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# WATER IN LEH:

## Crisis or Mismanagement ?

### 6 CLEAN WATER AND SANITATION



A ray of hope to address the water-related issues

Leh town is the main urban center of Leh district in Ladakh region in Jammu and Kashmir. Tourism-related activities are the economic backbone of the town. Situated at an altitude of about 10,500 feet in the rain-shadow of the Trans-Himalayas, the town witnesses less annual precipitation which is mainly in the form of snow. Traditionally, it has sourced its water needs from the stream that originates from the Khardung La glacier and various natural springs during summers.

Although Leh is home to about 30,870 people (2011 Census), its population swells by 100% in summers as it plays host to tourists and industry labourers. There

has been an exponential rise in tourist footfall. The number of tourists visiting Leh was 524 when Ladakh was first thrown open for the tourists but has now grown to 277,000 as of 2017.

As per the report of the Jammu and Kashmir Department of Tourism, 25-30 guest houses are being registered every year. As of November 2017, there are 826 hotels and guesthouses in the region, holding a capacity of 13,732 beds. In addition, numerous homestays aren't registered with the government.

The number of vehicles (commercial and non-commercial) registered with the regional transport authority in Leh district from April

1, 1994, to March 31, 2007, was 4,007. From April 1, 2007, to February 28, 2018, the number of vehicles registered in the Leh district shot up to 14,948. Their impact on the region's air quality is evident.

All these factors are casting a dark shadow on the present and future of Leh town.

At present, groundwater remains the primary source for domestic water supply. The Department of Public Health Engineering (PHE), the state government utility responsible for supplying drinking water to the residents of the town, currently supplies about 4.9 million litres of water per day in summer, of which 80% is pumped up through the various borewells operated by PHE. This figure excludes the numerous private borewells owned by the residents of Leh town. The easy availability of technology for drilling borewells means that there has been a surge in the number of private borewells in the town. In a recent survey carried out by LEDcG, more than 70% of the guesthouses and hotels in Leh town had a borewell. All those surveyed cited inadequate PHE water supply as the main reason for opting for their own borewells.

The demand is only anticipated to grow. According to PHE, the summer demand will increase at an unprecedented rate by 2020. A basic factor is an increase in population due to natural growth. A second major factor is a change in the preferred mode of sanitation for both the residents and the tourists as flush toilets is increasingly replacing the traditional dry toilets. A third factor could be the substitution of scarce surface water with groundwater for

irrigation. It is estimated that about 20% of the water supplied through pipes is being used for irrigation.

On the other hand, snowfall, the primary source of both surface water and groundwater, is decreasing. In a trend analysis carried out by the Groupe Energie Renouvelables et Solidarite (GERES) and the Meteorological Department, Air Force Station Leh, it was found that since 1973, the annual precipitation is on the decline. The Khardungla glacier, the main source of snowmelt for Leh, is said to have retreated over the past few years. There has been an almost 21% decrease in the glacial area in the western Himalayas.

The increasing abstraction of groundwater is occurring against a background of the absence of both policy-led and community-led stewardship of the resource. In terms of policy, the state of J&K does not have a Groundwater Management Act so far. The Ladakh Autonomous Hill Development Council (LAHDC) has not moved in to fill the gap either. On the other hand, the traditional community institutions of a surface water management have not been adapted to the management of groundwater.

It would appear that given the rising demand and falling supply, not only is the town headed for water stress, there may be conflict over the rights of those who have private access to groundwater and those who do not.

If a situation of water stress has to be avoided in this naturally water-scarce town, it is imperative to have management structures both on the demand side and the supply side. However, as seen above, this is not the case so far.

1. There is no regulation of the demand for water, either through direct tariffing, metering or through policies regarding domestic use of water or in the hospitality sector or in agriculture. The current government intervention is only geared towards augmenting supply.

2. Similarly, there is no movement between the community user groups to institute usage practices.

3. Moreover, there is no policy in place to regulate the drilling and ownership of borewells.

At present, there is little in terms of groundwater knowledge. A cursory literature review reveals that very little research has been done in the situation of changing water usage pattern with special reference to Leh. As yet, there appears to be no baseline study on the patterns of groundwater usage or even changes in water use behaviour in the society. There is a real possibility of over-exploitation and misuse of a scarce resource.

There is also a lack of information and data on resource boundaries, aquifer-based information, water level data, etc. It becomes imperative that whatever responses are tailored to meet the situation in this regard, there is a need to include a significant component of developing a basic understanding of the groundwater resources.

The available solutions to water needs are limited. For instance, the current range of modes of sanitation is either the traditional dry toilets or the water-intensive flush toilet, with no other options in between.





*Ice Stupas and artificial glaciers have emerged as viable solutions to address the shortage of water in Leh*

The hoteliers and guesthouse owners would rather have the flush toilet as they feel, with some justification, their guests will be put off by the rudimentary nature of the dry toilet. It is, however, possible to marry their concerns regarding their business with concern for wiser water use through eco-san technologies. But these alternatives have not been tested out for their economic and social feasibility so far.

Exploitation of water is not only an alarming situation. Also, with this unmanaged water system, the

consumption of water has increased at an increasing rate and with that, the production of wastewater has also increased. Since Leh does not have a centralised wastewater management, all the wastewater (grey and black) are collected in poorly managed soak pits and, at times, septic tanks. Many soak pits don't need to be emptied because of strong leakage and high hydraulic conductivity of the underlying sandy soil resulting in a high exfiltration rate of the wastewater out of the soak pit/septic tank into the underground. This highly inadequate wastewater management system has not only

caused environmental contamination of surface and groundwater, but also poses a high risk for human health as the groundwater from the shallow aquifer is used for drinking purposes.

In order to address these problems, the Liveable Leh Project of Ladakh Ecological Development Group (LEDeG), which is supported and funded by the European Union and BMZ, has focused on Goal 6 of the Sustainable Development Goals (SDGs), which is to 'ensure availability and sustainable management of water and sanitation for all by 2030'. SDG 6





*Water in rivers are drying up to add to the water woes*

focusses on the following targets:

**6.1** By 2030, achieve universal and equitable access to safe and affordable drinking water for all

**6.2** By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations

**6.3** By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing the release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally.

**6.4** By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity

**6.5** By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate

**6.6** By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers, and lakes

**6.7** By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling, and reuse technologies

**6.8** Support and strengthen the participation of local communities in improving water and sanitation management

Under the Liveable Leh Project, efforts have been taken to achieve SDG-6 in the context of Leh and make Leh water secure, clean and healthy city.



# STATE OF ARCHITECTURE IN LEH



*Leh town is slowly losing its charm due to the construction of tall concrete structures*

Since the doors of this lofty region were opened to tourists four decades ago, Ladakh has lost some of its purity and charm. The residents of Ladakh have fallen prey to the vicissitudes of tourism after remaining isolated from the rest of the world.

A lot of tourists still visit this Himalayan valley expecting exquisite villages nestled in high mountains. Once they arrive in Leh it dawns upon them that Leh is no different than Manali and Gangtok. The ancient Himalayan hamlet is now inching towards a modern Indian hill city.

## Current status

Development is inevitable, and Ladakh should not remain a cultural centre. In the age of technology and information Ladakhis have the right to have aspirations like other global citizens. The economic growth, which is perceived as the real growth, is often manifested through structural growth. Rampant and unplanned construction will eventually lead to urban sprawl. Unplanned and unregulated growth is putting pressure on natural resources. A recent restudy conducted by the Technical University of Munich and Ladakh Ecological Development Group (LEDeG) showed the presence of E-Coli in underground water samples collected in Leh town.

## Prevalent Practices

Professional architects were not available in the past. Those with the local knowledge and old wisdom of traditional were used for the construction of houses. Monasteries and royal families would ensure that people didn't construct anything on the agricultural land. No one was allowed to dwell in the valleys as they were kept aside for farming and pasture land for the cattle. However, modernism has rendered those old and ancient practices obsolete. People are following others mindlessly without thinking about the positives and negatives, whereas societies have stopped connecting the dots that make them whole and unified.

The irony is that buildings are now seen as a commodity and not as a symbol of one's rich culture and society.

## Perception of clients

Masses demand good spaces such as parks, markets, hotels, malls, galleries, theatres, whereas individuals look for rooms. Observation from the point from professionals suggests that prospective clients mostly ask for rooms. According to them, if one multiplies the number of rooms with the tourists visiting Leh every year than it adds up to a nice holiday in Europe, good education for their kids in a convent school in Delhi and proper medical care and facility somewhere in Bangalore.

While we have enjoyed and even marvelled at the rich legacy left behind by our ancestors such as the Leh Palace, Tsemo Gompa and Shanti Stupa in the main Leh town, our children are witnessing rampant construction- some structures which don't have its own distinct character. In the last one decade, the majestic skyline of the Himalaya has disappeared behind the sudden mushrooming of tiny matchbox rooms. Of course, there is nothing wrong with it as long as we are sure that it is what we want to leave for future generation.

## Rights as a Citizen

Lot of thought, effort and money are involved in the construction of a house. Just because a bank decided to provide loan for one's neighbour's structure doesn't mean that we should mindlessly jump on the bandwagon.

A little survey and study as well as understanding the impact of a new structure would go a long way in making or breaking public spaces. Constructing more hotels and guest houses to fuel the tourism sector in Ladakh will put thousands of endangered species of flora and fauna of the region at risk.

We need to answer certain questions: just because our cities have tall buildings made of concrete and steel, how different is it from a slum? Should we just think about ourselves or society as a whole? Good public and green spaces should be on top of our wish list. We need a city with a distinct character and not just a galaxy of hotels and guesthouses. We need a happy city to live in!





*Nimmu House, a traditional boutique hotel in Nimoo, is very popular among the tourists*



*The Leb main market is flooded with concrete structures*



*Local masons during the construction of a house*



# THE MAN WHO PAVES INDIA'S ROADS WITH OLD PLASTIC

*Indian chemistry professor shows that repurposed plastic can be good for the environment*

Source: The Guardian

At 73, Dr Rajagopalan Vasudevan is roughly as old as the mass production of plastic. But that is not the reason why the chemistry professor has a soft spot for the much-maligned material.

“Plastic isn’t the problem,” the venerable scientist says in his office in the southern Indian city of Madurai. “We are. Plastic wouldn’t clog our oceans or our landfills if we didn’t throw it there in the first place. And there is so much we can do with it instead.”

He should know. In January this year, Dr Vasudevan was honoured with one of India’s highest civilian awards, the Padma Shri, for his groundbreaking research on re-using waste plastic – in a very unusual way.

The idea emerged from his workshop at the Thiagarajar College of Engineering in Madurai as far back as 2001. Disturbed by calls to ban plastic, which he believed was important to poor people, he wanted to find a solution to the growing environmental challenges it raised.

“Ban plastic and it can severely affect the quality of life for a low-income family,” he says. “But if you burn it or

bury it, it’s bound to affect the environment.”

And so, he began a series of experiments in his workshop to discover effective disposal techniques. In a molten condition, he found that plastic had the property of an excellent binder. Acting on the principle that like attracts like, Dr Vasudevan looked at another chemical of similar nature: bitumen, a black tarry substance that was being combined with gravel to lay roads.

“Bitumen, a highly heterogeneous mixture of hydrocarbons is in effect, composed of polymers similar to plastic,” he says. When molten plastic was added to stone and bitumen mix, Dr Vasudevan found that, true to its nature, plastic stuck fast and bound both materials together.

The bitumen-modified plastic improved the tensile strength of the road by making it more durable and flexible. Plastic also prevented pothole formation. When the layer of molten plastic filled the space between the gravel and bitumen it thwarted rain water from seeping in and causing structural defects.

When late Dr Abdul Kalam, India’s

former president and scientist visited Thiagarajar College, he encouraged Dr Vasudevan to lay the first plastic paved road within the campus. “He asked me to make the roads grey, since black roads absorb and trap heat,” says Dr Vasudevan. In 2002, he paved a 60-ft road within the campus with plastic-modified bitumen. The road is still intact today. He received a patent for the process in 2006. Since then, almost 10,000km of Indian roads have been paved using his technique.

At Dr Vasudevan’s workshop, shredded plastic in big bins shines like bright confetti. These are the remains of the plastic material that we use (and throw away) in our everyday lives. Plastic from water bottles, notebook liners, single-use bags with a thickness of less than 50 microns; all kinds of plastic waste is fed into his shredder and reduced to strips.

An assistant demonstrates – on a much smaller scale – how the plastic road-laying process works.

Asphalt is heated to a temperature of 170C (338F). Shredded plastic below 70 microns (including the multi-layer plastic shreds) is then sprinkled over it.





*Dr Rajagopalan Vasudevan , dean and professor of chemistry at the the Thiagarajar College of Engineering in the South Indian city of Madurai*



*Waste plastic ready to be transformed*



The bits of plastic seemingly disappear, melting into the red heat. Heated bitumen is added next. The molten plastic then moulds with the bitumen and stone and results in a shiny tar surface.

“When using plastic as a binder, we’re reducing the quantity of bitumen that is normally utilized for road laying by 6-8%,” says Dr Vasudevan.

A regular road requires 10 tonnes of bitumen for each kilometre. A plastic road however, requires only nine tonnes of bitumen and one tonne of waste plastic for coating. So, for every km, the plastic roads save as much as one tonne of bitumen.

“Our planet is drowning in snack-food packaging that is non-recyclable,” says Almitra Patel, a member of India’s Supreme Court committee for solid waste management. “If (this technology is) seriously adopted in all cities for all multi-film laminates, it has the potential to achieve near-zero land-fill, leaving almost nothing for final disposal.”

The real challenge lies, she says, in collecting all of the voluminous post-consumer packaging.

To environmentalists who believe that the technology could be harmful because of toxic fumes from plastic residue, Dr Vasudevan points out that the plastic used is softened at 170C. “Plastic decomposes to release toxic fumes only if it is heated at temperatures above 270C (518F). So there is no question of toxic gases being released,” he says. Since plastic coats the stone and interacts with the hot bitumen, its properties change and it doesn’t break down when exposed to light and heat.

Dr Noreen Thomas, a polymer science expert at Loughborough University, said the process appeared to be an imaginative solution, but cautioned that plastic waste is often a complex mix of materials not all of which



*A toilet building built using 'plastone' blocks*

would work well with Dr Vasudevan’s operations. Some might burn up in the heat, and others, she said, might prove unsatisfactorily soft as a road surface.

“There is always a risk when heating or burning mixed plastic waste in an open environment when the composition of the plastic waste is unknown,” she said. “It is important to find more applications for mixed plastic waste but even more important to ensure that more environmental pollution is not created in doing so.”

Nonetheless, at least 16,000km of road have subsequently been paved in the state of Tamil Nadu. The national government has since approved the idea and sanctioned at least 13,000km across the country to be paved in the material as well. Of this, 8,600km have already been completed, says Dr IK Pateriya of the rural development ministry in Delhi.

Using the same process to merge waste plastic and stone with materials like

limestone, ceramic waste and granite, Dr Vasudevan has created another eco-friendly building material that consumes up to 40% more waste plastic than that used in the road laying process. He calls this material “plastone” and says that it is lasting, durable and cheap.

Each plastone block consumes nearly 300 plastic bags and between four and six plastic bottles.

A stone tile measuring one square metre has a manufacturing cost of Rs 100, approximately £1.. 60 plates would be sufficient to construct an eco-friendly bathroom, says Dr Vasudevan. The material could also be used to pave sidewalks, replacing cement, he says.

Today, self-help groups from various states across India, local citizens and schools are engaged in helping Dr Vasudevan collect waste plastic.

“It’s time we stop seeing plastic as the enemy and turn it into our biggest resource,” says Dr Vasudevan.





Poster of Power of Sun documentary film



The runner-up certificate that was awarded to the documentary filmmakers

## POWER OF SUN BAGS SECOND PRIZE AT PRESTIGIOUS INTERNATIONAL FILM FESTIVAL

Power of Sun (Nyimey Shugs in Ladakhi), a documentary film shot by Peter, Melissa, Ludivine and Tristan- four filmmakers from Les Films au Clair de Lune, a film association based in France, with support from Ladakh Ecological Development Group (LEDcG), finished runner-up in the children fiction category at the Colortape International Film Festival. The documentary was nominated in the Austral-Asia Pacific Region. The filmmakers were awarded a certificate on 30th January, 2019.

Power of Sun (Nyimey Shugs) is about the discovery of power of sunlight, technologies used to capture solar energy and its vast potential. The documentary aims to promote renewable energy in the Himalayan belt, especially Ladakh.

Les Films au Clair de Lune, or films clair de lune, is an organisation that has been working since 2012 to provide audio-visual service for associations and share their innovative approaches and inspire everyone. They raise awareness among the public on themes such as health, environment and education.

Colortape International Film Festival is a multicultural film festival promoting worldwide arts & culture through films,

while bridging cultural differences, friendship, showcasing the creative vision of filmmakers from over the world. They have rewarded over 2,510 filmmakers in the past five years. Colortape is a film competition and film festival offering an indoor/outdoor screening opportunity, to showcase filmmakers' work, and reward the worthy towards the end of the competitive season.

Colortape festival was nominated as one of the most prestigious and recognised film festivals in the southern hemisphere and one of Asia-Pacific's largest multicultural film competitions keeping in mind the large number of annual admissions.

Colortape International Film Festival is a platform for international, local professionals and amateur/novice film enthusiasts or upcoming and developing animators/filmmakers/script writers/digital content creators/musicians in need to showcase their creative skills to the world. The aim of the competition is to provide exposure to animators, short & feature filmmakers, documentary makers, script writers, subjects & topics, creative minds and digital content creators that might otherwise not break in the film and entertainment industry or through a more traditional way.

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