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EFFECT OF URBANIZATION ON FLOOD - A REVIEW WITH RECENT FLOOD IN CHENNAI (INDIA)

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ABSTRACT

Flood is a temporary overflow of a normally dry area due to overflow of a body of water, unusual buildup, runoff of surface waters, or abnormal erosion or undermining of shoreline. Floods can also be overflow of mud flow caused by buildup of water underground. Increased urbanization has added to the increase of flash floods as well as higher flood levels. Urbanization refers to the modifications made to a natural landscape through paving, lodging and building. How does this affect us? Cement is not capable to soak up water –compared to natural soil- to this excess water is directed to nearby streams, which then overflow, due to the excess amount of water. The urbanization of a catchment area – land whose waters drains into a body of water- dramatically impacts the characteristics of river flooding. There is a correlation between the increase of urbanization, the percentage of the basin paved and the recurrence interval of the flood. (Hollis, 431). We must be aware that our conscious effort for expansion and living space can actually precipitate a natural hazard. We put ourselves in areas where there is a higher chance for flooding due to the scenic views, the serenity of it all, etc. This paper emphasizes the effect of flood flows in urban environments and its impact in the form of destruction and describe that the occurrence of flood is not a natural calamity.

KEYWORDS: Flood, Urbanization, Runoff, Landscape, Pavingetc.

INTRODUCTION

Urban flooding is the inundation of land or property in a built environment, particularly in more densely populated areas, caused by rainfall overwhelming the capacity of drainage systems, such as storm sewers. Although sometimes triggered by events such as flash flooding or snowmelt, urban flooding is a condition, characterized by its repetitive and systemic impacts on communities that can happen regardless of whether or not affected communities are located within designated floodplains or near any body of water.Aside from potential overflow of rivers and lakes, snowmelt, storm water or water released from damaged water mains may accumulate on property and in public rights-of-way, seep through building walls and floors, or backup into buildings through sewer pipes, toilets and sinks. In urban areas, flood effects can be exacerbated by existing paved streets and roads, which increase the speed of flowing water. The flood flow in urbanized areas constitutes a hazard to both the population and infrastructure. Some recent catastrophes include the inundations of Chennai (India) in 2015, Nîmes (France) in 1998 and Vaison-la-Romaine (France) in 1992, the flooding of New Orleans (USA) in 2005, and the flooding in Rockhampton, Bundaberg, Brisbane during the 2010–2011 summer in Queensland (Australia). This review emphasizes the effect of flood flows in urban environments and its impact in the form of destruction and describe that the occurrence of flood is not a natural calamity.

HYDROLOGIC EFFECTS OF URBANDEVELOPMENT

Streams are fed by runoff from rainfall and snowmelt moving as overland or subsurface flow. Floods occur when large volumes of runoff flow quickly into streams and rivers. The peak discharge of a flood is influenced by many factors, including the intensity and duration of storms and snowmelt, the topography and geology of stream basins, vegetation, and the hydrologic conditions preceding storm and snowmelt events. Land use and other human activities also influence the peak discharge of floods by modifying how rainfall and snowmelt are stored on and run off the land surface into streams. In undeveloped areas such as forests and grasslands, rainfall and snowmelt collect and are stored on vegetation, in the soil column, or in surface depressions. When this storage capacity is filled, runoff flows slowly through soil as subsurface flow. In contrast, urban areas, where much of the land surface is covered by roads and buildings, have less capacity to store rainfall and snowmelt. Construction of roads and buildings often involves removing vegetation, soil, and depressions from the land surface. The permeable soil is replaced by impermeable surfaces such as roads, roofs, parking lots, and sidewalks that store little water, reduce infiltration of water into the ground, and accelerate runoff to ditches and streams. Even in suburban areas, where lawns and other permeable landscaping may be common, rainfall and snowmelt can saturate thin soils and produce overland flow, which runs off quickly. Dense networks of ditches and culverts in cities reduce the distance thatrunoff must travel overland or through subsurface flow paths to reach streams and rivers. Once water enters a drainage network, it flows faster than either overland or subsurface flow.

With less storage capacity for water in urban basins and more rapid runoff, urban streams rise more quickly during storms and have higher peak discharge rates than do rural streams. In addition, the total volume of water discharged during a flood tends to be larger for urban streams than for rural streams. As with any comparison between streams, the differences in streamflow cannot be attributed solely to land use, but may also reflect differences in geology, topography, basin size and shape, and storm patterns.The hydrologic effects of urban development often are greatest in small stream basins where, prior to development, much of the precipitation falling on the basin would have become subsurface flow, recharging aquifers or discharging to the stream network further downstream. Moreover, urban development can completely transform the landscape in a small stream basin, unlike in larger river basins where areas with natural vegetation and soil are likely to be retained.

NECESSITYOF URBAN FLOOD REVIEW

Urban flooding is necessity for study in now a days as urbanization increases the more accumulation of water which we called as flood risk , peak flows result in flooding very quickly in a very less time, large number of people are affected in dense population clusters and severe economic and infrastructure loss to industry and commerce. Urban flooding may be reduced by certain awareness i.e. by periodically maintain the existing drainage channels, providing a well-defined drainage paths (may be underground), to control the entry of garbage’s and other into theexisting drainage systems, providing pavements to allow infiltration of rainwater, etc. We and our habits are the solely responsible for causing the flood in urban areas. These are mainly are: Lack of maintenance in existing drainage system, chocking of drainage system by throwing solid waste materials, plastics etc., and development in river flood plain are the main causes of the urban flooding.

CAUSES OF FLOODING DUE TO URBANIZATION

Flooding in urban areas can be caused by flash floods, or coastal floods, or river floods, but there is also a specific flood type that is called urban flooding. Urban flooding is specific in the fact that the cause is a lack of drainage in an urban area.A lot of the sewerage and drainage network is old and its condition is unknown. They cannot cope with the volume of water or are blocked by rubbish and by non-biodegradable plastic bags. Sewers overflow because of illegal connections and the sewer system cannot cope with the increased volumes. As new developments cover previously permeable ground, the amount of rainwater running off the surface into drains and sewers increases dramatically. Developments encroach floodplains, obstructing floodways and causing loss of natural flood storage. Continued development and redevelopment to higher density land uses by high land costs. The proportion of impermeable ground in existing developments is increasing as people build patios and pave over front gardens. Increased impervious areas such as roads, roofs and paving, due to increasing development densities means more run-offs (Singh and Singh, 2011). Some of the major hydrological effects of urbanization are: (1) increased water demand, often exceeding the available natural resources; (2) increased wastewater, burdening rivers and lakes and endangering the ecology; (3) increased peak flow; (4) reduced infiltration and (5) reduced groundwater recharge, increased use of groundwater, and diminishing base flow of streams. According to natural hydrological phenomena, due to increased impervious area precipitation responds quickly reducing the time to peak and producing higher peak flows in the drainage channels.

REDUCINGFLOOD HAZARDS IN URBAN AREAS

There are many approaches for reducing flood hazards in basins under development. Areas identified as flood-prone have been used for parks and playgrounds that can tolerate occasional flooding. Buildings and bridges have been elevated, protected with floodwalls and levees, or designed to withstand temporary inundation. Drainage systems have been expanded to increase their capacity for detaining and conveying high streamflows; for example, by using rooftops and parking lots to store water. Techniques that promote infiltration and storage of water in the soil column, such as infiltration trenches, permeable pavements, soil amendments, and reducing impermeable surfaces have also been incorporated into new and existing residential and commercial developments to reduce runoff from these areas.

CHENNAI FLOOD (NOVEMBER - DECEMBER 2015)

- The Chennai floods have thrown up some fundamental flaws in our system of urban planning. Chennai is one such area where an enormous watershed finally drains into the sea through its rivers and canals. Recent flooding in Chennai will cost India's economy an estimated $3 billion in losses, making it the worst disaster of its kind this year in terms of damage to the economy. Overall, the Chennai flooding was the eighth-most expensive natural disaster this year. The geography of South India demonstrates how rivulets, ponds, streams and rivers emanating from the Western Ghats flow towards the East to the Tamil Nadu coast. On the other hand, this coast is also highly vulnerable to storms, depression, tsunami and floods. Traditionally the sub-region surrounding Chennai had big and small ponds connected by a working overflow system. The water was allowed to spread into fields and thousands of smaller ponds, with the entire region acting as a 'sponge' to absorb the excess water, supporting paddy fields and fish farming. These overflow systems and multiple canals finally find their way to lakes that surround Chennai city. Finally the rivers in Chennai absorb this flow.
- In Tamil Nadu's hurry to industrialize, these watershed areas have been ravaged, with all the major industries, new educational institutions, housing estates, etc. coming up in the past two decades. Thousands of smaller ponds and streams have been filled up, increasing the surface water flow manifold. The major tanks are silted and the amount of water flowing into them has increased. This increased run-off has found its way into the city. Unprecedented rain, induced by climate change, has compounded the problem. While the disaster has been caused by nature, the impact would not have been so severe but for the man-made factors.
- The second dimension of Chennai's flood is another man-made problem. The Adyar River in the south of the original city had a wide estuary and also a wide flood plain. Many areas south of the river have been marshy and low-lying, serviced by small rivulets and canals. Most submerged areas with floor-high water are on this part of the city, including the IT Park and many multinational corporate headquarters, paralyzing business not only in Chennai but across the country and outside.
- All the swamps, marsh lands, low-lying areas and streams that these big corporations, middle class housing and slums have built on are inundated as they are at the receiving end of overflowing large regional tanks.
- The planned developments along the Adyar River that reduced its capacity as a water outlet are largely government-sponsored as the river bed was in government ownership. In the past three decades, massive housing, planned and unplanned, has cannibalized the river bed, leading to increased flooding, and damaged Chennai's technology nerve centres and put millions of residents in danger. Chennai is indeed a sordid story of all the ills that plague India's subservient planning system. Our inability to enforce environmental laws and insatiable greed for land grabbing by both national and international commercial interests are in full play in Chennai. The silver lining, however, is the enormous outflow of altruism, public mindedness and compassion Chennai's citizens have displayed in the face of this calamity.
- Pinning responsibility for faulty planning and political decisions, preparing a scientific watershed management plan, putting in place a disaster warning system, and addressing the immediate problems of the urban poor are the first steps forward. Chennai's citizens have a resurgent spirit. That indeed is the human capital to build on.
- Geographically Chennai is a flat topography and absences of natural slope cease unrestricted run off. This is a major reason for development an active scheme for storm water drainage. The Corporation of Chennai has developed and maintains a storm water drain network of 855 km in the city.
- Random town planning, chocked drains, poor garbage management, and the rampant destruction of mangroves, forests, and pastures have been identified as contributory factor to flood risk in Chennai. The unprecedented rain from northeast monsoon from November to December 2015 left vast portion of Chennai submerged. Most of the floods in Chennai are credited to depression over Bay of Bengal. However, 2015 Chennai flood has been attributes to El Nino phenomenon (The Indian Express, 2015). Low pressure area was amalgamated and gradually strengthened into a deep depression on 8th of November 2015. As a result

of which, there was very substantial downpour over Chennai and northern districts of Tamil Nadu starting from 9th of Nov. (The Hindu, 2015). There was 370 mm rainfall in 24 hours. Several low lying areas were inundated by 13th Nov. In continuation, 15 to 16th of Nov, Chennai city and neighboring areas got 246.5 mm of rain precipitation. It inundated most of the parts of the city. In total Chennai drenched with 1049 mm of rainfall touching a return period of almost 100 years. Second system developed and brings heavy rainfall on 28th to 29th of November. It precipitates 490 mm of heavy rainfall in 24 hours. It was recorded as an official disaster (zeenews.india.com, 2015)

CONSEQUENCES OF URBANIZATION (RECENT FLOOD IN CHENNAI-2015)

- Urbanization leads in constant accumulation of water on roads, railway tracks and even at airports because of the improper and inadequate storm water drainage capacity in the drainage system within the city which results in congestion resulting in loss of time. Also, in case of heavy rainstormsthe air traffic gets diverted or become complete idle for some days.
- Entire communication with conveyance system gets disturbed and maintenance of supply of essential commodities becomes challenge by which industrial production gets hampered. Prices of essential commodities shoot up.
- The important task after floods is to recoverthe damaged roads, railway tracks, damaged buildings (which is very common for over lived buildings) and other structures and rehabilitation of residents from low lying areas and collapsed buildings. Perishable articles add to economical loss.
- There are a lot of financial burdens on relief measures. Schools and colleges get closed. Displacement of population in low lying areas and collapsed structures generally meets stiff resistance. Disruption in supply of essential commodities including power supply results in unrest. Water bodies get polluted. Waste disposal gets hampered due to traffic disruption. The stagnation of water, pollution of potable water and accumulation of waste at dustbins result in epidemics. Accidents due to open pits, manholes hidden under accumulated water adds to problem. As traffic gets disrupted it is challenging to assist medical assistance.

CONCLUSIONS

Urbanization generally increases the size and frequency of floods and may expose communities to increasing flood hazards. Current streamflow information provides a scientific foundation for flood planning and management in urban areas. Because flood hazard maps based on streamflow data from a few decades ago may no longer be accurate today, floodplain managers need new peak streamflow data to update flood frequency analyses and flood maps in areas with recent urbanization. Streamflow-gaging stations provide a continuous record of streamflow that can be used in the design of new urban infrastructure including roads, bridges, culverts, channels, and detention structures. Storm water managers can use streamflow information in combination with rainfall records to evaluate innovative solutions for reducing runoff from urban areas. Real-time streamflow-gaging stations, which make streamflow and rainfall data available via the internet and other communications networks as they are recorded, offer multiple benefits in urban watersheds. In particular, they provide flood managers with information that can guide flood control operations and emergency actions such as evacuations and road closures.

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