FROM SOURCE TO TAP:

IMPROVING WATER SUPPLY IN LAHAN, NEPAL

LEARNINGS FROM THE BEACON PROJECT

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नेपाल खानेपानी संस्थान
Nepal Water Supply Corporation

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THE BEACON PROJECT

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EXECUTIVE SUMMARY

The Beacon Project is a long-term partnership between the UK water company Anglian Water and its Alliances (AWA), WaterAid Nepal, the Nepal Water Supply Corporation (NWSC), and the Ministry of Water Supply (MoWS) and Lahan municipality. First initiated in 2016 and then put into action in 2017, the Beacon Project aims to achieve sustainable municipality-wide safe water and sanitation for all and to create a model that can be replicated in other municipalities and NWSC branch offices throughout Nepal. Creating a legacy that grows is central to the Beacon Project – so key learnings will continue to be documented and shared as the project progresses.

This report does not cover all aspects of the Beacon Project but focuses on improvements to the NWSC water supply system in Lahan. It documents the major activities, results and lessons learnt across seven technical areas, which can each be read as stand-alone case studies – demonstrating how the Beacon Project has contributed towards positive change across the whole water supply system, from source to tap.

WATER RESOURCE PLANNING

Strategic planning for water resources in Lahan is becoming increasingly important as more households are being connected to the network and the population is forecast to grow significantly. The Beacon Project has supported two hydrogeological studies undertaken by students from Tribhuvan University, as well as initiating groundwater monitoring and helping to improve collaboration between the different stakeholders – which will be essential to aid the development of an integrated water resources plan.

BOREHOLE DRILLING AND CCTV SURVEYS

The NWSC water supply system currently relies on groundwater abstracted from deep tubewells. However, NWSC have encountered problems with boreholes failing due to the ingress of fine sand, which has led to high turbidity in the network and ultimately caused the boreholes to silt-up. The Beacon Project has supported the better protection of existing boreholes, along with the decommissioning of old boreholes. It has also assisted NWSC to develop a new technical specification for drilling – which has been endorsed and rolled-out across all 23 branch offices. One of the learnings from the project has been the importance of on-site supervision by an independent hydrogeologist during the drilling process – with an experienced hydrogeologist recently being appointed to supervise the next three boreholes to be drilled in Lahan. A CCTV camera was also donated to NWSC and training provided for the branch managers on using this equipment to survey existing boreholes and identify problems.

WATER QUALITY MONITORING

Water quality monitoring was previously undertaken on an ad hoc basis due to lack of resources. Surveillance has now improved, with samples from the boreholes being tested monthly, field test kits being provided for NWSC staff to monitor basic parameters on a regular basis, and the installation of sample taps by NWSC at each borehole according to a specification provided by Anglian Water. A Water Safety Plan team has also been established and trained, and NWSC has allocated budget to recruit a dedicated water quality chemist for the Lahan office. Water quality data is now shared and discussed regularly at the local coordination meetings, illustrating the increased importance both NWSC Lahan and the municipality attribute to it.

KEY ACHIEVEMENTS

- CCTV borehole and leakage detection training for NWSC staff from many branch offices.
- Development of new drilling specification for boreholes, adopted by all NWSC branches.
- Land allocated for future borehole drilling in Lahan.
- Regular water quality monitoring established and budget allocated for dedicated water quality chemist.
- Chlorine dosing improved.
- Over 286 pipeline leaks repaired.
- Hydraulic model developed for the network and detailed planning for first two District Metered Areas (DMAs).
- Increase in water supply by an average of one hour per day.
- Over 250 Dalit households accessing safe water from communal taps.

WATER TREATMENT

To reduce turbidity, improvements have been made to the sedimentation tank and both this and the overhead tank are now flushed out on a regular basis. Manually emptying chlorine powder into the sedimentation tank has been replaced by a simple chlorine dosing pump, while designs have been prepared for a permanent inline chlorination system, which will be installed in the next three months. To ensure the new chlorine dosing system is sustainably managed – the past failures of the original systems should be taken into account.

REDUCING NON-REVENUE WATER

One of the early successes of the project was supporting the NWSC staff with training and equipment to detect and repair leaks in the pipeline. As of October 2020, 286 leaks had been repaired in Lahan and every tap at the public tapstands have been replaced. Improved protocols have also been developed for installing and commissioning new pipelines to reduce the risk of future leaks. Sustaining this progress requires thinking through how to incentivise prioritising the reduction of Non-Revenue Water (NRW).

NETWORK DESIGN (HYDRAULIC MODEL AND DMAS)

Information on the network was often incomplete and sometimes inaccurate, so the Beacon Project supported NWSC to conduct a drone survey to build up an accurate geographic information system (GIS) map, and customer connections were physically checked and tagged. Based on this map, a detailed hydraulic model has been developed, which shows where improvements are needed to ensure adequate pressure is maintained throughout the network. This has also facilitated plans to introduce District Metered Areas (DMAs) – which will allow NWSC to test and achieve continuous water supply within a specific area, in isolation from the rest of the system. The network will be divided into six DMAs, and detailed plans have been prepared for two of these areas to begin the transition to 24/7 supply.

EXTENSION TO DALIT COMMUNITIES

One of the key aims of the Beacon Project is to ensure that services reach the most marginalised and vulnerable communities of Lahan. A significant achievement of the project has been the extension of the piped network to four Dalit communities – who previously relied on inadequate and unsafe water points. 37 shared household tapstands have been provided serving 253 households, and further improvements on sanitation and hygiene have also been supported within the community, including construction of school and community toilets.

The seven chapters of this report reflect on the important steps taken across the different aspects of water supply in Lahan in response to various physical, technical and resource-based challenges. The progress made since the beginning of the Beacon Project and the lessons that have been learnt along the way indicate the importance of working on the technical issues, as well as strengthening coordination, monitoring and accountability to achieve sustainable results. This approach will be explored in a follow-up study that looks at the system strengthening aspects of the Beacon Project in detail.

1 INTRODUCTION

1. INTRODUCTION

The Beacon Project is a unique long-term partnership (up to 2030) between Anglian Water and its Alliances (AWA),[i] WaterAid Nepal, the Nepal Water Supply Corporation (NWSC),[ii] the Ministry of Water Supply (MoWS) and the municipality of Lahan, to achieve sustainable municipality-wide safe water and sanitation services. The project seeks to strengthen capacity and accountability, deliver sustainable solutions through partnerships, and empower the poorest and most marginalised to access safe water, sanitation and hygiene (WASH). The Beacon Project aims to develop and demonstrate holistic solutions that work across communities, local governments and utilities, and ultimately contributes to Nepal's journey towards achieving the Sustainable Development Goals (SDGs).

PROFILE OF LAHAN

- Largest of the 17 municipalities in Siraha District, with a population of 91,766 people across 24 wards (2011 Census).
- 35% of the population have access to an intermittent water supply.
- 65% have no access to a treated water supply.
- There are 51 informal, poor and Dalit settlements in the municipality with total population of 21,946 Dalit (2011 Census).

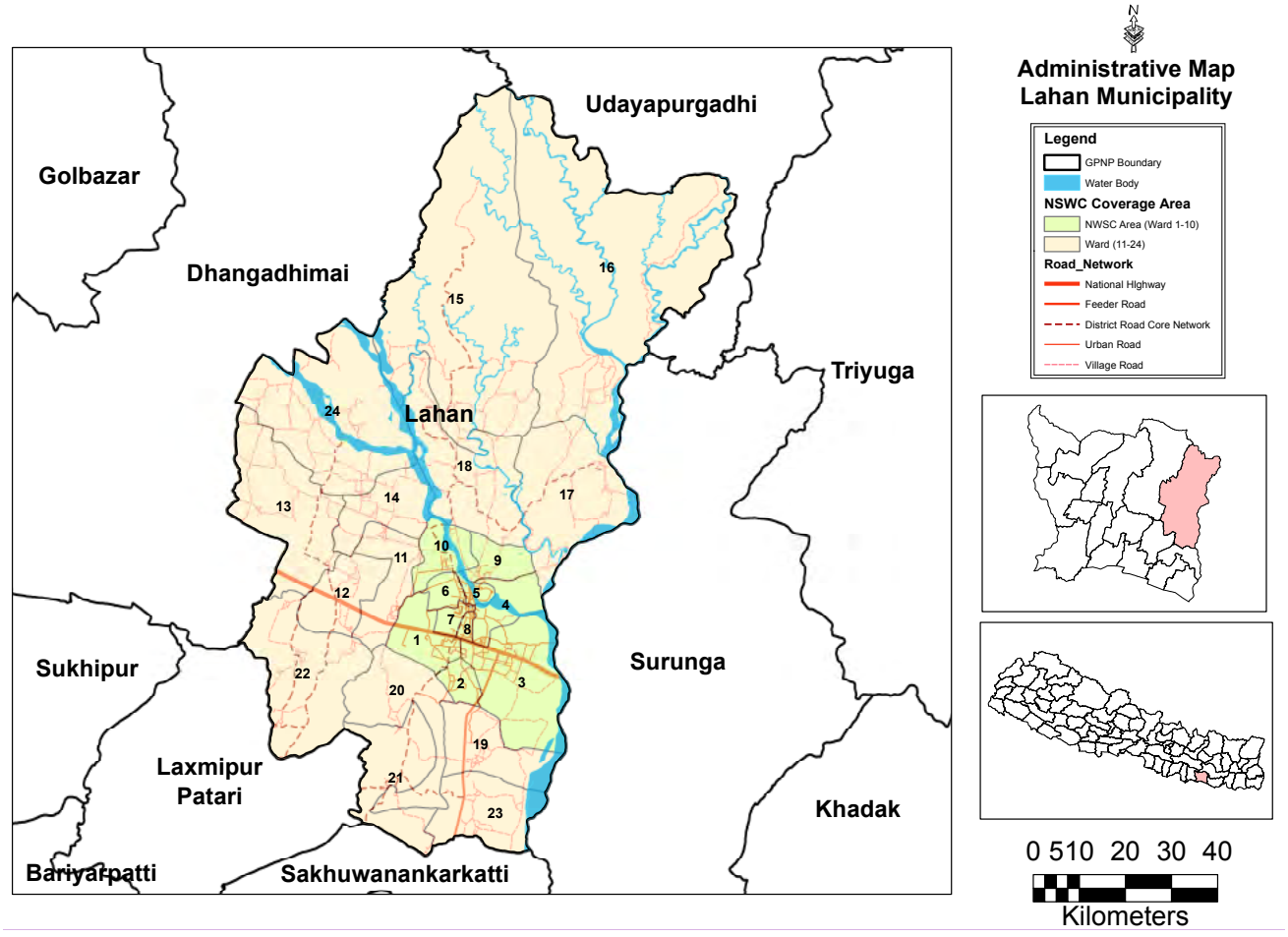

Figure 1: Map of Lahan municipality.

i Anglian Water is a UK water company. It has set up five alliances to harness the skills and capabilities of leading construction and technology companies to deliver its investment work. These are collectively referred to as the Anglian Water Alliances and all the companies involved contribute towards the Beacon Project.
ii NWSC is a public utility organisation, an autonomous government body formed under Nepal Water Supply Cooperation Act 2046 (1988) providing water supply to 24 towns in Nepal, including Lahan.

The Beacon Project outcomes are summarised below:

BEACON OUTCOMES 2020–2030[1]

The above wheel shows the outcomes the project intends to achieve in the centre with the accountabilities for each outcome shown in the outer rings. The central outcome of a legacy that grows is shown in the middle, as each of the other outcomes contributes to this outcome.

- **Water security** – long-term sustainable sources of water for all users which enable economic development (new homes and businesses, agriculture and tourism), improve public health and are resilient to future challenges around climate change and the need to protect and enhance the environment for now and future generations.
- **Safe, clean water** – water that is available for people to use is safely managed and a suitable quality for the purpose for which it is to be used.
- **Sanitation with dignity** – people in Lahan believe in the importance of hygiene and sanitation. They have safely managed sanitation facilities and improved hygiene practises in the home, at schools and in healthcare facilities.
- **Sustainable faecal sludge management** – Lahan is known for having a clean environment, with faecal sludge being safely managed and contributing to the local agricultural economy.
- **A legacy that grows** – organisations responsible for the management of water in Lahan are trusted by users and stakeholders, and use gender and caste equality as founding principles. Learnings from the project are shared to increase capabilities across Nepal.

The Beacon Project was initiated in 2016 with scoping and assessment by WaterAid and Anglian Water and then implemented from 2017. The governance structures of the project (as shown in Figure 2, next page) was established and agreements formally signed between collaborating partners in September 2018.

The project is a collaborative effort where each partner brings their specific area of expertise to co-create a dynamic and impactful project. Anglian Water and Alliances (AWA) provides partial technical and financial support for the NWSC's Lahan branch to introduce standard practices and technological innovations in close coordination with WaterAid Nepal. WaterAid Nepal facilitates the implementation of activities on the ground, working closely with NWSC Lahan, the Lahan municipality and a local partner non-governmental organisation (NGO) Dalit Jana Kalyan Yuba Club (DJKYC). The combination of capacity building and hands-on implementation support is transforming WASH services in Lahan towards a model that can inspire and guide the other 23 NWSC branches – achieving the right to water and sanitation for all.

Purpose and scope of this document

One of the key goals from the Beacon Project is to create 'a legacy that grows' and an integral part of this is in documenting and sharing the learning as the project progresses.

Rather than trying to capture everything in one report, the scope of this document is focused on sharing achievements and learnings with regards to improvements to the NWSC water supply system in Lahan. It documents major activities, progress and lessons learnt across technical areas – taking a 'source to tap' approach to trace how the Beacon Project has contributed to each stage of service provision to achieve improvements across the entire system of piped water supply.

This learning document will be followed by others, including an in-depth study on the system strengthening aspects of the Beacon Project.

NWSC installing pipeline in Lahan municipality.

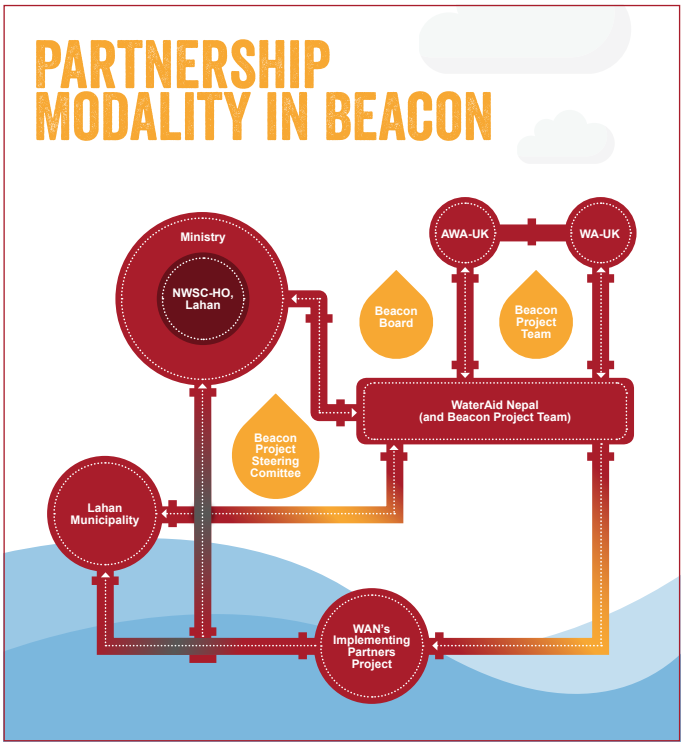

Figure 2: Partnership modality in the Beacon Project.

Structure of the report

A simple schematic and description of the NWSC water supply system in Lahan is provided for context. This is then followed by seven chapters reviewing key areas of progress under common headings to consider what the problem or issue was to be addressed; what has been done so far; results (both in Lahan and beyond); and lessons learnt. The series begins with water resources in Lahan – looking at recent research on Lahan's hydrogeology and wells, and the implications for long-term planning and strategy. The second chapter focuses on the drilling and operation of the boreholes that supply Lahan's piped water system. The following chapters move from source to distribution, providing an account of key steps taken to improve water quality and treatment. The next chapters look at the more system-wide issues of non-revenue water (NRW) and the introduction of district metered areas (DMAs). The final chapter shows how the improved and expanded supply of water through community and household connections (the 'taps') are changing the lives of people in Lahan municipality, particularly the marginalised Dalit communities in different wards.

2

OVERVIEW OF NWSC LAHAN'S WATER SUPPLY SYSTEM

2. OVERVIEW OF NWSC LAHAN'S WATER SUPPLY SYSTEM

The Lahan water supply system was installed in 1981 by the Department of Water Supply and Sewerage Management (DWSSM) and then upgraded by JICA (Japan International Cooperation Agency) with basic water treatment facilities and two more boreholes, before being handed over to NWSC in 1999.[2] NWSC have since drilled at least six boreholes – three to replace non-functional boreholes, and three new boreholes (BHs 6, 7 and 8), which were recently connected to the network. A schematic of the current water supply is shown in Figure 3.

The water supply relies entirely on groundwater sources, with large diameter (10 to 12") deep tubewells and electric submersible pumps. The groundwater table in Lahan is actually very shallow (less than 10m below ground level), but the boreholes were drilled up to 180m to draw from multiple aquifers. The chemical water quality is generally good except for the presence of iron, particularly in one borehole (Laxminiya) which has very high levels of iron and manganese, along with traces of arsenic. Borehole yields are relatively high (ranging from approximately 500 to 800 litres per minute) but have been seriously affected by the ingress of fine sand into the boreholes, which has resulted in high turbidity in the supply and caused the boreholes to rapidly silt up. Two boreholes have had to be abandoned because of this issue and a third (BH8) will be unlikely to enter supply.

Water is pumped up to two large elevated water storage tanks (each with a capacity of 450m^3) which then provide gravity-flow into the network; though two of the boreholes enter the supply directly as shown in the schematic. There are currently 3,109 connections as of September

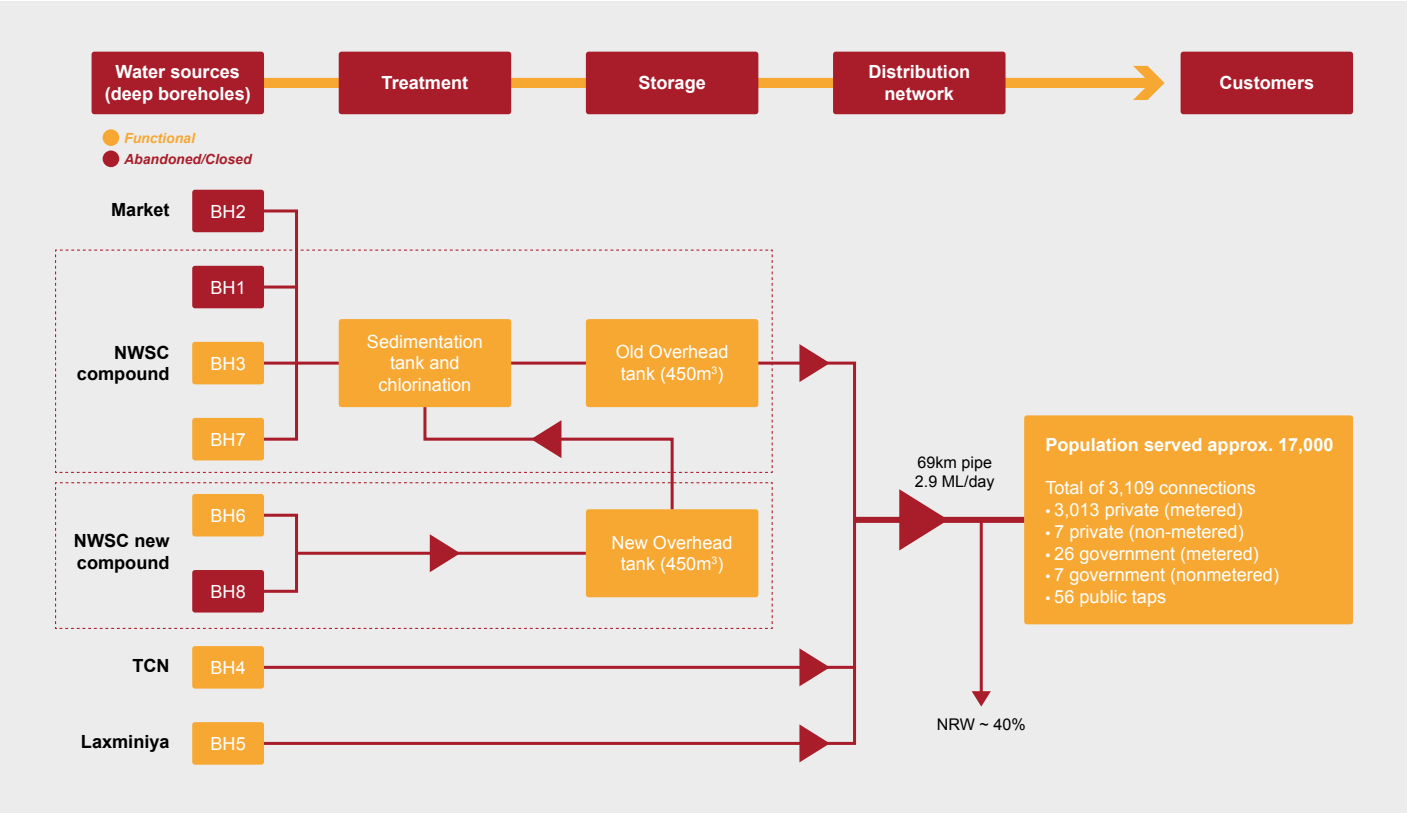

Figure 3: From source to tap.

Completion of the water tower in the new NWSC compound (2018).

2020, providing water to approximately 35% of the urban centre of Lahan (wards 1–10). The remaining population mainly rely on communal and private shallow tubewells with handpumps.

This report covers improvements which have been made so far to NWSC's water supply network in the urban centre, wards 1–10, which have a population of 33,653 (as per the 2011 Census). This was the initial scope of the Beacon Project and has been the focus up to now. However, with the new federal structure of Nepal, Lahan was expanded to cover 24 wards. Thus, over time, the Beacon Project aims to work with the municipality to improve access to all 24 wards, across the total population of 91,766 (as per the 2011 Census).

Groundwater training with NWSC staff.

3

PROGRESS AND LEARNING

3.1 WATER RESOURCE PLANNING

THE ISSUE

NWSC currently provides water for about 35% of the population[3] in the urban centre (wards 1–10) and supplies approximately 2,956 m^3/day[4] – with most connected households receiving supply for 4 to 5 hours. 100% of this supply is from groundwater.

In order to extend services to the entire population of Lahan town and provide 24/7 supply,[iii] the volume of water being abstracted by NWSC will need to be increased significantly. Although the new connections will mainly replace existing groundwater sources (private shallow tubewells fitted with handpumps), household demand and therefore total abstraction will increase substantially once a piped water connection is provided – the NWSC standard for planning is 135 litres per capita per day (lpcd). Furthermore, Lahan is a rapidly urbanising municipality. In their recent report,[5] Aviyaan Consultants assume a population growth rate of 2.98% per annum, which means the town's population can be expected to increase by 34% by 2030 and 141% by 2050. While reducing NRW losses in the network (currently estimated at 40%)[3] can help offset the increased demand, this alone will not be sufficient. NWSC estimate that demand for the whole municipality (wards 1–24) will increase from 14,000 m^3/day to 20,000 m^3/day within the next 15 years.[6]

It is critical to develop a better understanding of the groundwater resource in order to ensure that the future water demand can be met and sustained. This will enable a strategic plan for water resource management to be developed, which considers not only domestic water supply but also abstraction for agriculture and other uses. A previous study of the groundwater resource in Siraha District commissioned by WaterAid in 2017[7] found that water levels in boreholes had already begun to decrease in some areas – particularly in the Bhabur Zone in the northern part of the District.

WHAT WAS DONE

The Beacon Project helped support two geology students from Tribhuvan University (Kathmandu) to undertake their Master's research in Lahan in 2019. The two studies are briefly summarised below:

- **An assessment of groundwater resource of Siraha District with detailed hydrogeological mapping in Lahan.**[8] Borehole data was gathered from the Divisional Offices of the Groundwater Resource Development Board (GWRDB) and the Department of Water Supply and Sewerage Management (DWSSM), plus drilling companies. Lithologs from 37 deep tubewells were used to characterise the groundwater aquifer (depth, type, transmissivity and recharge) and information from a further 17 shallow tubewells was used to develop a detailed hydrogeological map of Lahan municipality – some of this data is shown in Figure 4.

- **Well performance and hydrochemical assessment of tubewells in and around Lahan municipality.**[9] Water quality samples were collected from 35 groundwater sources (27 shallow tubewells with handpumps, 5 deep tubewells (NWSC) and 3 dug wells and tested for 15 parameters).[iv] The chemical water quality was found to be within Nepal Drinking Water Quality Standards for the parameters monitored, though 25% of the shallow tubewells/dug wells had bacteriological contamination.

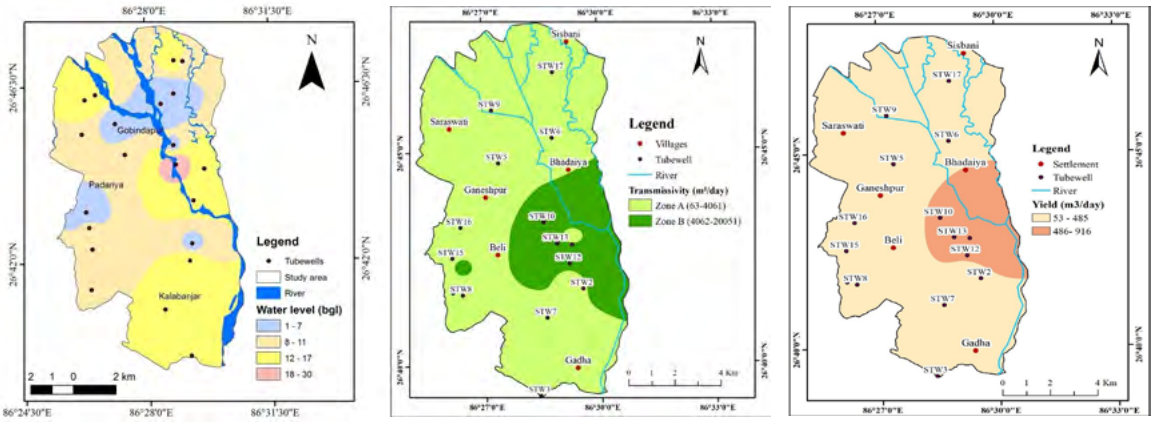

Figure 4: Examples of hydrogeological mapping for Lahan municipality.

1 – Groundwater levels
2 – Aquifer transmissivity
3 – Boreholes yields

iii Taken here to mean a continuously pressurised water supply.
iv Temperature, pH, electrical conductivity, total dissolved solids, dissolved oxygen, hardness, sodium, potassium, iron, nitrate, ammonia, sulphates, chlorides, calcium and coliform.

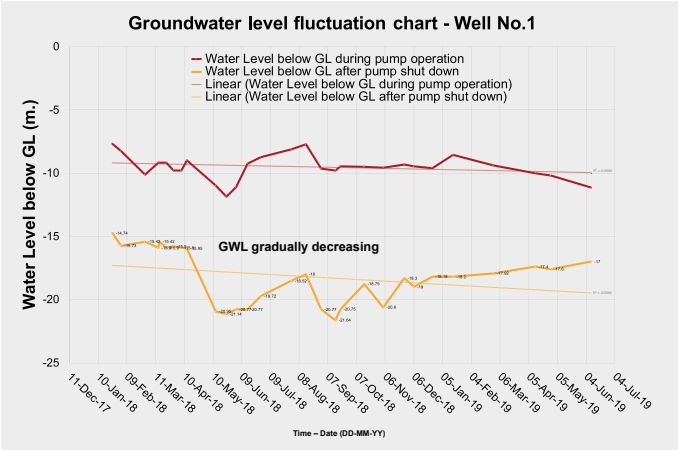

Figure 5: Groundwater data mapping of Well no.1.

Two further areas of work have been undertaken. NWSC recently commissioned a feasibility study[10] for construction of a sumpwell (infiltration well) at the river in Lahan (Jhirjhire Khola) to investigate the possibility of using surface water sources to meet expanding demand, while recognising that additional treatment would be required.

Also, groundwater level monitoring was initiated in one of the NWSC boreholes and data was collected for a period of about 18 months (see Figure 5) until the borehole had to be abandoned due to sand ingress and collapse. Future water resource management plans will require regular and systematic monitoring of groundwater levels in Lahan.

RESULTS

Water resource planning is still very much work in progress as part of the longer-term strategic planning for water supply in Lahan. Nevertheless, the initial hydrogeological assessment has provided valuable data to inform the current discussion about whether to develop more groundwater sources or use surface water in Lahan. The project has also begun to improve collaboration between the different government bodies responsible for water source development in Lahan – NWSC, DWSSM and the GWRDB, together with the municipality, which will be essential for integrated water resource management.

One of the consequences of this improved collaboration has been the active participation of the municipality in identifying and allocating other plots of land within the town to NWSC for future borehole drilling and associated works. Since land is under increasing demand for development as the town expands, this is a significant result and demonstrates the commitment of the Lahan municipality to provide safe and adequate drinking water for its citizens.

LESSONS LEARNT

While in general the Terai[v] region in Nepal is blessed with an abundant groundwater resource (calculations by the GWRDB, see Table 1, show that abstraction is currently just over 50% of annual recharge) a rapidly growing population, urbanisation and a growing demand with piped water provision require that effective systems are put in place to manage the resource sustainably.

Currently, there is a division of roles and responsibility for water resources across different departments and ministries. NWSC, which is governed by a board and sits under the MoWS, is responsible for water supply in old Lahan (wards 1–10). The Water Supply and Sanitation Divisional Office (WSSDO), which also reports to DWSSM, is developing new water supply systems in the rural areas (wards 11–24). However, water supply for agriculture is developed separately by GWRDB under the Ministry of Energy, Water Resources and Irrigation. Historically there has been little coordination between the two line ministries. Improved collaboration is needed to develop an integrated and sustainable plan for groundwater development,[vi,12] which extends beyond administrative boundaries to provide comprehensive solutions to water resource challenges. For example, the recharge zone for the groundwater in Lahan is much further north in the Churia hills and land use changes there (including deforestation) will have a significant impact on this future resource in Lahan.

Total recharge		Total abstraction	
Land area	22,380 km^2	Irrigation (1,438 deep tubewells and 175,056 shallow tubewells)	3,837 MCM
Annual rainfall	1,730 mm		
Recharge – Bhabar	4,651 MCM	Domestic use	1,151 MCM
Recharge – other Terai	5,522 MCM	Industrial use	287 MCM
Total recharge (Terai)	**10,173 MCM**	**Total abstraction**	**5,276 MCM**

Table 1: Estimates of the annual groundwater recharge and balance in the Terai.[11] Measured in million cubic metres per year (MCM).

v The Terai is the flat, lowland region in southern Nepal which runs adjacent to and approximately parallel with the Indian border.
vi For further information, see the recent research published by WaterAid Nepal on groundwater resource and governance, which includes an analysis of the institutional and policy framework for groundwater.[13]

3.2 BOREHOLE DRILLING AND CCTV SURVEYS

THE ISSUE

A poorly constructed borehole can fail after a few years of operation, resulting in wasted investment and disappointed users. Governments, utilities and WASH stakeholders have a responsibility to ensure that boreholes are constructed to a high standard, with proper supervision of drilling procedures, in order to avoid any preventable failures.[vii,13] It should be noted that drilling a new borehole is very costly – drilling one 12-inch diameter borehole of approximately 180m depth costs approximately NPR 43,00,000 (GBP 28,000). But a well designed and constructed borehole should last for a minimum of 20 years (and potentially up to 50 years), thus achieving a reliable, sustainable and cost effective water supply.

In Lahan, due to challenges related to borehole design and construction, and the lack of regular supervision, most of the existing boreholes have been affected by ingress of very fine sand causing them to rapidly fill up and, in some cases, leading to the borehole being abandoned. In addition, the high turbidity causes frequent failures of pumps and flowmeters, requires more frequent cleaning of overhead tanks to manage sedimentation, and has been a source of regular customer complaints (with turbidity being one of the most visible indicators of water quality for users). Maintenance under such challenging conditions has considerable cost implications each year. Many of the boreholes constructed in the past also did not have the provision of sanitary seals, which increased the probability of contamination from surface water.

Using an air compressor to complete the development of BH7.

WHAT WAS DONE

Protecting existing boreholes

As a quick win, the project provided technical support to protect existing boreholes – replacing the borehole head plates to prevent surface contaminants entering the boreholes (for example, see the before and after photos below) and constructing a protective shed around the borehole in the marketplace. Where the borehole is of sufficient diameter, a monitoring shaft was fitted to facilitate groundwater monitoring.

Before and after replacing borehole head plates.

CCTV surveys

Another key intervention was to conduct camera inspections of these boreholes – these surveys provide important information on the condition and performance of a well or borehole. CCTV camera surveys conducted immediately after the construction of boreholes provide a useful benchmark against which to monitor the condition during future routine inspections.

A hands-on training on operating downhole CCTV cameras was conducted in Lahan in March 2019, attended by 27 NWSC staff from 17 branches including the NWSC head office, two staff members from Lahan municipality and one staff from the WSSDO of Siraha district. The onsite training on the existing boreholes in

vii See the guide produced by the Rural Water Supply Network (RWSN) 'Supervising Water Well Drilling: A Guide for Supervisors' for further details.[14]

NWSC Lahan revealed cracks in the borehole casing and inappropriate screen selection – which may have contributed to the sand ingress. Most of the functional boreholes were already more than half filled with sand and in immediate need of air-lifting. The direct experience of observing the state of these boreholes made a real impact on the NWSC staff and brought home the importance of proper borehole drilling and construction. Following the training, the CCTV camera unit procured by the Beacon Project was handed over to NWSC, and has been in regular use since, not only in Lahan, but also in nearby NWSC branches.

Decommissioning non-functional boreholes
As part of the project's support to surveying existing boreholes, five boreholes that had been abandoned by NWSC from 2004 to 2019 were properly decommissioned by NWSC with technical support from the Beacon Project. The decommissioning involved backfilling the borehole with gravel, followed by a thin layer of sand and a cement grout at the top. This prevents the old boreholes acting as transmission pathways for the contamination of groundwater and ensures they are rendered safe.

Reviewing drilling specifications
The project supported NWSC with reviewing the current drilling specifications to see if these could be revised to improve future installations. The review was done through a consultative process involving staff from NWSC, WaterAid Nepal and Anglian Water, and an updated set of technical specifications on borehole construction was drafted. This included key changes on requirements for sanitary seals, the design of the gravel pack and screen sizing, and a specification for well development and test pumping. Following further discussions and reviews, this was endorsed and rolled out by NWSC across all their branches throughout Nepal.[14]

Bringing in hydrogeological expertise
Following the updated technical specifications, the Beacon Project team realised that a full-time hydrogeologist was needed to ensure the borehole specification and test pumping instructions were properly followed and embedded in the institutional ways of working. An experienced hydrogeologist has recently been appointed in consultation with NWSC and AWA team, and will be onsite to guide and supervise the forthcoming drilling.

CCTV survey training by Anglian Water.

Planning for drilling of new boreholes
Due to the failure of several boreholes, NWSC are planning to drill a new borehole in Lahan in order to maintain current supply. The Beacon Project is also funding two boreholes for the two DMAs[viii] which have been prioritised in the south-east and north-east of the town as part of the longer-term transition towards a 24/7 supply, as well as supporting the increase in demand with extension to the Dalit communities (see section 3.6 for details of the proposed DMAs). The municipality has proposed available land as an option for both the South-East and North-East DMAs and it is anticipated that all three boreholes will be drilled between December 2020 and March 2021. The new specifications have been issued in the tender documents and the appointed hydrogeologist will supervise the work.

viii District Metered Area (DMA): A DMA is defined as a discrete area of a water distribution network which can be isolated from the system with boundary valves and bulk meters so that the flows in and out of the DMA can be monitored to help quantity and manage water losses. To achieve pressurised safe water supply in wards 1–10 of Lahan, NWSC has planned six DMAs for these wards, with technical support from the Beacon Project. Out of six, two DMAs were prioritised. The Detailed Project Reports (DPRs) have been developed and are currently being reviewed by AWA.

Further drilling will be required in Lahan in the future to meet the increased demand as more households are connected and to provide a 24/7 supply. The Detailed Project Report (DPR) prepared by the consultant[5] presents a phased approach to drilling boreholes over a 30-year horizon (i.e. up till 2050), but further work is needed to develop and discuss this long-term plan. Meanwhile, NWSC and WaterAid Nepal have started assessing land availability with endorsement from the Project Steering Committee (PSC) chaired by the Mayor.

RESULTS

With the technical support and continuous follow-ups, the new technical specification for borehole drilling and test pumping has been approved by the NWSC board and has been adopted in all NWSC branches as the standard for future drilling and test pumping. This is a landmark achievement with the potential to make a massive difference in terms of the quality and sustainability of boreholes, resulting in significant cost savings for NWSC.

The project is also facilitating more systematic planning around borehole drilling in the long-term through the DMA DPRs and taking specific steps, such as identifying land for acquisition for borehole drilling.

Alongside these longer-term measures, the usefulness of the CCTV camera survey has been widely understood across NWSC branches, and Lahan and nearby municipalities are making more informed decisions based on the practical tools and training provided by the Beacon Project. Since the training was carried out, six boreholes in Lahan and two in Janakpur municipality have been surveyed.

LESSONS LEARNT

While the project has facilitated a critically important revision of the technical specifications for drilling, there is a need to follow this process through to the point of implementation – ensuring that all drillings undertaken now strictly follow these procedures through communicating the new guidelines to all levels of staff and ensuring proper supervision. Recent experiences with a new borehole that was failing due to a construction flaw and sub-standard materials further demonstrated the need for appropriate siting, drilling and construction to be closely supervised by trained professionals.

The current Public Procurement Act of the Government requires departments to go with the lowest bid; technical criteria are only incorporated into the bid evaluation for tenders above NPR 20 million. In practical terms, this means that drilling less than five boreholes under a single contract will fall below this threshold. This presents a significant challenge to improving drilling practise as it is essential to review the experience and references of the drilling contractors as part of the selection process and ensure that bids comply with minimum technical standards.

3.3 WATER QUALITY MONITORING

THE ISSUE

Prior to the Beacon Project, water quality in Lahan was tested occasionally at the boreholes and consumer taps but was not systematically monitored. The Nepal Drinking Water Quality Standards (NDWQS) (2005)[15] requires the water supplier to carry out monitoring of water supply and sets standards for 27 parameters. For urban water supply schemes, five parameters (turbidity, pH, colour, taste/odour and free residual chlorine (FRC)) are to be monitored daily, and the other parameters on a monthly or annual basis. Responsibility for the surveillance of drinking water quality and adherence to the Standards falls under the Ministry of Health and Population and its line agencies (Department of Health); however, currently there is no formal reporting system. The role of DWSSM is to provide technical support. The NDWQS was recently revised (in 2019) and once this is enacted, it will require all service providers to report on 19 mandatory water quality parameters (within five years) in order to develop a national database.

Arsenic contamination of water supply is a challenge in certain areas of Nepal, with the most recent Multiple Indicator Cluster Survey[16] estimating that 2.8% of the population uses source water contaminated by arsenic. It is particularly a problem in the Terai region and a significant concentration has been found in one borehole in Lahan, BH5 Laxminya, where five out of the 13 samples taken between June 2018 and March 2020 contained arsenic levels of 0.02mg/l (which exceeds the World Health Organization (WHO) guidelines but is less than the national limit). High iron and manganese are also an issue and exceedance of NDQWS levels for these parameters has been observed in a number of boreholes. (For BH5, average levels of iron and manganese between March 2019 to March 2020 were 3.36mg/l and 1.8mg/l respectively).

As described earlier, high turbidity is a problem throughout the network and this has been a cause of frequent customer complaints since it is one of the more obvious signs of poor water quality. A customer survey in 2020[17] found that out of 2,881 connections, 416 connections (14%) always had turbid water and a further 224 (8%) had turbid water during the rainy season. When turbidity is very high, some consumers revert to using shallow tubewells with handpumps for drinking water. Of even greater concern, is ensuring that the water supplied has no bacteriological contamination

Water quality test being conducted at NWSC.

– this is a particularly high risk in Lahan given the lack of sanitary seals for boreholes, along with an intermittent supply which leads to regular drops in pressure, and high turbidity which compromises effective chlorination.

WHAT WAS DONE?

Regular water quality testing

The Beacon Project provided field-based water quality testing kits at the NWSC branch office in Lahan, and trained staff on testing critical parameters like iron, turbidity, pH balance, conductivity and faecal coliform. Turbidity, iron and FRC are now regularly tested at the outlet to the sedimentation tank and overhead tanks, and are recorded in a register. NWSC is also in the process of establishing a mini-laboratory at the branch office to facilitate testing and recruiting a water quality lead, who will regularly update the water quality data.

Furthermore, monthly samples from the boreholes, sedimentation tank and overhead tanks are collected and sent to a certified private laboratory in Biratnagar for

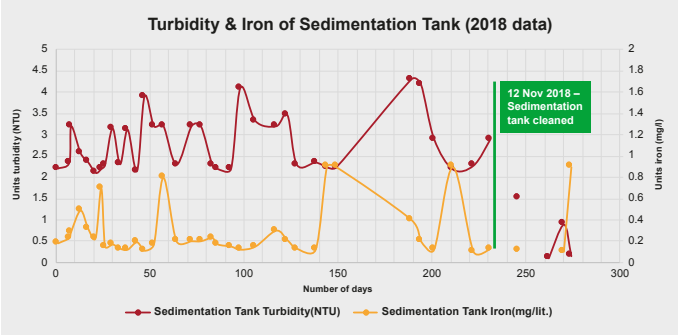

Figure 6: Turbidity and iron at the outlet of the sedimentation tank.

chemical and bacteriological tests, and the data is then systematically logged. These results are also shared in the PSC meeting, so appropriate action can be taken if there are any water quality concerns.

Water safety plans
A Water Safety Plan (WSP) team has been formed with members of NWSC, the municipality and the local partner, and a four-day training course was conducted in January 2018. A refresher training was also completed in October 2019. The WSP is a risk-based approach whereby hazards (possible contamination points) are identified and appropriate solutions implemented to mitigate the risks across the whole water supply system, from source to the point of consumption. The local partner (DJKYC) will support NWSC to take over leadership of this team to ensure that the WSP is regularly reviewed and updated.

Installation of sampling taps at each borehole
Sampling taps have been installed by NWSC Lahan at each borehole according to a specification shared by Anglian Water. This ensures that taps can now be properly sterilised before collecting water samples, so if any contamination is identified it is known to be from the source and not local contamination at the tap itself.

RESULTS

The project has established water quality monitoring as an integral part of NWSC's activities, and the fact that it is now regularly discussed in PSC meetings illustrates the importance both NWSC Lahan and the Lahan municipality have attributed to it. The upcoming initiatives of displaying water quality parameters and WSP reports, as well as conducting customer satisfaction surveys, will further strengthen the focus on water quality and create a system of accountability whereby both NWSC Lahan and customers can regularly engage on water quality issues. NWSC has also allocated budget to recruit a water quality chemist to join the branch office as a dedicated resource for future monitoring.

Borehole sampling tap installed in NWSC Lahan.

LESSONS LEARNT

Previously, infrastructural challenges associated with pump failures and old pipeline networks, lack of a proper surveillance system and limited accountability mechanisms meant water quality was a serious but neglected concern. The lack of a designated person to carry out water quality testing, meant that existing staff in the branch office could only undertake testing as and when other duties allowed, and there was limited accountability with water quality data not being regularly shared either with the municipality or the national NWSC office. Although there is a national drinking water quality standard, there is currently no effective surveillance system or targets for water quality compliance for utilities in Nepal.

In this context, Beacon has identified some resource-efficient ways to improve water quality in the short-run, while building towards a more advanced system in the long term. A combination of cost-effective testing, including field-based kits and interval-based testing of samples, along with basic training on testing and recording data, have set up a structure of regular monitoring and accountability. However, monitoring bacteriological water quality regularly remains a challenge for the team and, when resources allow, water quality monitoring (particularly FRC) should be monitored throughout the network at a sample of customer taps, not only at the point it enters the supply.

3.4 WATER TREATMENT

THE ISSUE

A limited water treatment system was installed in Lahan by JICA before it was handed over to NWSC. This consists of a 650m^3 sedimentation tank with a chlorine dosing system on the roof.

However, there are a number of issues with the current system. Firstly, it only treats water from boreholes in the NWSC compound – other remote boreholes (TCN and Laxminiya) enter the supply directly with no treatment. Secondly, due to the high turbidity in the boreholes themselves, the sedimentation tank rapidly fills up with sand and a significant sand/silt content is then still evident in the overhead tank and in the distribution network. Thirdly, the level of aeration and retention time in the tank is insufficient for iron oxidation to be complete by the time the water leaves the tank. Fourthly, there is no mixer for the chlorine and the sedimentation tank is not designed to act as a contact tank, so chlorination may not be effective. The automatic chlorine dosing system has not been operational for over a decade, so a manual dosing system has been established whereby NWSC staff manually add bleaching powder each morning from the upper manhole. However, this is both unsafe and allows for limited control of the chlorine levels.

WHAT WAS DONE?

Reducing turbidity

At the boreholes, testing has been carried out to monitor the turbidity at reduced flow rates in order to minimise the fine sand being pumped. However, current demand in the network with the existing boreholes means there is not much scope to reduce the pumping rates. The sedimentation tank was manually emptied to remove large deposits of sand that had built up, and the washout on the overhead storage tank is now used more regularly to flush out this tank before it enters the supply. Anglian Water also advised NWSC on the specification for hatch covers, and these have been replaced on the sedimentation tank (see photo) to prevent ingress of rainwater, bird faeces or vermin.

Chlorine dosing

The previous chlorine dosing system has been improved by installing a temporary pumping system in the sedimentation tank (see photo on the next page) and training the operator on safety measures around chlorine dosing and the preparation of the bleaching solution. The AWA has also prepared a design (Figure 7) with an inline chlorination system as a more permanent solution. NWSC plan to install three such chlorination systems – one between the sedimentation tank and overhead tank,

Rehabilitated sedimentation tank with the new hatch covers.

Figure 7: Temporary chlorine dosing system (photo) and proposed solution (drawing).

one at the new overhead tank and one at the remote borehole (TCN). The design has been approved by NWSC (after some modification to the tank size) and procurement is currently underway.

Iron removal plant
There is a longer term plan to develop an iron removal plant in Laxminiya and the new compound next year, the design of which is currently under discussion between NWSC Lahan and the Beacon Project team. However, land allocation for construction of these is being discussed with the municipality in the two DMAs that have been initially prioritised.

RESULTS

Previously, the challenges NWSC faced around water quality and treatment meant that many customers were dissatisfied, with less than 50% of customers satisfied with services according to one survey in 2016.[2] However, the changes brought about under the Beacon Project has led to positive engagement with the town's residents, particularly those from Dalit and marginalised communities. The Beacon Project is already working with NWSC to provide training to technical staff from other branches on water quality and treatment, and preparing to replicate the chlorine design system in other branches after successful installation in Lahan.

Similarly, the MoWS, DWSSM, NWSC and the Beacon Project are working together to develop a water improvement training programme for water utilities to share the Beacon Project's experiences more widely. AWA and DWSSM are now working on developing the training package, which will serve as a role model for national level training.

LESSONS LEARNT

The Beacon Project is working on addressing water quality challenges through improving current chlorine dosing practises, as well as investing in automated chlorine dosing and iron removal treatment down the line. However, alongside these technological solutions, the training provided on the safe handling, storage and use of chlorine is a simple, cost-effective measure supporting better water treatment that can be replicated more widely.

Regarding the design of the chlorine dosing system, some modifications to the initial design were requested by NWSC, since the large (15,000 l) plastic tanks for mixing are not readily available in Nepal. Also, given past negative experiences with chlorine dosing systems, it will be important to develop an operation and maintenance (O&M) plan to demonstrate how this can be sustainably managed in Lahan (and other branches). The potential benefits for effective disinfection – resulting in microbial risk reduction – throughout the network are enormous.

3.5 REDUCING NON-REVENUE WATER

THE ISSUE

Non-Revenue Water (NRW) is the difference between the volume of water that enters supply in a piped water network, and the volume of water billed and paid for by customers. It is expressed as a percentage of the water entering the supply which is 'lost'. High rates of NRW are a global problem in water utilities and in Lahan it is estimated at 40%.[3]

There are two major problems contributing to NRW in Lahan. One is a high rate of leakage in the piped network leading to physical losses. Leaks may be caused by poor construction (for example, poor quality joining), corrosion of old pipeline, mechanical damage (particularly where pipe has been installed at a shallow depth – see photo), or damage to valves, meters or other fittings. Many leaks remain undetected, and the water lost though them after treatment and pressurisation represents wasted money and energy that adversely impacts the sustainability of the whole system. Furthermore, leakage points are a potential health risk as they can be entry points for secondary contamination. This is particularly the case in a network with intermittent supply as there are regular drops in pressure, so contaminants can easily enter through any leakage points.

A second contributing factor, is that not all of the water supplied to customers is paid for, leading to a further loss in revenue. A survey conducted in 2020, showed that out of 2,881 tap connections, 102 were non-metered and a further 212 connections had non-functional meters.[17] In addition, there are 20 public taps serving 236 households in Lahan which are unmetered and run continuously during the supply hours, as taps are usually broken or stolen.

Leakage detection training.

Damage to pipes due to the shallow depth.

Leakage repair and household connection.

WHAT WAS DONE?

Reducing leakage in the network

In 2017, a mapping of NWSC Lahan's existing pipe network in GIS platforms was initiated with support from the Beacon Project. In November of the same year, a leakage detection training using listening rods was provided to seven participants from six NWSC branch offices, including Lahan, and two participants from WSSDO. Eight leakage detection equipment kits were procured, out of which two were handed over to NWSC Lahan, five were handed over to other NWSC branch offices, and one unit was kept in the Beacon Project office.

Based on this training, NWSC Lahan worked on repairing all visible leakage as an initial step to reduce physical losses. With proper recording of the leakages repaired, a heat map of the entire network was generated which identified hotspots for areas with leakages (see Figure 8). This has been a great tool to identify potential areas for the non-visible leakage detection and repair programming.

Repairs to the network being carried out by NWSC.

In addition, all 20 public tapstands were fitted with better quality taps, and nearby communities using these taps mobilised to take responsibility for using them properly. Meters will also be installed shortly so that consumption and losses at these public tapstands can be tracked and monitored.

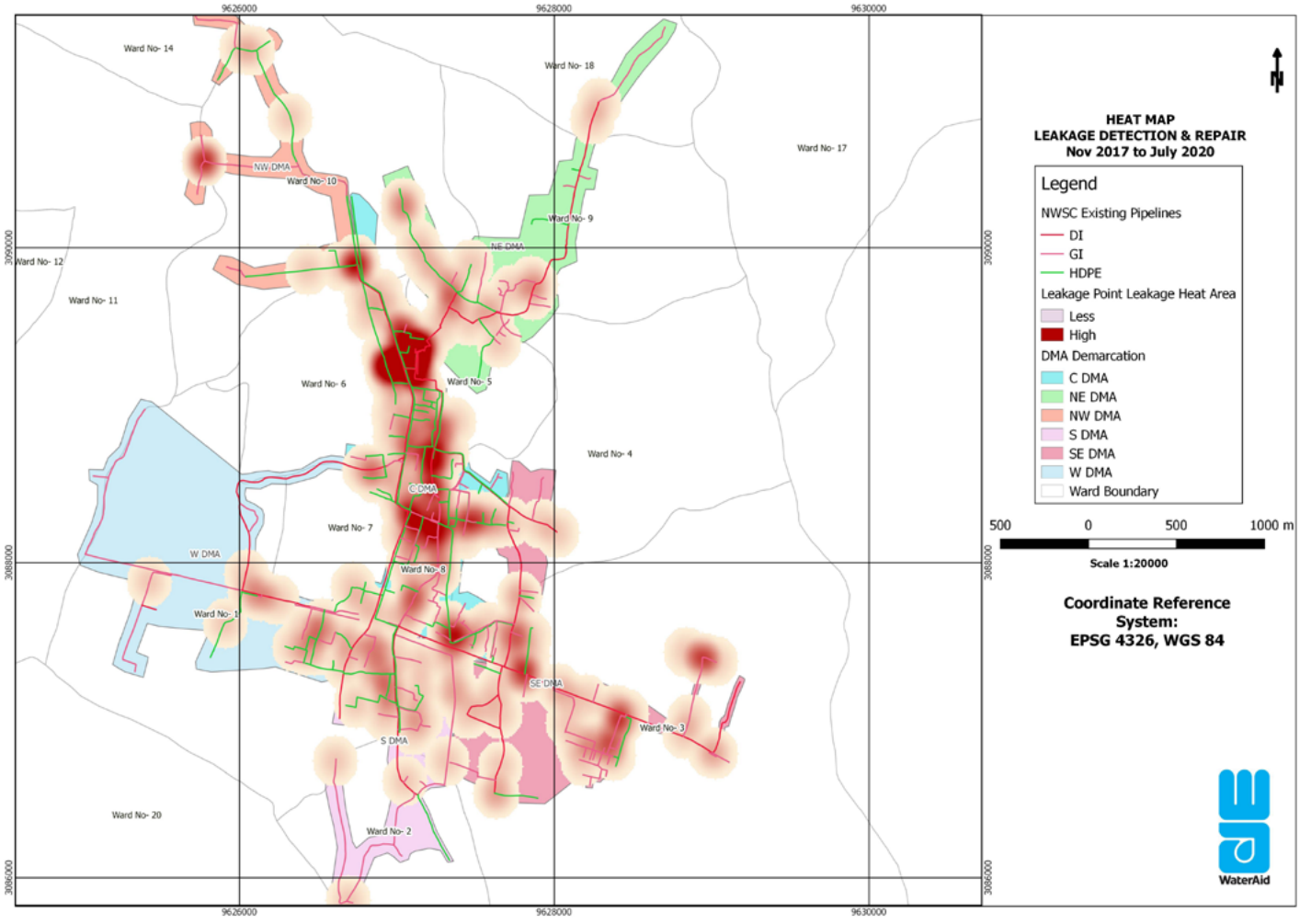

Figure 8: Heat map of piped water network highlighting leakages.

Figure 9: Welding high density polyethylene (HDPE) pipe.

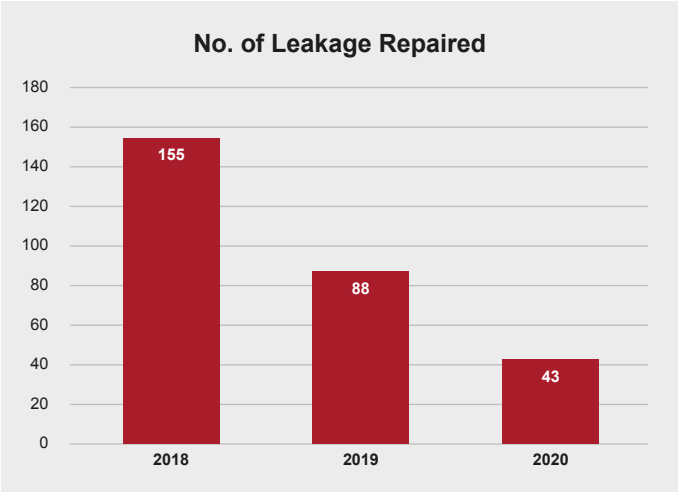

Figure 10: Leakage repaired by NWSC Lahan.

Protocol and equipment for installation of new pipeline

The Beacon Project has supported NWSC with training on best practice for installation of new pipelines, which includes (i) installing pipe to a minimum depth of 0.9m, (ii) bedding plastic pipe on a protective sand layer, (iii) using heavy class galvanised iron (GI) pipe where pipes have to cross the canal, and (iv) disinfecting and pressure testing the new pipeline before it is commissioned.

The project has purchased a vehicle and equipped this with tools and equipment, which will be handed over to NWSC to facilitate the leakage repair team. An electric butt-welding machine and mini-digger have also been donated, together with training, to help NWSC install new pipe and carry out repairs efficiently and safely.

Meter calibration and replacement

Revenue meters have been procured and will be installed to replace all of the non-functional customer meters and the meters at the public tapstands. AWA also assisted with the specification for electromagnetic bulk meters to be fitted in the network as part of the DMA design. Procurement is currently in process. Although these meters are more expensive, they offer two key advantages – firstly, very high accuracy and secondly, resilience to any fine particles in the water, since there are no mechanical parts.

RESULTS

Since the leakage detection training, 286 leakages have been repaired and recorded in Lahan between 2018 and October 2020, as shown in the graph above. Visible leakages dropped substantially as the repairs were done regularly and rigorously. With knowledge and hands-on experience of leakage detection, staff of other branches are also following this technique to detect non-visible leakages. Currently, it is not possible to quantify the impact on NRW, but once the bulk meters are installed this can be calculated in each of the DMAs and for the network as a whole.

LESSONS LEARNT

Every year, the municipality undertakes projects to clean the town's open canals. As most households lie across the canal, a lot of connection pipes become damaged in the process of using an excavator to clean the canal. Ongoing coordination and information sharing between the municipality and NWSC on projects that affect the pipeline infrastructure, such as building or repairing roads or digging ditches, is critical in reducing the number of further leakages. The PSC provides a platform for improved coordination and communication – however, key members of staff from both NWSC and the municipality will need to attend regularly and act on information shared to ensure timely responses.

Currently, there is no direct financial incentive for a branch office to reduce the NRW since all the revenue collected from customers is transferred directly to the NWSC head office; and the soft loan which NWSC receives from the Ministry at central level is then distributed each year to branch offices – largely on the basis of customer connections and major infrastructure works required. There is limited expectation that a branch office will collect enough revenue from customer billing to cover its costs.

3.6 NETWORK DESIGN (HYDRAULIC MODEL AND DMAS)

THE ISSUE

NWSC had incomplete records of the pipeline network in Lahan, with information missing on the location of valves, pipe sizes and elevation profile. Without this information it is impossible to build an accurate hydraulic model of flow rates and pressure in the system, and without the hydraulic model, future connections and expansion of the network may be inappropriate and create problems in supply operation.

It is also needed in order to help NWSC plan the transition from an intermittent supply to provide a 24/7 supply in Lahan. A consumer survey conducted in February 2020[17] showed that 1,974 connections (68.5%) receive water for up to four hours per day, 853 connections (29.6%) receive water for more than four hours, and 54 connections (1.9%) reported no water; though as part of the COVID-19 response, it has since been possible to increase supply by an average of one hour per day. Intermittent supply is common in Nepal and other countries, which creates a number of problems – including negative pressure risking contamination ingress and affecting meter accuracy, and resulting in customers needing to increase water storage in their premises, with a higher associated risk of secondary contamination.

DMA principles can be applied to convert from an intermittent to continuous water supply system. First, the water utility should consider installing a small number of DMAs that gradually feed continuous water supply, leading users in those DMAs to adjust to the new system and reduce excessive collection of water. Once consumption stabilises, the inflow volume into the DMAs should decrease within the five to seven-day period. The water utility should then undertake leak detection activities and customer surveys to reduce water losses to an acceptable level, creating spare capacity at the production plant. This spare capacity represents additional water that can be supplied to other areas. Once these first DMAs have successfully supplied water continuously and effectively reduced water losses, then the next set of DMAs can be established for conversion to 24-hour supply. The additional benefit of having 24-hour supply is that the pipe will be constantly pressurised, meaning that infiltration from outside the

Figure 11: Drone survey mapping.

Figure 12: Drone view of Lahan municipality.

pipe will be minimal. This will ensure that the quality of the water is kept to a premium and that the customer receives water of an acceptable quality.

WHAT WAS DONE?

GIS mapping

In 2018, a consultant was employed by the Beacon Project to create a GIS map of the network based on existing information.

Drone survey

A drone survey of the entire network was commissioned and carried out in 2019[18] in order to gather more accurate information (including elevation). The Unmanned Aerial Vehicles (UAV) survey was carried out at a height of 80 to 100m from the ground taking digital photographs of 12 to 50-megapixel resolution. Altogether 181 missions were flown to cover the entire area. A dense point cloud was generated from the tie points and classified into ground, road surface, high vegetation, buildings and human-made objects. The dense point cloud was used to generate a digital elevation model (DEM). The classified point cloud was used to create the Digital Terrain Model (DTM) by excluding buildings, structures and vegetation. In order to work in the GIS platform for further modelling, a Raster DTM with a resolution of 10cm was prepared. The Raster DTM was then used to prepare contours at 1m interval using QGIS software. The final survey is extremely accurate with an error of approximately ± 0.05m in the horizontal and ± 0.10m in the vertical direction.

Customer survey

In order to ensure all the customer connections were accurately mapped, a detailed consumer survey using a GPS was carried out during February 2020. Out of a total of 2,995 NWSC connections, 2,881 connections could be located, and detailed questionnaires and location survey

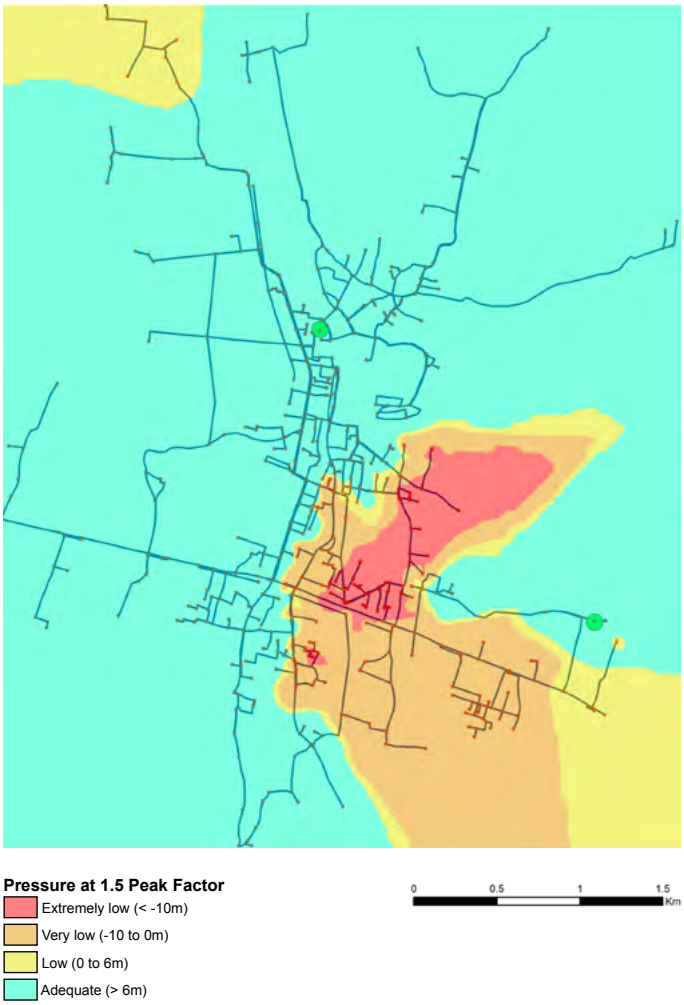

Figure 13: Results of hydraulic modelling of the current network.

were carried out. All of the meters were tagged with the customer identification number used on NWSC's billing system and entered on the SWMaps app. This means that the meter readers can now easily locate customers using this app.

Developing a hydraulic model[ix] and establishing DMAs

Hydraulic modelling of the existing system has been carried out with the data from the consumer survey and this is illustrated in Figure 13, which shows significant areas of negative pressure even at a peak factor of only 1.5.

DMA demarcation has been carried out with the objective of splitting the entire system into smaller manageable units with its own main supply or source. Altogether six DMAs were planned for the present coverage area of NWSC. For the detailed planning, two DMAs were prioritised and a DPR has been prepared for the two prioritised areas, namely South-East DMA (401 ha) and North-East DMA (542 ha). This model is based on

ix A hydraulic model of a water supply system is a map showing flow rates and pressure distribution throughout the network.

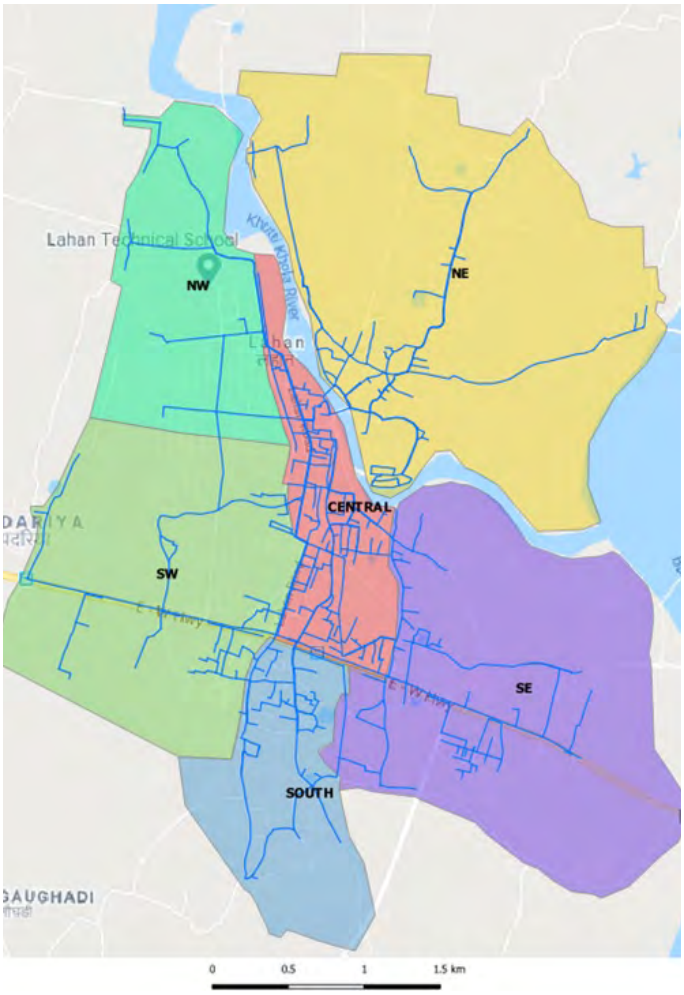

Figure 14: Proposed DMAs in NWSC Lahan.

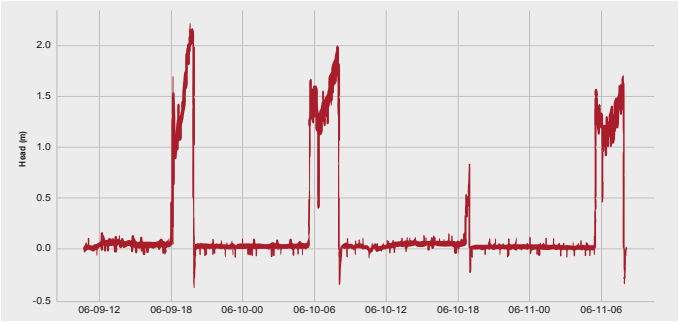

Figure 15: Variation in pressure near the end of the distribution network (North-East DMA).

forecasting water demand for the period up to 2050 and calculates the number of new tubewells likely to be required (based on existing flowrates of 600–800lpm and an allowance for 25% standby).

Procurement of flow meters, valves and pressure loggers

In order to validate the results from the hydraulic model, electromagnetic flow meters, valves and pressure loggers will be installed. This will give a fair validation and more confidence on the comprehensive hydraulic model of the entire 69km pipeline network and will also identify areas for improvement. The UK team provided support on the specification of equipment with the required accuracy and durability (including a relatively high tolerance of fine sand/silt) and procurement is currently in process.

Academic partnership

The Beacon Project has entered into an academic partnership with Sheffield University to further investigate the transition from intermittent to continuous water supply. During a visit in 2019, a pressure logger was installed in the overhead tank and at the end point of the North-East DMA to begin collecting data on pressure variations. Figure 15 shows the low pressure near the end of the distribution line and transient negative pressure when supply stops.

In September 2020, a PhD student started work on a four-year research project to determine the impact of developing a 24/7 supply of drinking water on assets, communities and the environment in Nepal. This will help to develop a much deeper understanding of the issues relating to intermittent water supply and ultimately guide the Beacon Project on how lessons from the transition to 24/7 in Lahan could be transferred to other locations in Nepal.

RESULTS

NWSC Lahan now has a detailed and accurate map of the network and an accompanying hydraulic model, which is essential for planning to the move towards 24/7 supply, and design of further extensions.

With the DPR of two DMAs in place, NWSC Lahan is now well equipped for budget planning, and justifying approval of the required budget to the NWSC board. Due to these factors, the budget allocation for NWSC Lahan branch has more than doubled compared to previous years. This also demonstrates the level of commitment amongst the NWSC Lahan branch, head office and even NWSC board towards the vision and aim of the Beacon Project.

LESSONS LEARNT

The operation of each DMA can be a challenge due to the limited human resources and their capacity to operate in transition from intermittent supply to 24/7 supply. Thus, capacity development trainings for NWSC staff at different levels are very important. Apart from that, the age of the pipeline that has been mapped is not known. This can result in many leakages once these pipelines are pressurised.

The network model has largely been developed by consultants and the Anglian Water team, and further training will be required for NWSC staff to enable them to develop similar models for other branches. Additional GIS capacity may be required so that maps can be kept up to date as the network is extended and new connections added.

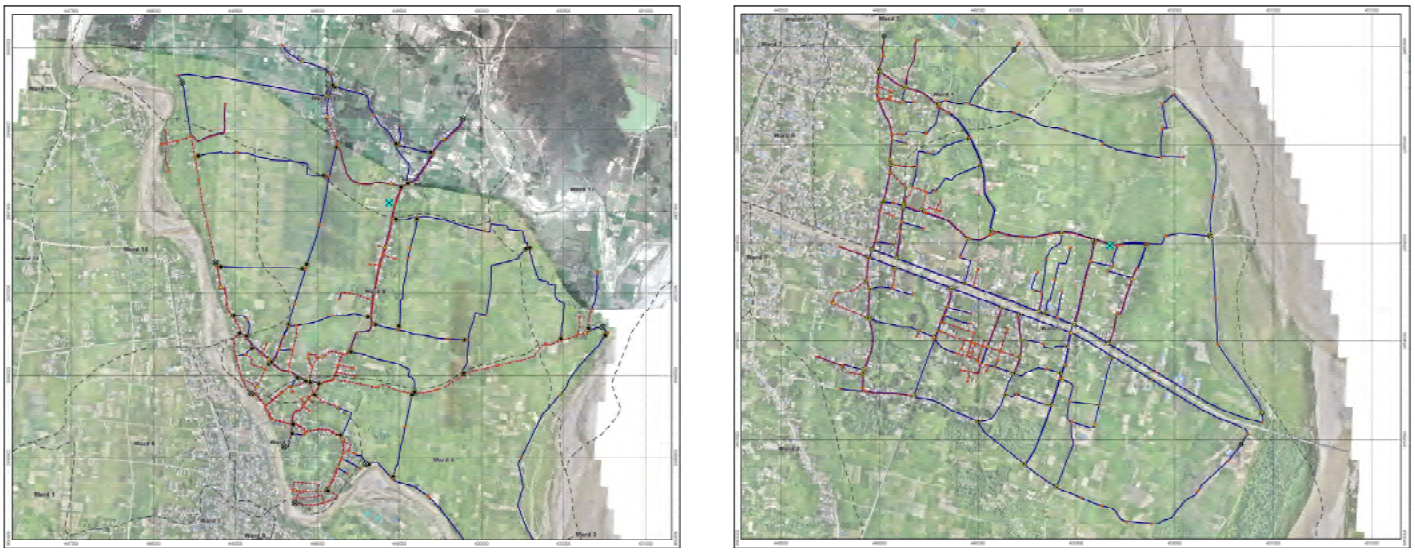

Figure 16: Network maps of North-East (left) and South-East (right) DMAs.

3.7 EXTENSION TO DALIT COMMUNITIES

THE ISSUE

Lahan is also home to a large Dalit population, distributed throughout all the wards with 6,508 in wards 1 to 10 alone (2011 Census). The Dalit community is a marginalised caste in Nepal, and are often geographically and socially segregated. Most households in the community rely on seasonal work as agricultural labour, earning a nominal 300–400 rupees per day for part of the year. Discriminatory attitudes against Dalit people mean they face serious opposition accessing communal resources, with women and girls bearing the brunt of these challenges as it is often left up to them to collect water from shared sources. The financial hardships, social discrimination and limited access to essential services, collectively pose a significant barrier to Lahan's Dalit population, denying them their right to water and sanitation – affecting their health, wellbeing and economic potential. The COVID-19 pandemic has exacerbated these manifold challenges, making it all the more difficult for these communities to make ends meet and intensifying social tensions and pressures both within and beyond the community.

The Dalit community are not covered under the piped water network, and so rely on shared water points, which are often few in number and far from their home. Many pockets of the community depend on just one or two tubewells which supply poor quality water. While due to insufficient water supply, others rely on water from unprotected dug wells or surface water to bathe in and wash their clothes and dishes.

At the community level, patriarchal social structures remain entrenched in the community, and as a result, women bear the burden of all water-related duties. Dalit women face regular conflicts and lack of cooperation from other community members over accessing these sources, who dispute their right to collect water during busy periods and accuse them of not taking responsibility for the O&M of the sources.[19] Since the tubewells and dug wells dry up in the summer season, some of the Dalit women walk for approximately 30 minutes to another village or the nearby river to collect water.

While household water connections or private tubewells would have eased much of the burden placed on women and girls, this is prohibitively expensive given the financial costs involved and the economic situation of Dalit households. The connection cost is NPR 8,500 and the house has to purchase fittings, taps and contribute to excavation and backfill for pipe laying from the main pipeline up to their houses. In addition, most of the Dalits have no land ownership certificate, which is a mandatory requirement for new connections from NWSC.

WHAT WAS DONE?

Expanding access to water

One of the major targets of the Beacon Project is to bring 24/7 water supply in wards 1 to 10 of Lahan municipality. In line with this ambition, community consultations were carried out in the Dalit communities to understand how they could be brought under 24/7 coverage in a sustainable way. These consultations revealed that given the connection costs and monthly tariffs, a 'One House, One Tap' approach would eventually create an unsustainable economic burden for a household. Instead, community members opted for a shared tap, where they could divide the connection charge and tariff among multiple households.

New tapstands being constructed to replace the communal handpump.

Dalit woman using the new taps in Mushahari tole.

This also circumvented physical constraints and legal issues – some Dalit communities are tightly packed together, living in cramped mud houses built in confined spaces of 200–500 square feet, without good drainage or sufficient space to install a tap in their home. Even where there is space, the NWSC requires land ownership certification to install taps in a property – which is rare amongst Dalits, given their lack of access to land and resources due to generations of caste-based discrimination. To facilitate shared connections given these circumstances, WaterAid's local partners Urban Environment Management Society (UEMS) followed by DJKYC, worked with tole lane organisations (TLOs),[x] which are community-based organisations formed of members from poor and marginalised households (including Dalit households), to support and monitor development activities within the community. Based on discussions between the project team, TLOs, NWSC Lahan and the municipality, and a request from the Dalit communities, the municipality recommended shared household taps in these areas to NWSC.

RESULTS

The Beacon Project's intervention in Lahan municipality has made a lasting impact in the Dalit communities. So far, the pipe network has been extended by 1,169 metres through financing from the Beacon Project to serve four Dalit communities. 37 taps have been constructed, benefitting 1,338 people in 253 households. Work is also underway to extend a piped water network with community connections in all ten wards over the next two years.

Availability of good quality water close to homes has resulted in greater personal safety by reducing the need to make long or risky journeys to collect water. Women and girls no longer have to queue for hours, and the disputes that had become part of daily life have disappeared. With improvements to drinking water and the knowledge of safe water handling, sanitation and

IMPROVING SANITATION AND HYGIENE IN LAHAN

Alongside access to water, the Beacon Project has been working on sanitation and hygiene, both of which bear a special import for women and girls in the Dalit community, who often have to manage with very limited facilities. One community toilet has been renovated, serving 60 Dalit families, while work on another community toilet is near completion. Sanitation campaigns and street drama performances were also conducted by WaterAid Nepal's local partner to raise awareness about the importance of safe sanitation.

To support the proper maintenance of these essentials, 18 WASH management committees have been formed in ten Dalit communities. These committees collect a tariff of NPR 50 from each household every month, which is used to pay electricity bills and purchase toilet cleaning materials, for example.

Beacon also promotes hygiene as an integral component of health. The project team distributed handwashing devices (bucket with tap and lid) with soap to 1,284 Dalit households, and organised orientations on proper handwashing with soap when COVID-19 struck Nepal.

x Tole – a community or segment of an urban settlement that is smaller than the lowest administrative unit (ward level).

hygiene, they are now reporting lower incidences of disease and lower expenditure on health.

Promotion of good hygiene in the communities has led to better solid waste management. While earlier, rubbish would be dumped by the roadside and left to decay, this is now collected in cement rings placed by the municipality in common disposal sites, which they periodically empty. Frequent trainings on sanitation and hygiene have prompted the communities to clean their houses and community areas. Children can now be seen regularly washing their hands and bathing.

The 'One House, One Tap' approach could not be implemented in the four Dalit communities that the Beacon Project supported in wards 1 to 10 due to feasibility constraints. However, the design estimate and pipe extension for expanding the scheme to the remaining communities has been planned, and will be implemented after assessing the economic situation of individual households.

LESSONS LEARNT

Early consultations and participation of Dalit members in the project's activities have been important in guiding the Beacon Project's intervention design – for example, changing from the 'One House, One Tap' model to shared household waterpoints. This engagement needs to extend to future plans and interventions, including during revision of current pricing – ensuring that price structures reflect the communities' ability to pay and willingness to pay, leading to a more equitable development trajectory.[19]

The research conducted in Lahan indicated that in some cases, households were not aware of how to apply for a connection to the NWSC network and that in addition to the cost of connection there may be other reasons why people continue to rely on informal water supplies, such as private tubewells.

While the 'One House, One Tap' national policy recommends household connections for every home, there are circumstances where shared household waterpoints can be considered as an alternate solution due to physical and economic constraints. Other NWSC branches can consider such a solution in cases where conventional household connections might not be sustainable.

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