

Assessment of the status, service delivery infrastructure and governance of drinking water supply in small and medium towns



WaterAid/Prashanth Vishwanathan



**Bodh Gaya, Gaya,
Bihar**

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With the objective of assessing the critical water supply situation, governance, and service delivery in small and medium towns of India and of providing recommendations to the municipal bodies, water utilities, and governments, WaterAid India conducted a study in 2019 in six small towns across India. Bodh Gaya, in Gaya district of Bihar, was one of the small towns selected for the study.

OBJECTIVES

1. To assess the drinking water supply situation and service delivery in four small and two medium towns. This includes assessment of the quantity and quality of water being supplied.
2. To understand sanitation systems, both at the individual and household (HH) levels as well as community levels, from a drinking water safety point of view.
3. To understand the current mandates as well as policy, regulatory, and legal framework, specific functions, finances, and functionaries allocated to the local bodies in order to fulfil these mandates.
4. To consolidate learning and suggest solutions, especially in the context of the poor and other marginalised populations, in the small and medium towns of India.

METHODOLOGY

In order to capture the households' and community's perspective on the water supply and sanitation situation in Bodh Gaya, a survey was conducted in 180 households spread across three wards of the town. This was followed by an interview with five key informants (KI) using structured questionnaires, and focus group discussions (FGDs) with community members. Laboratory-based water quality testing of 40 drinking water samples from select water sources was also conducted.

For the household-level survey, three wards were shortlisted—one from the central area of the town, another from its periphery, and the third from between the centre and the periphery. 60 sample households were surveyed from each of the three wards. The sampling criteria for surveying households in Bodh Gaya ensured coverage of: i) households with access to piped water supply, and ii) households using all other types of water sources. Families from marginalised communities or people living in slum or informal settlements were also identified and covered. Key Informant interviews (KII) mainly covered the broader perspectives of the town; service delivery provisions, water conservation, and water quality monitoring measures. FGDs were also conducted to supplement and triangulate findings from the survey and the interviews.

These findings were supplemented by testing samples from shortlisted water sources in an NABL accredited test lab. 40 such samples (28 from source and 12 user-level samples) were tested as part of the study. The criteria for short listing water source samples for testing was:

- Samples from each type of drinking water source including individual households, public water points, piped water supply source, and surface water bodies.
- Samples from water sources at varying ground level depths ranging from a private hand pump at 30ft to submersible pumps at 120ft and deep boring at 250ft.
- Samples collected from different locations that present a mix of potentially safe and unsafe sanitary sites.

The entire study process was conducted between September and November 2019.

BACKGROUND

Policies and regulations for urban water supply and management in Bihar

Bihar ranks as the second least urbanised state in India with less than 11 per cent of its population residing in urban areas. Urban centres in Bihar present a myriad of developmental challenges. Some of the key challenges include a lack of basic urban services, issues in local governance, and a high incidence of urban poverty.

In terms of composition and growth of urban areas, there are a total of 143 Urban Local Bodies (ULBs) in Bihar comprising 12 municipal corporations, 45 municipal councils and 86 nagar panchayats¹.

To ensure suitable levels of water and sanitation services to its urban population, regulatory measures have been initiated by the state government but these are limited and yet not in final shape. Following the passing of the National Water Policy of 2002, the Bihar Water Resources Department had prepared a draft of the State Water Policy in 2009. But it could not be finalised and announced. Similar is the case with the Comprehensive Solid Waste Management Policy, 2018, which is still in draft stage.

¹<http://urban.bih.nic.in/Acts/AR-01-04-10-2018.pdf>



Table 1

Water and sanitation-related policies in the state

BIHAR STATE WATER POLICY, 2014 (draft)

The scheme accords high priority to use of water for drinking and sanitation, followed by food security, sustainable agriculture, and ecological needs. The remaining water should be treated as an economic asset.

COMPREHENSIVE SOLID WASTE MANAGEMENT POLICY, 2018 (draft)

Source: <http://urban.bih.nic.in/Acts/AR-01-04-10-2018.pdf>

The overall goal of this state solid waste management strategy is to develop, implement, and maintain a system of integrated solid waste management that deals with the solid waste and minimises its negative impacts on health and environment.

BIHAR GROUNDWATER (Regulation and Control of Development and Management) Act, 2006

Source: <http://www.ielrc.org/content/e0633.pdf>

Any user of groundwater who intends to dig a borewell in a notified area shall apply to the authority for grant of permit. The Act also stipulates provision of rooftop rainwater harvesting (RWH) structures in building plans of an area of 1000sqm or more.

BIHAR BUILDING BY-LAWS, 2014

Source: <http://www.indiaenvironmentportal.org.in/files/file/bihar%20building%20bylaws-2014.pdf>

Provision of RWH shall be mandatory for all plot sizes. The size of the recharge trench shall be 6cu m for every 100sqm of roof area.

AFFORDABLE HOUSING AND SLUM REHABILITATION AND REDEVELOPMENT HOUSING POLICY, 2017 (revised)

Source: <http://urban.bih.nic.in/Acts/AR-01-29-03-2007.pdf>

The Municipality has the responsibility (a) to take steps to ascertain the sufficiency and wholesomeness of water supplied within the municipal area, (b) to provide, or to arrange to provide, a supply of wholesome water in pipes to every part of the municipal area in which there are houses.

Chart 1

Legal framework and authorities for giving effect to the provisions of the Bihar Municipal (Amendment) Act, 2009²

Bihar Municipal Act, 2007

Municipal Corporation
Large urban area
having population
above 2,00,000

Municipal Council
Medium urban area with population
Class A: 1,50,000 - 2,00,000
Class B: 1,00,000 - 1,50,000
Class C: 40,000 - 1,00,000

Nagar Panchayat
Transitional small
urban area with
population between
12,000–40,000

² <http://www.bareactslive.com/BIH/BH464.HTM>

FINDINGS OF THE STUDY

Introduction to Bodh Gaya town

Bodh Gaya is located in the Gaya district of Bihar. As per Census 2011, the town has 19 wards with a total population of 38,439. Two rivers, the Morhar and Phalgu flow by the town. The majority of the population earns its livelihood through agriculture and tourism. Bodh Gaya was declared as a nagar panchayat in 2001. In 2019, at the time of this study, Bodh Gaya had 9,996 households and the population had reached approximately 50,000 people.

Water supply and sanitation arrangements

Piped water supply (PWS) was introduced in Bodh Gaya in 2017 by Bihar Urban Infrastructure Development Corporation Limited (BUIDCO) with the support of a private contracting agency – Jindal Water Infrastructure Limited (JWIL). JWIL has three primary responsibilities—water resource development, supplying water at consumer end, and operations and maintenance for the first three years.

No money is charged for new PWS connections. Monthly water supply is free to households for the first three years. After three years, INR 30 per month is to be charged as monthly tariff. Commercial users are prohibited from receiving individual connections and have, therefore, dug individual bore wells. The water supply is groundwater-based as JWIL has four groundwater extraction units³ and overhead tanks from which it supplies water to the residents. According to the Jawaharlal Nehru National Urban Renewal Mission (JNNURM), the minimum supply of water in urban centres is 135 litres per capita per day (lpcd). The interviewed officials claimed to be meeting the demand but a simple calculation dividing the total population with the total storage capacity

of the overhead water tanks suggests that the town supplies approximately 96lpcd currently.

Out of 19 wards, PWS services have reached 15, providing water to 7,890 households through a combination of PWS and 150 stand-post connections. In the four remaining wards (2,106 HH) pipelines are still being laid. Water is also supplied free of cost through PHED tankers in case of shortage of water supply; a major breakdown or extra demand in the summer. This service is not extended for allied activities like construction, weddings, or other events. For personal events, private tankers are available wherein a tanker with a capacity of 4,000 litres costs INR 1,200. However, this water is not necessarily potable.

The Sanitation Task Force looks into issues related to water and sanitation in cities while the nagar panchayat follows a grievance redressal mechanism through BUIDCO in towns. The grievance redressal mechanism allows complainants to register complaints with BUIDCO in the form of a letter (hard copy), e-mail, or verbal/telephonic communication. No database is maintained to verify the percentage of grievances registered and addressed in 2019, specifically with regard to PWS.

During the peak tourism season, especially during the ‘kalachakra puja’ and ‘bodh mahotsav’ when thousands of tourist flock Bodh Gaya, the nagar panchayat makes temporary supply arrangements at ten marketplaces and pilgrimage sites.

³ <https://nalandauuniv.edu.in/news/bodh-gaya-water-supply-scenario-in-small-towns/>



Water service delivery

According to the key informants at the nagar panchayat office, coverage of piped water supply (PWS) is close to 79 per cent. However, as per the survey results, only 9.4 per cent of the households have access to PWS within their premises, while 21.1 per cent access water through public stand posts, and 24.4 per cent through hand pumps (Graph 1). Moreover, only one of the three surveyed wards had complete coverage, the second ward had stand post connections, while the third did not have any form of PWS and was dependent on other sources of water. This stark difference in data for PWS coverage is partially because the official record is for projected rather than actual coverage for the year 2019.

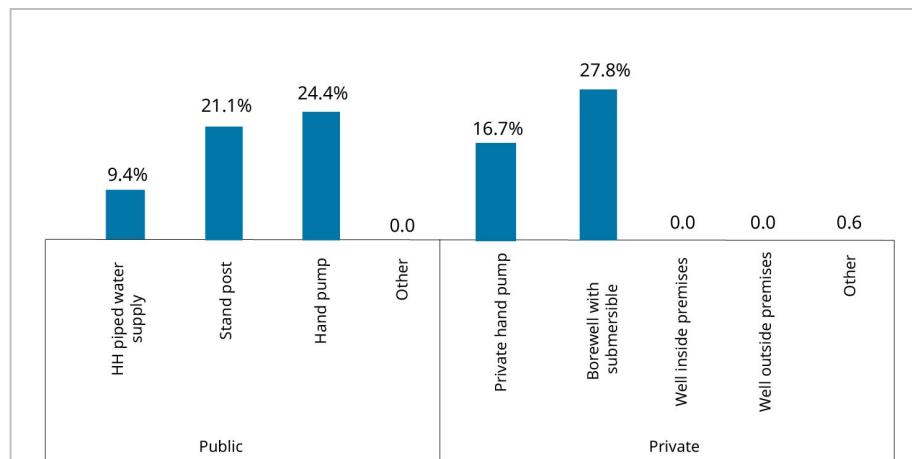
Overall, 54.9 per cent of the surveyed

households accessed water through public delivery sources. Further, half of the households relied on individual arrangements like private handpumps or submersible pumps. As shared by the nagar panchayat, piped water is supplied at the stand post and household level twice a day for three hours (two hours in the morning and one hour in the evening). The main reason stated for lack of PWS was the absence of a distribution line in the ward, which clearly indicates that laying of the pipeline was not complete under the scheme at the time of the study (Graph 2).

Reliance on the market for purchasing cooking and drinking water was minimum. However, as Bodh Gaya is an international tourist destination, there can be high reliance on packaged drinking water by restaurants, hotels, and commercial establishments.

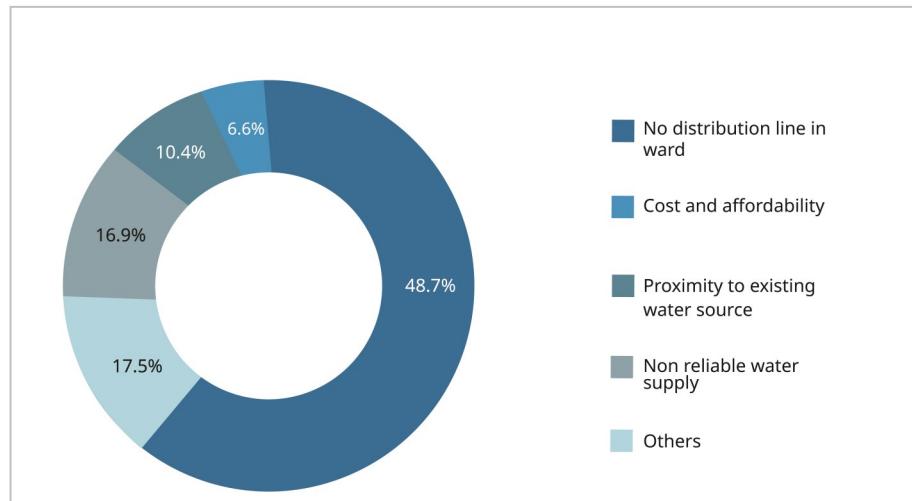
Graph 1

Public versus private water sources (n=180)



Graph 2

Reasons for lack of access to PWS (n=144)



Access to water

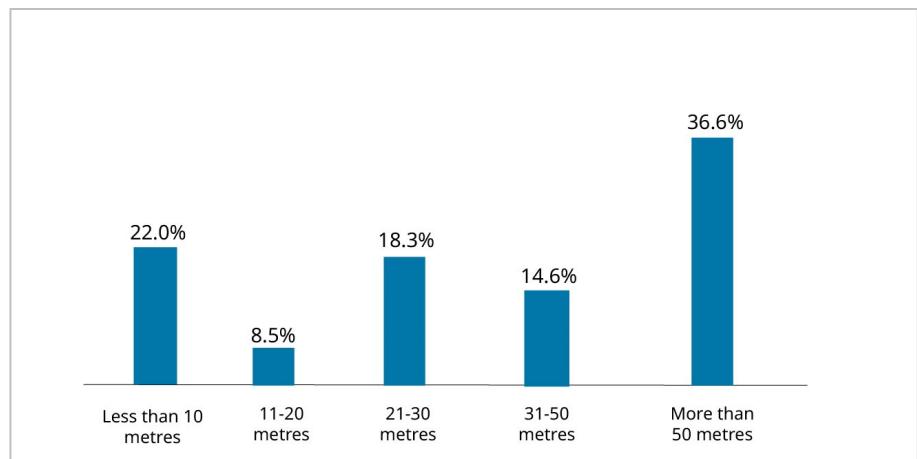
More than half of the households (54.4 per cent) have access to water within their premises, through various sources like PWS connections, individual borewells, and hand pumps. The remaining 45.6 per cent have to fetch water from outside. Of these, the majority (57.3 per cent) of the households make more than five round trips per day to access water for domestic purposes. Further, 51.2 per cent of the households fetching water from outside their premises have to walk a distance of more than 30 metres, thereby reflecting the need for improvement in access to water (Graph 3). The survey revealed that the task of fetching water is mostly undertaken by women (85.4 per cent) and girls (6.1 per cent).

Thus, accessibility to clean drinking water inside the premises is important as it substantially reduces the burden on women and girls.

93.9 per cent of the surveyed households reported that the quantity of water drawn or supplied from various primary water sources does not face frequent disruption. The main reason for disruption, whenever the town faces one, is decline in groundwater levels (Graph 4). Since the majority of households do not face any disruption in water supply, only 9.4 per cent households depend on secondary sources to meet their water requirements in times of disruption.

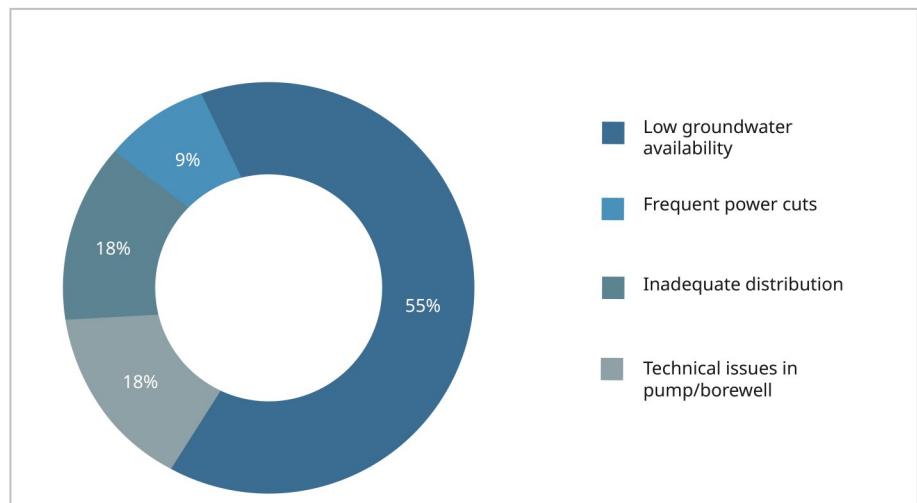
Graph 3

Distance travelled to fetch water (n=82)



Graph 4

Reason for disruption in water supply (n=11)





Caste-wise access to water source

The study found that different caste groups accessed water from various water sources. Among the various social groups, access to water through the piped water supply (PWS) system was reported to be highest among the Other Backward Caste (OBC) households at 17.9 per cent and lowest among the Scheduled Tribes (ST) at 4.3 per cent (Graph 5).

Overall, the least dependent caste on external water sources were the OBC as 89.3 per cent households were found to be accessing water from inside their premises. Households from the general category followed at 80.9 per cent. The caste groups that were reported to be primarily dependent on external water sources were the SC and ST together, with close to one-third (30 per cent) of these households fetching water from outside.

Access to water through bore wells with submersible pumps was reported to be highest among the general category households, followed by OBC.

Water storage and use

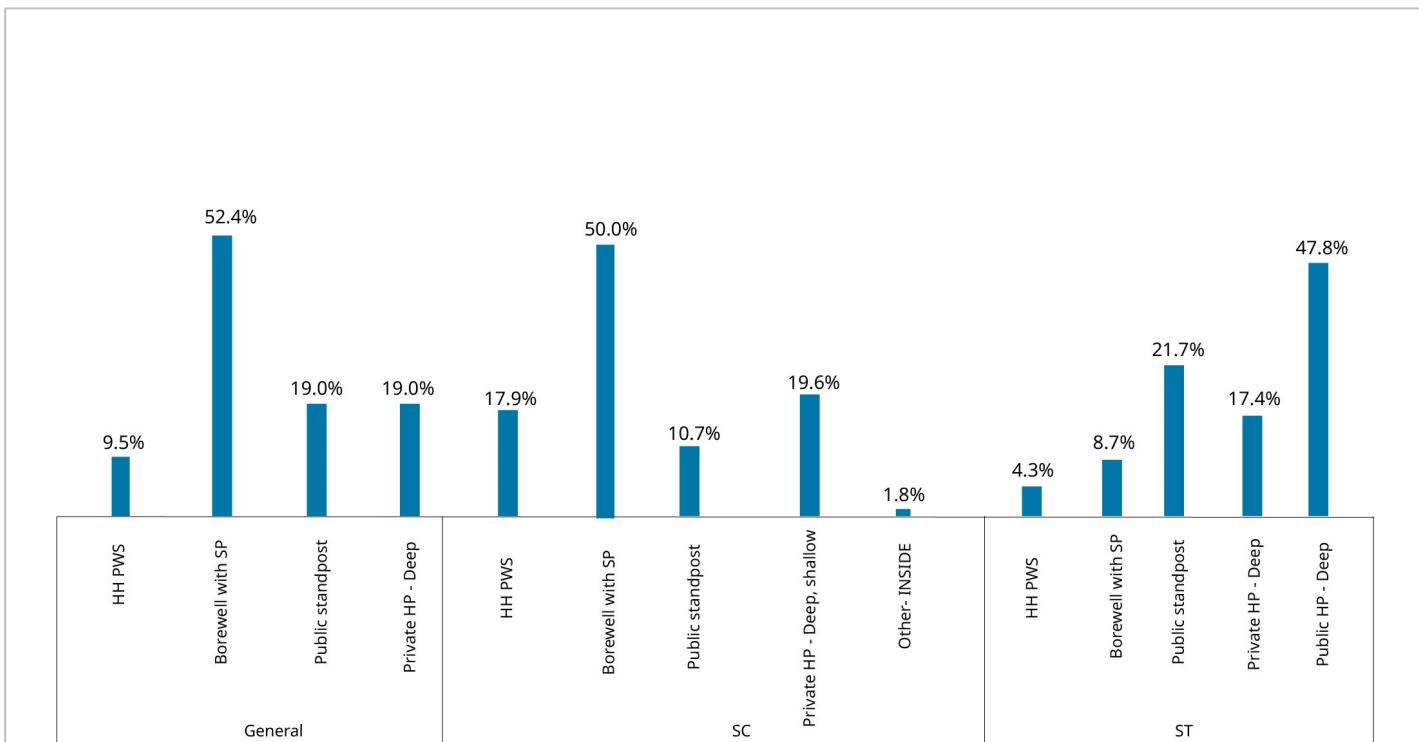
As piped water supply is available for a limited duration, households most commonly stored water in buckets (77.2 per cent). It was also found that use of overhead tanks for storing drinking water was second highest in Bodh Gaya (23.3 percent), as compared to the other six study towns. Interestingly, all households that reported having an overhead tank, also had a bore well with a submersible pump as the primary source of drinking water. A similar trend was reported in the town of Bakshi ka Talab in Uttar Pradesh where all households storing water in overhead tanks also had bore wells with a submersible pump.

Water for drinking and cooking purposes was generally stored in containers with lids (88.3 per cent), though a small per cent (6.1 per cent) stored water in water filters with taps and the remaining 5.6 per cent used containers with a tap to store water.

72.2 per cent of the households were reported as keeping drinking and cooking water at

Graph 5

Caste-wise access to water source (n=180)



ground level. This increases the chance of contamination by kids, pets, insects, and dust. A majority of households (76.1 per cent) were found to have poor water handling habits as they used non-ladle vessels to draw water from the container. Such unhygienic habits could result in water contamination and affect the health of the family in the long run.

Water quality monitoring

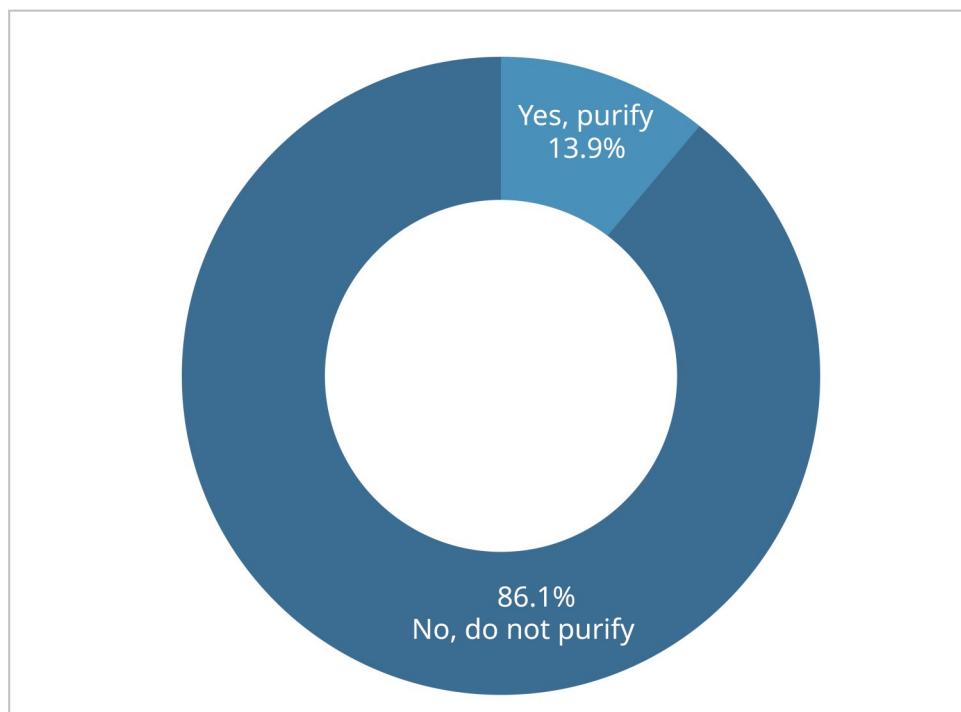
The water supply plant at Bodh Gaya has a chlorination unit but no filtration unit. Chlorination needs regular dosing which does not seem to be followed in Bodh Gaya as bacteriological contamination has been detected in the water quality test conducted by the NABL accredited lab (Graph 8). This could also be due to leakages in the distribution line. In terms of monitoring water quality in the town, tests were last conducted by the Public Health Engineering Department (PHED) at the time of source identification and deep boring for the PWS plant. Since then, water quality has

not been monitored either by PHED or by the contracting agency, BUIDCO. Even the local representatives/ward councillors of the nagar panchayat admitted that no water quality monitoring processes were followed. This was further confirmed by 97.8 per cent households who reported that water samples have never been collected at their level.

According to the officials, water quality tests conducted by PHED in district Gaya in the past revealed fluoride and nitrate contamination in groundwater at Bodh Gaya. However, neither of these contaminants was detected in the water quality tests conducted as part of this study. The district lab has two permanent and one temporary staff member and faces a shortage of reagents. In early 2020, spectrophotometers were provided to district water testing labs for precise water quality analysis. However, the staff has not yet been trained to use them.

Graph 6

Households practicing water purification (n=180)





Moreover, as reported by 2.2 per cent households, private companies selling water purification units have conducted such tests in the past and recommended the use of water filters to households.

In terms of the quality of drinking water, 12 per cent of the surveyed households reported problems with drinking water quality.

According to a respondent from ward 13, 'the tap water supplied has low pressure and looks dirty for the first few minutes of supply'.

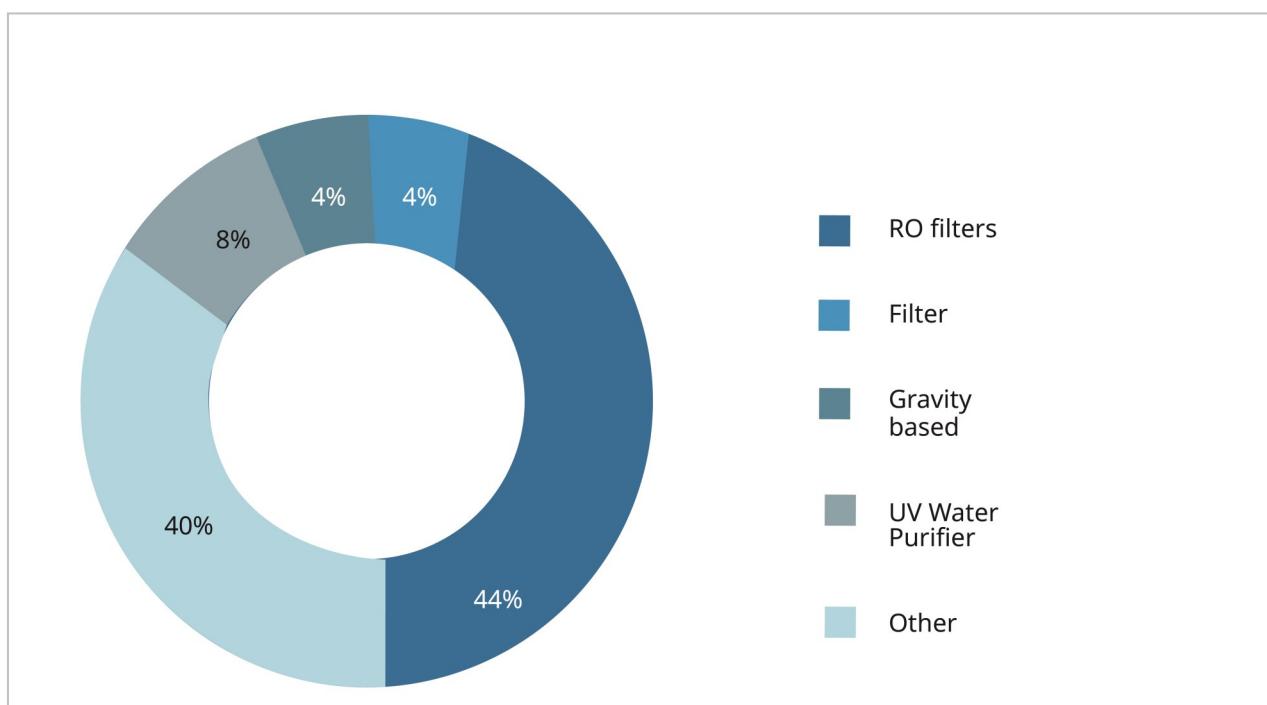
Water quality is mostly compromised in terms of change in taste, followed by change in odour and colour. 36 per cent of surveyed households face quality issues both occasionally and seasonally though not recurrently or daily.

Despite water quality being impacted, purification habits are not well established, as only 13.9 per cent of the surveyed households reported purifying their drinking and cooking water (Graph 6). The most common filtration method was the use of Reverse Osmosis (RO) filters followed by simple filtering or sieving (Graph 7).



Graph 7

Types of purification measures practiced in households (n=25)



Water quality test results

Both chemical and bacteriological contamination in water has been detected as being above acceptable limits in 75 per cent of the total source samples from Bodh Gaya. The major chemical contaminants were total hardness, total alkalinity, and magnesium. The major bacteriological contaminants were total coliform, faecal coliform, and E. coli. 100 per cent of the public water service delivery sources - PWS, stand posts, and public hand pumps - were found to be bacteriologically contaminated, while 88.8 per cent were found to be chemically contaminated (Graph 8).

Even private water sources like bore wells and hand pumps were chemically contaminated but bacteriological contamination was lower in private water sources.

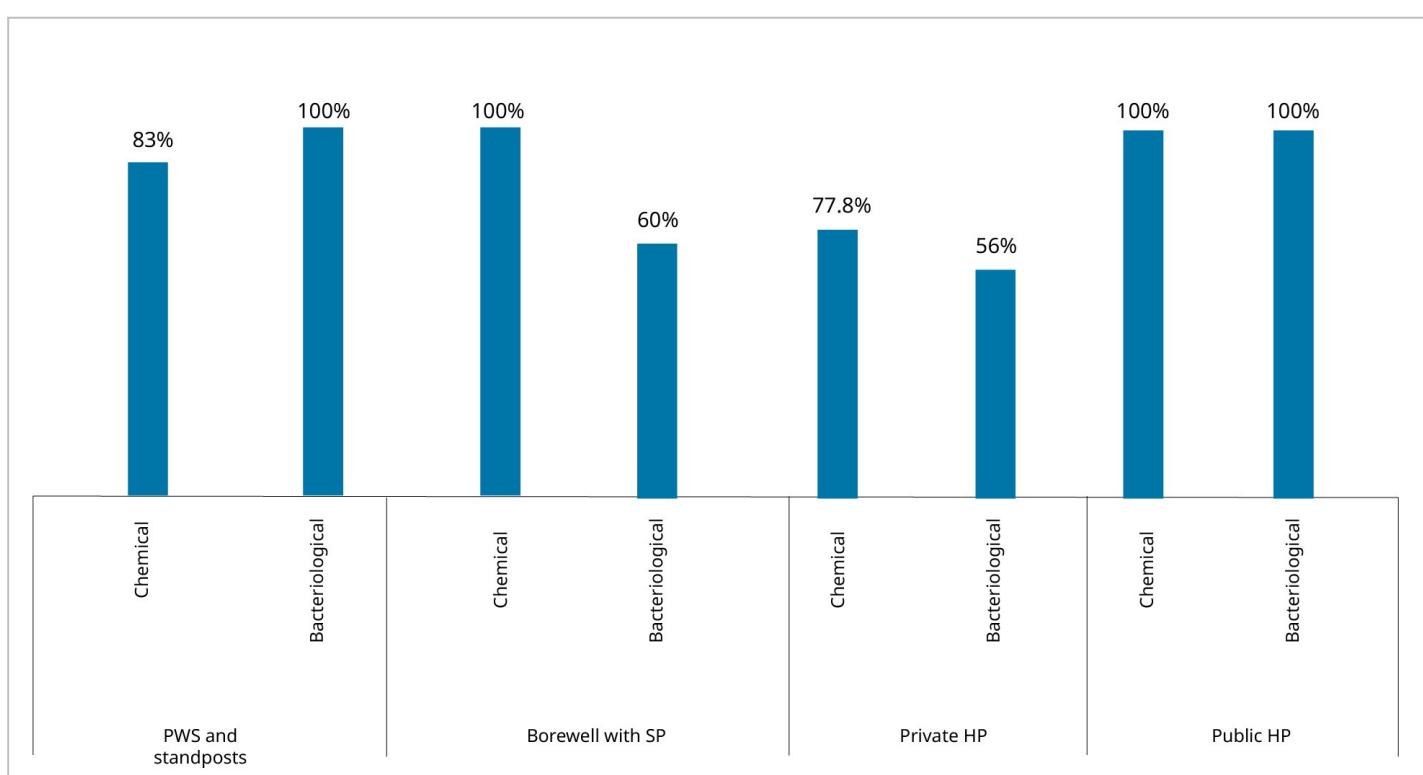
Sustainability measures

The groundwater level is monitored once every year by the PHED and has reportedly decreased by 0.5–1.0 metre in the past ten years. As the decline has not been drastic, measures to conserve and replenish groundwater have not been planned or advocated by the nagar panchayat.

Further, access to water becomes scarce when tourism picks up from September to April. The increasing number of hotels and restaurants in the area has led to an increase in demand for water during the peak tourism seasons. These hotels and restaurants depend on groundwater for consumption, which poses a threat to the groundwater level in the future. There is no rainwater harvesting programme being undertaken at the public or individual level in the town, which forebodes the impending danger to groundwater sources.

Graph 8

Water contamination by source (based on lab test results (n=28))





Sanitation

Access to safe sanitation is a fundamental need of all people. The survey data revealed that slightly more than half (58.9 per cent) of the households in Bodh Gaya have functional toilets at home. Out of these, most households have simple containment structures, i.e. simple holding tanks while 23.6 per cent have septic tanks (Graph 9)⁴. According to the respondents from ward 6, "most of the containment structures are connected to the open drains, thereby causing faecal matter to be discharged in the open".

The proper management of faecal sludge is of primary importance. According to the survey, 90.6 per cent of the toilet pits have not been desludged in the past. Since there is no sewerage collection and treatment plant in Bodh Gaya, the groundwater and surface water bodies have a high possibility of contamination due to poor faecal management.

At present, the sewage generated from

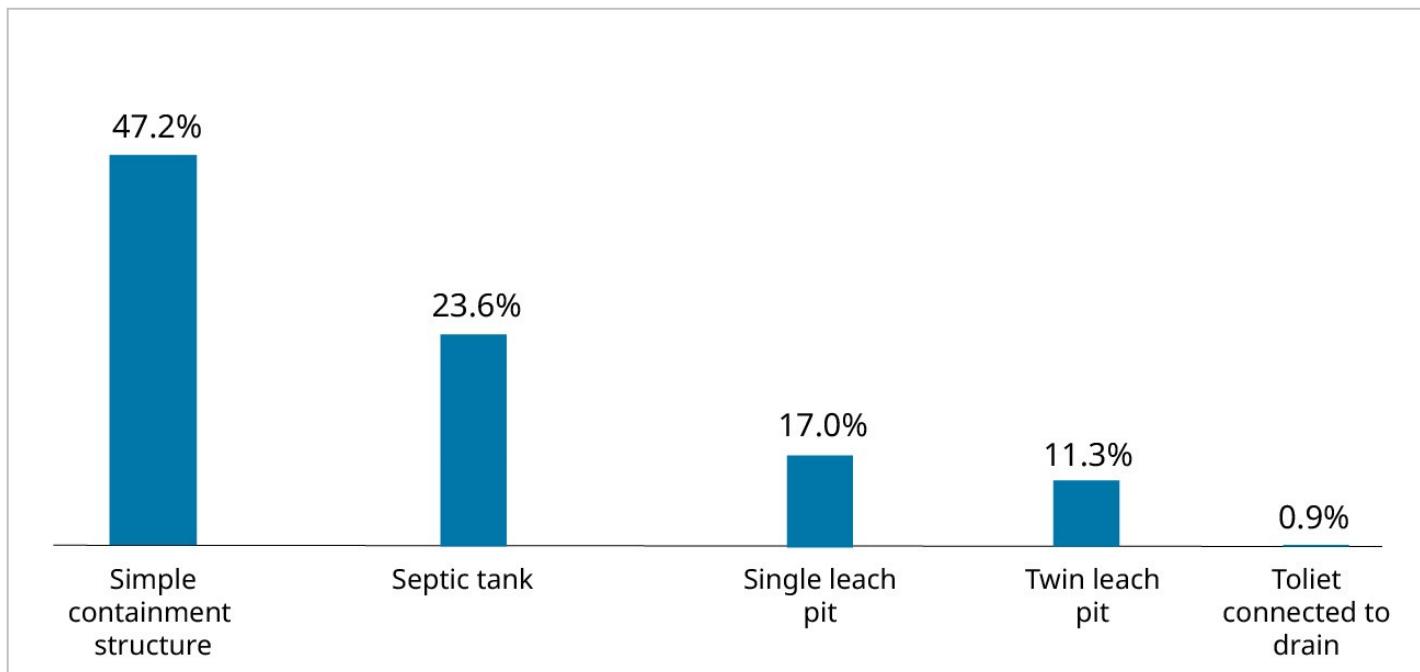
individual houses, monasteries, temples, and other establishments is discharged into the nearby storm water drains or agricultural fields either without any treatment or after partial treatment, while wastewater finds its way into the local river Phalgu.

Apart from unsafe toilet technology, 31.7 per cent households have not maintained the minimum safe horizontal distance of ten metres between the primary groundwater source and the nearest toilet pit. Maintaining a safe distance between the water source and toilet pits is important as 45 per cent households have a groundwater-based water source located within their premises used for drinking and cooking purposes and a mere 23.4 per cent of these households use any measures to purify their water.

31.7 per cent households have not maintained the minimum safe horizontal distance of ten metres between the primary groundwater source and the nearest toilet pit.

Graph 9

Types of toilet technology (n=106)



⁴ The data presented is based on the responses of the respondents; verification of toilet sub structures was not possible.

INTERVENTIONS NEEDED

- Piped water supply was started in the town in 2017 but PWS with a household connection is quite low at 9.4 per cent despite there being no connection charges and no water tariff for the first three years. The town authorities therefore need to understand the reason for the low uptake of piped water in the town and make efforts to increase access of households to clean drinking water.
- As the piped water supply scheme for the town has been recently provisioned, its operations and maintenance system need to be planned with clearly defined roles and responsibilities of the implementing agency, operating agency, and the nagar panchayat.
- Water quality monitoring of public water sources or at the household level is not an established norm in Bodh Gaya. Since contamination has been detected in both public and private water sources, it is recommended that urban water quality monitoring protocols should be developed at the state level and followed by the ULBs.
- Legislative provisions like the Water (Prevention & Control of Pollution) Act, 1974 need to be enforced in the town.

The State Pollution Control Board should plan a comprehensive programme for the prevention, control, or abatement of pollution of streams and ponds.

- The reliance on groundwater in the town is quite high as the PWS and individual water sources are also groundwater-based. Groundwater recharge should hence be given prime importance and measures such as rainwater harvesting should be promoted in public premises and at the household level in accordance with the Bihar Building By-laws, 2014.



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