

Lucknow Drainage Solution: A Review Paper on Urban Drainage Solution

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Abstract - The rain is the main part of the man’s livelihood. The rain causes so many fruitions in the human’s life but it causes so many problems also. With rain there comes a problem of drainage problem, the situation of water logging is so imminent in the Indian region. But when the rain water is in its excess the water flows out through the predestined paths which are created by its flow and therefore. The water fills out the paths which are not for its own purposes and the sustainability of water which is not going down onto the ground level or flowing through the ground it’s called waterlogging. Waterlogging can cause many problems for the urban livelihood as there is not much space and the alternate ways to deal with the drainage and water logging problems.

Index Terms –Water Logging (WL), Reduce Level (RL), Sewage Treatment Plant (STP), Lucknow Municipal Corporation (LMC), Sewage Drainage System (SDS), Sustainable Development (SD)

I. INTRODUCTION

Urbanization has made several affects in the hydrological cycle, which causes rise in increased runoff, since rain water do not percolate due to roads, parking lots , and rooftops. This has causes many environmental pollution, waterlogging and effect on health, including flooding, erosion, and water quality reduction. It also causes economic, socio and environmental problem .Therefore, developing and implementing effective urban drainage solutions is essential for sustainable urban development. The purpose of this research paper is to review and analyze different urban drainage solutions and their effectiveness in managing storm water runoff in urban areas. In this paper we will study, analyze and giving solutions to the drainage solution Lucknow.

Lucknow, the capital of Uttar Pradesh is situated 123 meters above sea level. It is situated on 26.30 & 27.10 North latitude and 80.30 & 81.13 East longitude. Lucknow covers an area of 3,244 sq.km with an annual average rainfall of 999 mmi i.e., 39.3 inch per year. It is surrounded on the eastern side by District Barabanki, on the western side by district Unnao, on the southern side by Raebareli and on the northern side by Sitapur and Hardoi districts.

The paper will also highlight the challenges associated with implementing urban drainage solutions, especially in Lucknow and suggest potential solutions to overcome these challenges.

Component of Drainage-

According to the 2011 census Lucknow district has a population of 4,589,838 people. This makes it very essential to have a sustainable drainage solution for this large population holding city, because of the interaction between human activity and the natural water cycle. This interaction has two main forms: the abstraction of water from the natural cycle to provide a water supply for human life, and the covering of land with impermeable surfaces that divert rainwater away from the local natural system of drainage.

These two types of interaction give rise to two types of water that require drainage, these are –

1. Sewage water
2. Storm Water

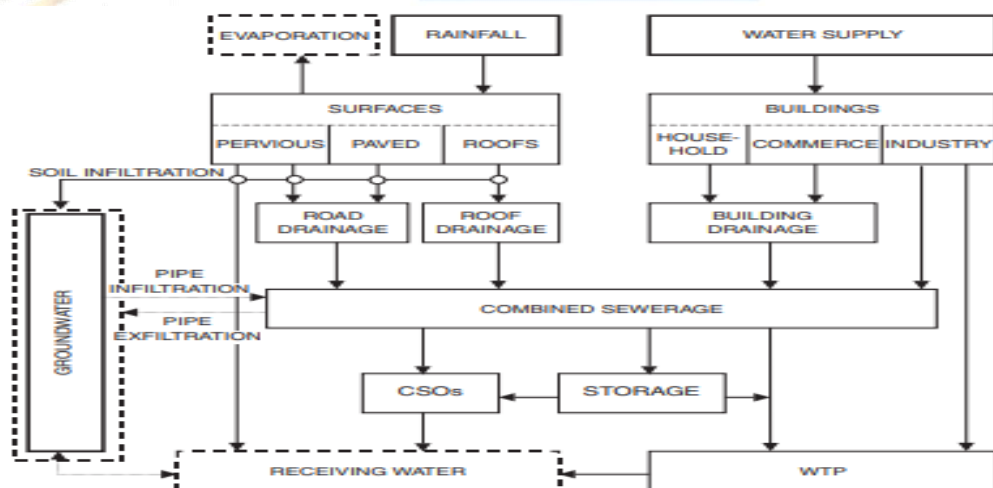


Fig.1 A visual representation of sewage i.e., water supply and storm water i.e., rainfall and its disposal is showed in the picture

Rainfall (storm water) is one of the major reasons why the drainage systems are provided.

(1) Sewage Water-

Drainage systems may be significantly impacted by sewage water. Sewage can clog drains and cause blockages when it is poorly disposed of, which can result in backups and spills. This can harm infrastructure like pipes and create health risks when untreated sewage is present.

Additionally, sewage water has high concentrations of nutrients and organic materials, which can encourage the growth of algae and other aquatic plants. This may result in drainage system blockages and obstructions, which may result in flooding and property damage. Furthermore, if untreated sewage is permitted to enter the drainage system, it may contain dangerous diseases, bacteria, and viruses that represent a serious risk to human health. Among other illnesses, these viruses can lead to cholera, typhoid, and hepatitis A.

Sewage must be appropriately collected, processed, and disposed of in order to prevent the damaging effects it has on drainage systems. This can entail performing routine maintenance on drainage systems, installing and using septic systems correctly, and putting in place efficient wastewater treatment procedures.

(2) Storm Water -

Particularly in metropolitan areas with impermeable surfaces, such as roads, parking lots, and buildings, storm water can significantly affect drainage systems. Storm water from rain can quickly build up and overwhelm drainage systems, causing floods and other detrimental effects.

These are some examples of how storm water might affect drainage: A greater danger of flooding and erosion results from higher runoff, which can be caused by storm water.

Build-up of silt: Storm water can introduce sediment and other pollutants into drainage systems, causing clogs and a reduction in capacity.

Infrastructure damage: Storm water runoff that is too high can corrode pipes, culverts, and other drainage infrastructure.

Impacts on water quality: Pollutants like oil, grease, and other toxins can be carried into streams by storm water, resulting in poor water quality and ecological harm.

Different management techniques can be used to lessen the impact of storm water on drainage systems. These can involve the use of green infrastructure to absorb and filter storm water before it enters drainage systems, such as rain gardens and permeable pavement. To lessen the effects of storm water runoff, other measures can be used, such as the use of detention basins and other storm water storage facilities, as well as the execution of storm water management plans.

II. ANALYSIS OF DRAINAGE IN LUCKNOW

The R.L. of Lucknow is 123 m above sea level which is lower than the nearby cities which makes it ideal for sewage to be disposed of after treating the sewage water and disposing it into Gomati River which is passing from middle of the city and having lowest R.L. in the city.

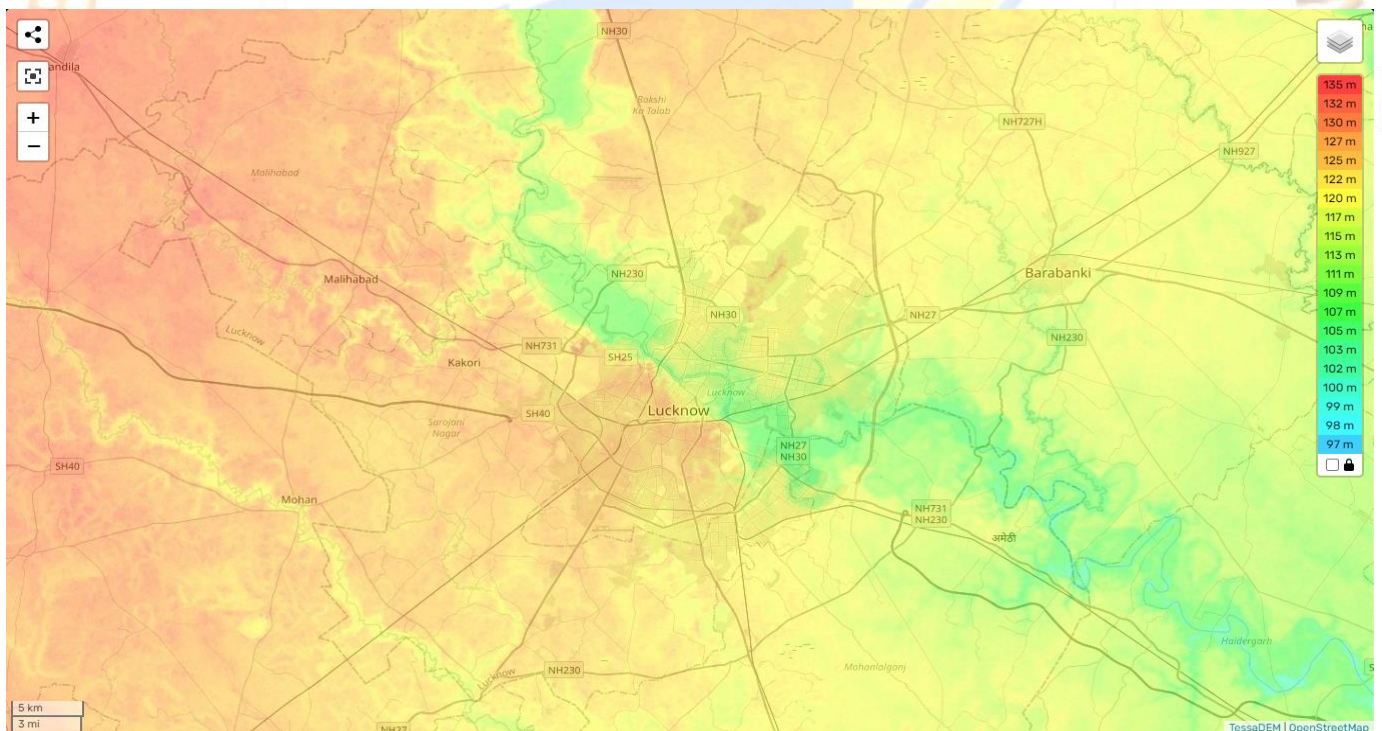


Fig.2 Colored representation of reduce level of different place of Lucknow

In Lucknow, the Lucknow Municipal Corporation (LMC) is in charge of the drainage system. Surface drainage and subsurface drainage make up the majority of Lucknow's drainage system. Open drains make up the surface drainage system, whereas sewage lines and manholes are part of the subsurface drainage system.

The city frequently floods during the rainy season despite having a drainage system. This can be attributable to a number of things, such as the drainage system's inability to manage excessive rainfall, drain encroachment, and waste being dumped into drains. The LMC has been attempting to resolve these problems by enhancing the drainage system and enforcing stricter rules for garbage disposal.

There have been several initiatives to upgrade Lucknow's drainage infrastructure in recent years. For instance, the state government has provided funding for the construction of new pumping stations and sewage treatment facilities, while the LMC (Lucknow Municipal Corporation) has built new drains and increased the capacity of existing ones.

But still, Lucknow's drainage system continues to have issues such as it fails to give solution for storm water and it's mixing with sewage water which makes the sewer lines choked and result in worsening the situation.

III. APPROACHES FOR DRAINAGE

(1) TYPES OF SYSTEM: PIPED OR NATURAL-

Urban area development can have a significant impact on drainage. Flooding and increased pollution may arise when rain that has collected on impermeable surfaces and gone via a piped drainage system reaches a river much more quickly than it would when the land and its drainage were in their natural state. The recent trend has been to try to transition to a more natural manner of drainage, utilizing the infiltration and storage qualities of semi-natural features such storage through detention basins, rather than relying on "end of pipe solutions" to these difficulties.

(2) TYPES OF PIPED SYSTEM: COMBINED OR SEPARATE-

Storm water and wastewater are the two types of flow that urban drainage systems handle. The connecting of wastewater to ditches and natural streams whose original purpose had been to convey storm water was a significant development in the history of urban drainage. There are very few systems in which the interaction between the transportation of wastewater and storm water is straightforward or optimal, therefore it has remained a complex one. Drains conveying flow from individual properties and sewers carrying flow from clusters of properties or bigger areas make up piped systems. The entire infrastructural system, including the pipes, manholes, buildings, pumping stations, and other elements, is referred to as "sewerage." Basically, there are two types of conventional sewerage systems: a combined system that moves both storm water and wastewater.

(3) COMBINED SYSTEM-

A sewer network is a complex branching system. The combined sewers carry both wastewater and storm water together in the same pipe, and the ultimate destination is the wastewater treatment plant (WTP), located, in this case, a short distance out of the town. In dry weather, the system carries wastewater flow. During rainfall, the flow in the sewers increases as a result of the addition of storm water. Even in quite light rainfall, the storm water flows will predominate, and in heavy falls the storm water could be fifty or even one hundred times the average wastewater flow. It is not economical for the big cities like Lucknow. So it's a solution but we try to avoid it for a sustainable urban drainage.

(4) SEPARATE SYSTEM-

Wastewater and storm water are carried in separate pipes, usually laid side-by-side. Wastewater flows vary during the day, but the pipes are designed to carry the maximum flow all the way to the wastewater treatment plant. The storm water is not mixed with wastewater and can be discharged to the watercourse at a convenient point. The first obvious advantage of the separate system is that CSOs, and the pollution associated with them, are avoided. An obvious disadvantage might be cost. It is true that the pipework in separate systems is more expensive to construct, but constructing two pipes instead of one does not cost twice as much. The pipes are usually constructed together in the same excavation. The storm water pipe (the larger of the two) may be about the same size as the equivalent combined sewer, and the wastewater pipe will be smaller. So the additional costs are due to a slightly wider excavation and an additional, relatively small pipe.

(5) DETENTION BASIN-

In urban and suburban regions, detention basins are a practical way to manage storm water runoff. They are intended to temporarily store extra rainwater before releasing it gradually and deliberately into the environment. This aids in lowering storm water runoff's peak flow rate and averting flooding and erosion.

By enabling contaminants and sediment to separate out of the water before it is discharged, detention basins can also aid in improving the quality of the water. This is so that the water can be filtered and cleaned for a longer period of time due to the slower release rate. Detention basins can assist the environment in other ways besides drainage, such as by fostering wildlife habitat and enhancing the aesthetics of a location.

IV. CONCLUSIONS

After study of methods and analysis, for a city like Lucknow the concept of separate drainage system along with detention basin would be appropriate solution to handle the sewage water as well as storm water. It will make Lucknow a sponge city.

Here separate drainage system will ensure the separation of sewage water which is to be treated by STP (sewage treatment plants) and then dispose of, and storm water to be directly dispose of in Gomati River; and since Gomati River is at distance from different parts of the city, so detention basins would help in containing the storm water for some time and then dispose of in Gomati River or can be used to recharge ground water.

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