Nepal Water for Health (NEWAH)

Halde Kharka WASH Project
Electric Lifting Pilot
Lekgaun VDC - 6 & 7, Surkhet – District

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Er. Santosh Kumar Basnet, NEWAH Technical Division

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Acronym

VDC	Village Development committee
V-WASH CC	VDC Water Sanitation and Hygiene Coordination Committee
DDC	District Development Committee
GI	Galvanized Iron
HDPE	High Density Polyethylene
HP	Horse Power
LPCD	Liter per capita per day
LPS	Liter per second
ltrs	Liters
MWRO	Mid-Western Regional Office
mtrs	Meters
NEWAH	Nepal Water for Health
NEA	Nepal Electricity Authority
PMDF	Parliament Member Development Fund
RWSSP-WN	Rural Water Supply and Sanitation Project-Western Nepal
WUSC	Water Users' and Sanitation Committee

Executive Summary

Nepal Water for Health (NEWAH) has been working in WASH for 20 years in rural villages in Nepal, applying different technologies appropriate for the context. In the hills, NEWAH implements gravity flow pipe water supply systems, to tap water at the top of the village for supply to villages lower down. NEWAH also promotes rainwater harvesting where settlements are at the top of a hill and water sources are significantly further down. Fog water harvesting is also used in locations where people are living on ridged foggy areas. However, fog water harvesting can be quite complicated because of the feasibility, sustainability and community management implications. In the plains, the only possibility is ground water abstraction: NEWAH supplies water to the community through shallow hand pumps, deep tube-wells and hand dug wells in these areas.

In 2012, NEWAH implemented integrated water, sanitation and hygiene (WASH) project, incorporating an electric water lifting pilot in Lekgaun VDC Ward No. 6 & 7 in Surkhet District through the Mid-western regional office (MWRO) based in Nepalganj. This report contains information only on the pilot water supply system.

Halde Kharka's lift and gravity water supply system is the first project of its kind for NEWAH. In its long history of applying different water supply technologies to rural hill villages, this is a bold innovative initiative. Although it's more expensive than regular gravity flow water supply systems, it has allowed 71 households that without such an initiative would not have been able to access water through any other means.

A spring water source, down below the settlement, has been lifted using the national electric grid to the top of a hill where the village lies. A surface reservoir tank (not an overhead reservoir tank) has been constructed at the top of the village to collect the water. The water supply system has been designed as a gravity flow system, distributing water from the reservoir tank to 12 tap-stands using HDP pipes to the households targeted in the settlement.

This project has been technically supported by NEWAH, with financial and technical support from Nepal Electricity Authority (NEA), and financial support from District Development Committee (DDC), Parliament Member Development Fund (PMDF) and Village Development Committee (VDC) at the cost of 4.1 million Nepali Rupees. All local materials, portage and labor contribution were covered by the users. Although this is an integrated WASH project, the cost mentioned in section 8 of this report covers only the water component and not the sanitation, hygiene and management cost of NEWAH.

Regarding the technical features of the project, it consists in one spring intake; two reservoir tanks; one sump-well; one powerhouse; twelve tap-stands; and a total of 6,437 meters pipes. Electrical parts consist of 21 electric poles, one 50 KVA transformer, two on/off switch boards, electricity meter, 2,780 meters ACSR cable, three 900 meters ACSR wire cable with accessories and 4HP Falcon brand water pump.

The communities now are very happy to access water from 12 tap-stands in the morning and evening. However, power is one of the major problems in effectively operating the system according to the users due to power fluctuation and 14 hour load-shedding. Besides, electricity charges are also high. The electricity charges being a bit costly for the community people to pay, NEWAH coordinating with NEA that the water would also be used for micro irrigation (vegetable farming), was successful in reducing the per unit charge.

Although costly than a regular gravity flow system, this kind of project has proven feasible for settlements like Halde Kharka on a hill without water sources above or around the community. There are future possibilities for NEWAH to implement lifting projects in close coordination with government bodies, other organizations and communities based on this experience. The future sustainability of the project would rely on a number of factors such as the availability of a trained caretaker with the knowledge of electrical systems, compliance of users to pay regular operation and maintenance fund for system upkeep, active WUSC to coordinate and establish linkage with concerned stakeholders for long term system management.

1. Salient Features

Project Name:	Halde Kharka WASH Project
District:	Surkhet
VDC:	Lekgaun
Ward no:	6 & 7
Road Head:	Nepalganj - Birendranagar (Surkhet) and Birendranagar - Phinikanda (Lekgaun-9)
Distance from road head to site:	Half an hour walking distance

Table 1: Design and structure Information

SN	Items	Qty	SN	Items	Qty
1	Households	71	12	Spring Intake	1
2	School	1	13	Reservoir Tank	2
3	Present population	369	14	Sump well	1
4	Students	170	15	Power house	1
5	Per capita demand	40	16	Tap-stand	12
6	Per capita demand school	10	17	HDP pipe	4,826 mtrs
7	Total water demand	14800 ltrs	18	GI Pipe	1,611 mtrs
8	Water source name	Haldeni	19	Electric Pole	21
9	Safe yield	0.32 lps	20	50 KVA Transformer	1
10	Lifting vertical head	182 mtrs	21	ACSR Electric cable	2,780 mtrs
11	Water pump	2nos.(Falcon)	22	ACSR cable 3 wire	900 mtrs

2. Project Introduction

NEWAH is a non government organization which has been working in rural WASH (water sanitation and hygiene promotion) sector in Nepal since 1992. In terms of technology, NEWAH implements, gravity flow, rain-water harvesting, fog-water harvesting technologies suitable and applied in hilly areas and shallow tube-well, deep tube-well, hand-dog well in the plains. NEWAH also has the experience of implementing small scale overhead tank water supply systems using the ground water and spring water sources.

Nepal has 80 to 85 percent drinking water supply coverage in the country while around 15% of people are still excluded from systematic water supply systems. Those people reside in difficult areas that are remote, scattered and /or are on hill tops, steep slopes or in boulder zone areas. For those areas, it is difficult to provide drinking water, due to availability of the water sources in accessible areas. For those communities, only alternative water supply technologies that require quite significant investments are apt.

Lekgaun VDC's Wards No. 6 & 7 in Surkhet district, has no water sources within the settlement or above the settlement to supply the village. All the water sources are located below the settlement. For decades people have carried water on their backs from all the way downhill, taking 20 minutes to reach the source and 45 minutes to walk back uphill to the settlement.

However, when the rural electrification reached nearby the village, people were hopeful. They approached different agencies and organizations to support a pumping/lifting project to lift water from down spring source to upward settlement as it only seemed a viable option to gain access to water in the village.

Therefore, when NEWAH Mid Western Regional Office (MWRO) Nepalganj was approached, they carried out a survey to understand the feasibility of a lifting project in two areas - Halde Kharka, Lekgaun - 6 & 7 and Phinikanda, Lekgaun – 9. Although two lift/pump projects were demanded by the people, Halde Kharka was found feasible of the two due to an existing source dispute in Phinikanda.

The Halde Kharka lift/pump water supply project, the first lifting project for NEWAH was initiated on 1 January, 2012 and completed on 31 December 2012. Prior to implementing the project, NEWAH sought support from other agencies with the knowledge and experience on lifting projects. NEWAH headquarters coordinated with Rural Water Supply and Sanitation Program-Western Nepal (RWSSP-WN) Pokhara and Gorkha Welfare Scheme (GWS) Pokhara for exposure visits. Ten technical staff from the organization's visited one GWS lifting project in Tanahun district, and participated in two-day training on lifting project designs with design software from RWSSP-WN.

After an exposure visit and training, when NEWAH's staff acquired knowledge in design and estimates, the project cost was finalized for the Halde Kharka lifting project. Following this, NEWAH-MWRO coordinated with other agencies in the district and VDC such as Nepal Electricity Authority (NEA), District Development Committee (DDC), VDC, Member of Parliament (MPs) and the community people for financial support. And finally, NEWAH succeeded in garnering financial and technical support from all these agencies and the community. As a result of this joint initiative, today Halde Kharka Lifting is a successful and well functioning project.

3. Project Area Background

3.1 TOPOGRAPHY AND THE PROJECT SITE

The project site is situated at Lekgaun VDC Ward No. 6 & 7, Halde Kharka of Surkhet District. The project area is situated in the south east of Lekgaun VDC. The fair weather road, closest to the site, is Phinikanda in Surkhet District. Although, soil of this area is boulder mixed type, almost 70% of the village area is arable, while the rest is covered by forest, bush and grassland.

This site is not feasible for a gravity flow system; it has no water sources available above the settlement. The water source that the villagers are using is about 45 minutes roundtrip from the farthest house and about 30 minutes walk from the nearest one.

3.2 OCCUPATION AND ECONOMIC STATUS

The majority of the population of Halde Kharka depends on subsistence farming. The local production is not sufficient for the whole year. Maize, wheat, paddy, millet and vegetables are the main crops of the area. Aside from agriculture, much income is generated from the village men working in India, the Gulf countries and other countries. Some also work as wage workers outside of the village but within Nepal. Very few households produce vegetables and are sold within the village and at local markets.

Keeping livestock is common in the project area, as they are considered a source of nutrition (milk and meat) as well as a source of income. Goats, cows, buffalos, pigs and chickens are the main domestic livestock in the village.

3.3 DEMOGRAPHY, BENEFICIARY AND USERS COMMITTEE

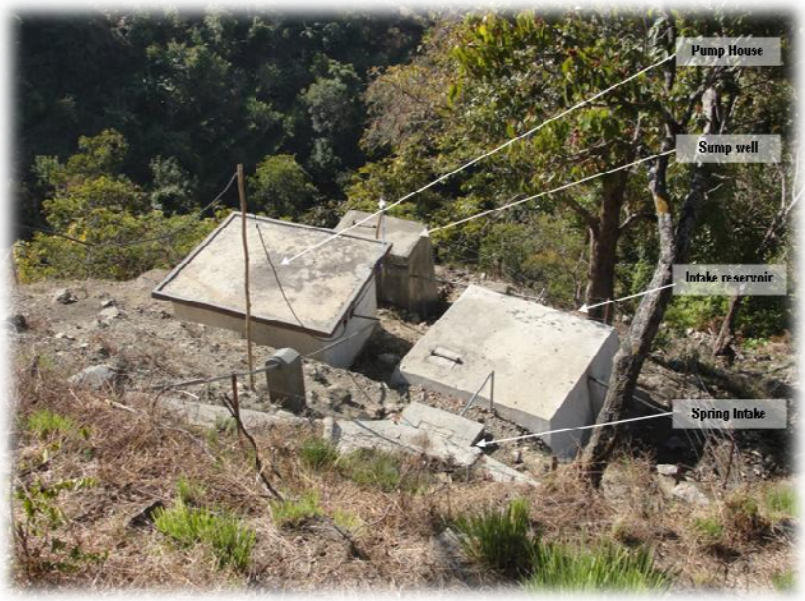
The lifting project has benefited 71 households with 369 inhabitants from Ward No. 6 & 7 of Lekgaun VDC, including one ward where there is a primary school with 170 students. The project area is comprised of Dalit, Magar, Chhetri and Brahamin households.

Table 2: **Demographic composition**

Ethnicity	Total HH	Total Pop	Gender				Economic Status			Disability	
			Men	Women	Boys	Girls	Ultra Poor	Poor	Medium	Disable	Non Disable
Dalit	25	122	40	35	15	32	83	39	-	-	122
Disadvantaged Janajati	34	194	65	65	31	33	13	64	117	-	194
Brahmin, Chhetri	12	53	17	18	9	9	8	18	27	-	53
Total	71	369	122	118	55	74	104	121	144	0	369

3. Civil Structures

Different civil structures have been constructed in the project site. There is a spring intake that captures water from the spring source. Water then flows into an intake reservoir constructed next to the spring intake. A sump-well and powerhouse have been constructed near the source. It is the first reservoir from where the water lifting system operates. Motor on/off electric panel board and electricity meter are installed inside the pump-house. As the total water demand of the community is 16,000 liters per day, a 9,000 liter ferro-cement tank has been constructed at the top of the village. The 9,000 liter tank is positioned in a proper place, making water flow through a gravity flow system to all 12 tap-stands.



People are getting water twice a day for four hours, through the tap-stands, two hours in the morning and two hours in the evening. Operators open the valves during the scheduled period, whereby people are able to collect water in their nearby tap-stands.

Panel boards inside pump house

Electric cables supported by 10 m steel poles

4. Transmission and Distribution Pipe

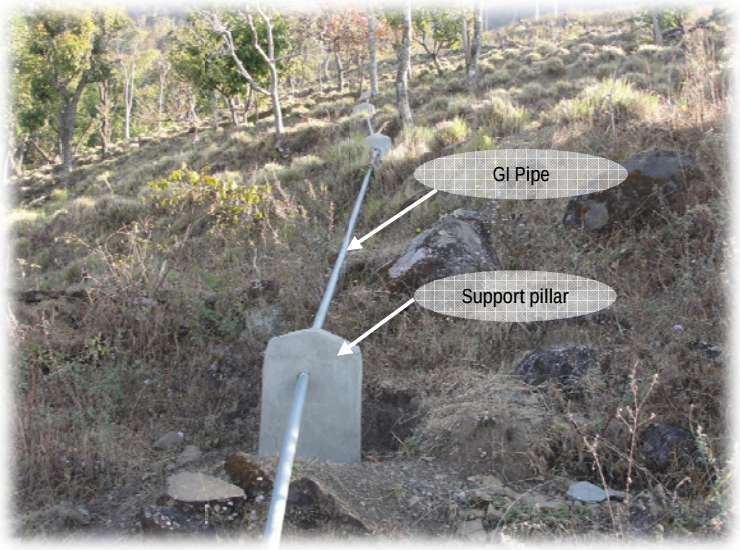
From the intake reservoir to the distribution reservoirs, the total length of the transmission pipe is 523 meters. In the transmission line 40 mm galvanized Iron (GI) pipe is used with proper stone masonry support, while GI pipes used are of medium duty quality. The masonry supports an average of 6 meters from the intake to the distribution reservoir.
High density polyethylene (HDPE) pipes with sizes varying 50 mm, 40 mm, 32 mm, 25 mm, 20 mm and 16 mm as per design have been used for distribution. All the HDPE pipes and 6 kg/ cm2 and 10 kg/ cm2 pressure because pipe size varies due to the water quantity and sloped terrain. The total HDPE distribution pipe length is 4,826 meters. A 15 mm GI pipe is used for tap-stand fittings and in the pipeline where water pressure head exceeds more than 100 meters.

Table 3: Details of pipes used

Pipe Types	Diameter (mm)	Actual Length
G.I. Pipe	15	1088
G.I. Pipe	40	523
HDP Pipe	32	834
HDP Pipe	40	881
HDP Pipe	16	551
HDP Pipe	20	1406
HDP Pipe	25	854
HDP Pipe	50	300
HDP Pipe		4826
GI Pipe		1611
Total		6437

5. Pipe Laying and Support Blocks

All the HDP pipes are buried one meter deep with well compacted earthen backfill. For the GI pipes exposed in the surface, masonry pillars (400 x 400) mm in size and average 600 mm height has been constructed to strongly hold them. As far as possible all the GI pipes are laid on a straight line as permitted by the geographical terrain so as to increase the smooth flow of water and put less power overload on the water pumps. Reducing the internal pressure and centrifugal force exerted by the moving water at pipe bend either in horizontal or vertical direction an external resistance.



6. Protection and Safety

The spring source, intake reservoir tank, sump-well and powerhouse are protected within one compound by a standard fencing to protect from animal hazard. Barbed wire and MS angle fencing poles are used for such a protection. The spring intake is covered by concrete for protection of flood and other contaminant agents therefore; we can say that spring intake water is safe with no chances of contamination.

For strong support of GI pipes 400 mm x 400 mm in size and average 600 mm height masonry pillar has been constructed from intake reservoir to distribution reservoir at every 6 meter's distance. Those masonry pillars have been put in place to support the GI pipes from vibration and swinging when water flows inside the pipe. The ferro-reservoir tank is also fenced using MS steel poles and barbed wires.

The distribution pipeline is masked one meter deep so that it will protect the pipe from any agriculture activities (like tilling, excavating etc) as well as from fire and pipeline cutting by people. All the tap-stands were constructed near the user's house and users' are agree they will protect clean up every day.

7. Water Quality

Water quality was tested twice: once during the project survey period and the second time after project completion and before the taps started running. Water test reports have given good results, that the water is safe for drinking. As it is a spring water source, unlike a stream source, prevention of hazardous activities around the source was possible.

During the construction phase, the source was fully covered and fenced properly, preventing any cattle and human activities to take place around it. This has been done to ensure that water remains safe and free from contamination for a longer period of time.

8. Project Financing

All project project cost concerning the water supply works in terms of civil structures, pipes and fittings was financed by NEWAH. For the pump and electro mechanical contributions have been made by NEWAH, NEA, DDC-Surkhet, PM Development Fund and VDC-Lekgaun. The total cost of the project is 4.1 million Nepali rupees.

Table 4: Financial Contribution

S N	Financing Contribution	Amount (Rs)
1	NEWAH, all WS works (civil structures, pipes and fittings)	2,236,068
2	Pump and Electro mechanical work	
	a. NEWAH	668,488
	b. Nepal Electricity Authority (NEA)-Surkhet	883,107
	c. DDC - Surkhet	100,000
	d. PM development fund	50,000
	e. VDC - Lekgaun	200,000
Total Cost		4,137,663

9. Formation of Users' Committee

During the project, a users' committee of twelve members was formed for the effective implementation of the project. The committee was responsible for the decision making, coordination and implementation of all activities of project work. Upon the completion of the project the same committee was automatically transformed into an operation and maintenance committee.

10. Operation and maintenance

For the operation and maintenance of the system the Water Users and Sanitation Committee (WUSC) initially collected NRs. 40. With the realization that this amount was not enough now it collects NRs. 100 per household as a monthly tariff. According to the following income and expenditure details, now only 46 of the 71 households pay regularly, thus the collection amounts to NRs 4,600.

Table 5: Income and expenditure statement of O & M funds

Type of Income/ expenditure	Income	Expenditure
Tariff Per HH Per month @ Rs 100 X 46	NRs. 4,600	
Salary for operator/ caretaker		NRs. 2,000
Electricity tariff per month (approximate)		NRs. 2000
Surplus/ deficit		+Rs 600

Currently this amount seems to cover the monthly operation works but in the future, if the system requires other maintenance work, it will not be adequate. Thus, NEWAH has suggested that the collection has to be made from all households. A WUSC meeting was also called to discuss about the issue and future sustainability of the system. A decision was made to make the remaining 25 households comply and regularly pay every month, if they want to continue accessing water through the system.

Considering the costliness of electricity charges to lift the water, NEWAH initiated the effort to reduce the cost by negotiating with NEA that the water would also be used for micro irrigation (vegetable farming). As a result, per unit charge for electricity has been reduced from NRs. 10 to NRs. 4.

11. Learning

1. The caretaker needs to be trained in electric operation so that small problems can be identified and solved immediately and locally without having to wait for an electrician. The caretaker in such projects should have at least a high school level education to be able to understand the functioning of the electrical system and its devices.
2. Designing the pump should be done carefully so that the risk of the pump suctioning is averted. 15 percent should be added to the head measurements when ordering the pump device.
3. Service center should be identified before the selection of a pump.
4. The community should agree to pay adequate cash for the maintenance fund as well as the electricity bills prior to implementing the project
5. NEWAH staff should also be capacitated on pump installation as well as electrification.

12. Conclusion

The Halde Kharka Lifting project, NEWAH's first water lifting initiative, has served 71 households in a community deprived of water, through 12 tap-stands. In a community where water sources are located much below the settlement and where a regular water supply system was impossible, water lifting has been possible through rural electrification. Although the cost of the project as compared to a regular gravity flow project is high, this was the only viable option for this particular community.

In Nepal, there are many such communities like this one, yet to be served with water. They have no alternative solution but this. The local government authorities need to be informed of the benefits of these projects, to support the implementation and contribution to repair and maintain them when required. The community members need to be willing to raise the regular operation and maintenance fund when needed. To keep this kind of water supply system running, the users committee should remain active in maintaining close coordination and linkages with NEA, local government, users, and technical agency (pump supplier, service center).