whole path.

Conclusions

A vast number of study investigations have concluded that the majority of the world's rivers adapt their geometry in response to natural and anthropogenic changes and nullify of the result of intervention approximate up to the with distance. however, Waghire Odha does not have this type of natural adjustment due to unplanned urbanisation around the Waghire stream. Unfortunately Waghire stream do not have such change do the continues enchochment around channel form its source to mouth (where it meets to river Pavna). Even river pawana aslo facing same problem and river mula too. When this type of situation is occur like river channels are narrowing, tributaries are vanishing and increasing impervious surface in river basin it gives birth to the flash floods. Which is very common in nowadays.

Acknowledgment

The authors express their sincere gratitude to the Department of Geography, Akurdi College, Pune, for providing academic guidance and research support throughout the study. Special thanks are extended to Dr. Tushar A. Shitole for his valuable suggestions, encouragement, and supervision during the preparation of this research work.

Financial support and sponsorship

Nil.

Conflicts of interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

References

1. Cooke, R. U., & Doornkamp, J. C. (1990). *Geomorphology in Environmental Management*. Oxford University Press.
2. Gilewska, S. (1964). Hydraulic geometry and urban impact on river channels in southeastern Nigeria. *Geographical Studies Journal*, 12(2), 45–58.
3. Giddings, E. M. P. (2005). Urbanization and stream channel morphology. *Environmental Hydrology Journal*, 9(4), 101–112.
4. Kale, V. S., & Gupta, A. (2002). *Introduction to Geomorphology*. Orient Longman, Hyderabad.
5. Rajagopalan, R. (2005). *Environmental Studies: From Crisis to Cure*. Oxford University Press.
6. Chorley, R. J., Schumm, S. A., & Sugden, D. E. (1984). *Geomorphology*. Methuen Publications.
7. Leopold, L. B., Wolman, M. G., & Miller, J. P. (1964). *Fluvial Processes in Geomorphology*. W.H. Freeman and Company.
8. Knighton, D. (1998). *Fluvial Forms and Processes: A New Perspective*. Arnold Publishers.
9. Gregory, K. J., & Walling, D. E. (1973). *Drainage Basin Form and Process*. Edward Arnold Ltd.
10. Schumm, S. A. (1977). *The Fluvial System*. Wiley-Interscience.