A light grey map of India is shown in the background. The state of Uttarakhand is highlighted in a darker teal color. The title 'Inar Piped Water Supply Scheme' is overlaid on the map in a large, bold, teal font.

Inar Piped Water Supply Scheme

District Almora,
Uttarakhand



Lying gracefully on the top of a hill in the middle Himalayas, village Naugaon showcases a model of community-managed piped water supply (PWS). This scheme has been providing drinking water 24x7 to its residents for over 20 years.

Surrounded by rolling hilltops, the village was dependent for its water on the stream below. The village, home to 534 people in 1999, the year the scheme was executed, has a mixed population of about 84 households today. 20 households are from the Ram and Arya castes (scheduled castes) while the dominant group comprises some 64 households from the Parihar (Rajput) caste.

The local aquifer system in the village was not conducive for tapping drinking water from naulas (depression aquifers) and dharas (springs) as groundwater availability is inadequate in the area. The village, therefore, was only left with the option of accessing its drinking water from a local stream. But this was a challenge as the village was at a considerable height from the stream.

Water would have to be brought from great distances through gravity in order to have the necessary head for further pumping the water up to the village; a rather costly process given the high energy charges involved.

THE OLD SCHEME

Naugaon village in Tarikhet block of Almora district has two habitations – Naugaon and Kakrighat. Kakrighat has a separate piped water supply scheme, which has been functioning satisfactorily. But in Naugaon, the gravity-fed piped water scheme constructed by the UP Jal Nigam (in undivided Uttar Pradesh) in 1985 became defunct in 1993 when its boulder-filled gallery was washed away in the floods and the roughening filter was damaged.

The old scheme had been weighed down by design-related problems right from the start. The pipelines starting from the former gallery were laid too close to the river and would often get damaged during floods. The engineers had provided a very low head difference that led to low availability of water at the intake reservoir at Naugaon. The



The long walk for water took up much of the women's time as they would make trips to the Sarota stream downhill at least three to four times a day. Tales of young girls missing out on school or college to fetch water for the household were common.

source had been inappropriately located at a height where it was impossible to tap water for supply. The intake pipes too had been laid very close to the river, leading to excessive wear and tear.

Securing even a minimum amount of water for their everyday needs had become a struggle for the community. The system provided for a few (about 17) individual household connections with some stand posts, but they became redundant in a few years.

THE NEW SCHEME

A new piped water supply project was conceived under 'Swajal 1' and was named after Inar village where the intake point (or source) was located. The project was taken up under Phase 3 of Swajal 1 in 1999 when a group of villagers from Naugaon, led by Bhupal Singh, the then gram pradhan, and

Dhan Singh, the current chairman of the Village Water Sanitation Committee (VWSC), approached the District Project Management Unit (DPMU), Nainital, along with CHIRAG, a Nainital-based non-governmental organisation (NGO), citing problems related to the drinking water scheme at Naugaon. Administratively, Naugaon fell in Almora district, yet the DPMU, Nainital became interested and conducted a preliminary enquiry into some aspects of the water system, such as technology, sustainability, and the community's role, before deciding to take up the project. Observing the interest of the community, CHIRAG too made a foray into the area as a support organisation under the Swajal project, even though it had not worked in Almora till then. The scheme was taken up as a village water supply reorganisation project in 1999.



The Inar water supply project was based on a demand-driven participatory approach.

This was an innovation in itself as the old structures and pipelines were to be reused as much as possible. However, the complexity due to gravity-fed gadhera (stream) system was a challenge as the engineering staff of Swajal DPMU was more acquainted with the construction of spring-based rural water supply schemes. Usually, naula or spring-based schemes involve construction of a stone or concrete-lined tank that catches dripping water from springs and streams, which is then distributed to the habitation.

Inar stream, as a water source was a bigger and more complicated project for the engineers at that point of time. It was a large gadhera with a high discharge¹ of 350 litres per minute (lpm)².

COVERAGE

As per the Swajal criteria (1996), the designed water demand for Naugaon village was worked out at 55 lpcd (revised upwards from 49lpcd under the 1985 scheme). Water supply was designed as 70lpcd for private connections and 40lpcd for stand posts. Additionally, water was supplied to the primary and high school (now inter college), for which the demand was calculated at ten litres per student per day. The scheme also provided water to ten households (34 people in 1999) of Panaura village which lay on its course, through a stand post. This was done after a conflict erupted at the design stage between Panaura and Naugaon villages about the laying of pipelines through the former. Worried that the pipelines may be trampled

¹ After the identification of the source, the yield was determined accurately by guiding the water through a V-notch fixed in the waterway. The head in the notch was measured from the tip and the discharge got from the table corresponding to the head. The design life period of the system was 20 years and as per the DPR the population for the design period was decided.

² Measured as on 05 January 1999, at the time the scheme survey was underway.

upon by angered Panaura villagers, the community at Naugaon agreed to Swajal's suggestion to resolve the dispute by including the ten households of Panaura in the scheme. The community succeeded in resolving many of the local problems related to project implementation, such as land acquisition, source-related disputes, and laying of pipelines.

Evidently, the number of households has increased from 64 in 1999 to 99 in 2019. Households with private connections increased from 17 to 53 over the period, while those relying on the seven stand posts in the village decreased from 47 to 31 during the same period. Water is supplied on a 24x7 basis throughout the year, barring summers, when supply is restricted to two hours each in the morning and evening. Water supply from the tank is controlled by the village maintenance workers (VMW). Water supply regulation decisions are taken by the VWSC and implementation is carried out by VMW with the support of the VWSC president. There are no water meters in place to measure water supply as it is available in abundance through the year. The quality of water is also not monitored regularly. The last mile coverage of households is looked after by the VMW, who also checks for leakages in the distribution line every few days.

Source identification considered the water requirement of the community till the end of the designed period of 20 years. It also considered source discharge; that the source was perennial, adequate, and sustainable on a long-term basis; as well as the absence of upstream and downstream pollution from the site of water withdrawal.

Groundwater availability is a problem in the village, so no borewells have been installed or are encouraged. If at all necessary, an NoC (no objection certificate) has to be acquired from the gram panchayat for installing borewells.

INSTITUTIONAL ARRANGEMENTS UNDER SWAJAL

The Inar water supply scheme was taken up under the Uttar Pradesh government's Swajal 1 project in the Rural Water Supply and Sanitation (RWSS) sector with assistance from the World Bank. It was conceived and conceptualised under the sector reform programme as planned under the Rajiv Gandhi National Drinking Water Mission (RGNDWM).

The process involved establishing and enhancing its institutional capacity to implement, manage, and sustain the state's work on RWSS. The work entailed financing infrastructure and software investments such as:

- (i) Investments in water supply schemes and catchment-area protection works.
- (ii) Community mobilisation and developmental activities.
- (iii) Sanitation programmes.

The scheme was handed over to VWSC in the year 2000. Swajal 1 was implemented as a pilot project from 1996 to 2003 (1146 schemes) and was followed by a sector-wide approach (SWAP), also known as Swajal 2, implemented from 2003–2014. Swajal 1 entailed software components such as a series of workshops to build ownership of the programme at all levels, and intense capacity building and training programmes for the state, district, and village functionaries.

The support also provided for longer pre-planning, planning, and post-implementation phases³, which was not the case with Swajal 2⁴. Under Swajal 1, the project planning period lasted one year, project implementation was one year and the post-implementation period was three months. However, once SWAP/Swajal 2 began; the project planning period was reduced to three months and the implementation period to six months. Swajal 1 also had better outlays for programme management Swajal⁵ ended in 2014 as the department's thrust shifted to sanitation. Work on drinking water schemes suffered as Swajal DPMU anchored sanitation related work in the state. The department of drinking water supply (DDWS) is now working on the convergence of the 14th finance commission funds, MGNREGA, and Swajal.

INSTITUTIONAL ARRANGEMENTS TO RUN THE SCHEME

The Inar project was based on a demand-driven participatory approach and users could choose the service level. They also had to share the cost of capital investment (nine per cent labour cost and one per cent cash contribution) as prescribed, and at the same time, bear the full cost and responsibility of O&M.

In Naugaon, each household contributed INR 1,000 as the initial capital, apart from contributing labour for construction. In addition, households with individual connection paid INR 3,000 as connection

charges, that were deposited into VWSC's O&M account (gram kosh). The project had the following approach:

- Demand-driven approach for village selection.
- The community was given a lead role in decision-making for planning and implementation.
- The support organisation (CHIRAG) aided in community development as well as in implementation.
- Women empowerment through setting up of a self-help group (SHG).
- Emphasis on behaviour change and not just on provision of technology.
- Exposure visit of community representatives to Chimi Matela rural drinking water scheme.
- Prior to implementation, VWSC and CHIRAG had to give a written assurance of complete coverage within the revenue village, including the surrounding hamlets that wished to participate.
- The sustainability aspect was assessed before the start of the planning phase and the necessary cash contribution from the community was deposited in the bank.
- There was a systematic learning approach and use of participatory methods throughout.
- There was a balanced approach towards hygiene and environmental sanitation awareness.

³ The Swajal project cycle was sequenced in four stages: pre-planning, planning, implementation and post-implementation phases.

⁴ The project used third-party verification at the planning and implementation stages, and had a specially developed 'online' monitoring system for reviewing the work-in-progress.

⁵ Swajal 1 project launched and implemented during 1996–2003 in undivided UP soon became a sector model in India and the Sector Reforms Project of the GOI in 1999 was designed on similar lines and later on took the shape of Swajaldhara

- A choice was offered between different water and sanitation technologies.
- There was a community-based approach to service delivery and O&M.

During the initial stages of the project implementation phase, the role of the government was that of a facilitator of water supply and sanitation services, rather than a provider. The rural communities were involved in the planning, designing, and constructing. Subsequently, management of their water scheme was handed over to the VWSC, the community institution. The constitution of VWSC is mandatory for gram panchayats to initiate the implementation of the scheme. The duties of the president, treasurer and VMWs are well defined and VWSC has been registered as a sub-committee of the gram panchayat under Swajal 1.

The Inar VWSC is functional even now after 20 years. Of the 11 members, six are women⁶.

The last two gram panchayat elections in Uttarakhand were held in June 2014 and more recently in October 2019, but with the election of a new gram pradhan, a new VWSC is not constituted. Neither are new members selected. The same VWSC has continued for the last 20 years, barring two instances where new members were appointed in place of the ones deceased. The management of the system rests with VWSC members until their demise or on becoming incapacitated; the idea being that those involved with the scheme since its inception understand its technology, management, and financial aspects quite well.

The project entailed full involvement and participation of user groups, beneficiaries, and gram panchayats right from the planning stage to the implementation and post-implementation phases. VWSC manages the water supply scheme and collects a monthly user fee of INR 30 per household as O&M charges from the 53 users with a household connection. INR 20 is collected from the 31 users accessing water from stand posts. Members of the VWSC have been trained in operations and minor maintenance of the system and they carry out the overall management of the scheme. The operations and maintenance charge/tariff used to be collected by the president of the VWSC every month. However, these monthly charges are now being collected on a six-monthly basis. Additionally, a decision has now been made to revise the charges to INR 40 for public stand posts and INR 60 for private connections.

A Village Maintenance Worker (VMW) has been appointed who operates the pump and takes care of the subsequent distribution of water, for a monthly fee of INR 500. The operator also ensures day-to-day upkeep and maintenance of the system. Though the rules entail disconnection of the household water connection on non-payment of tariff, no such case has been reported so far and people pay even if on a delayed basis. The gram panchayat funds major repair work and has even provided MGNREGA funds to the tune of INR 1.5 lakh for the system's repair.

VWSC has opened a joint bank account in the name of the president and treasurer, with both as signatories of the account. The water charge is collected and deposited in

⁶ Swajal mandates that VWSCs comprise at least 30 per cent women and 20 per cent SC/ST members. Prior to implementation, the VWSC and the SO (CHIRAG) had to give a written assurance that there will be complete coverage within the revenue village including surrounding hamlets that wish to participate.



The project entailed full involvement and participation of user groups, beneficiaries, and gram panchayats right from the planning stage to the implementation and the post-implementation phases.

the bank and VWSC maintains the income and expenditure details of the scheme as well as records like cash books and expenditure voucher details.

The scheme requires periodic maintenance to detect and repair leaks, and keep the intake source intact. Right from the initial stages, VWSC members were actively involved in the construction as they were familiar with the water system technology. They were able to gain access to spare parts for repairs and when the system broke down post-construction, especially during monsoons, they relied on local knowledge for simple repairs, replaced sections of the pipes, and rebuilt the boulder-filled gallery. However, major repairs were carried out by a trained plumber from the village itself. Being a hilly terrain, the road for transportation of material for repair and maintenance, posed a challenge.

According to CHIRAG, the planning phase involved awareness creation in the village community towards the need for water and sanitation through various techniques of community interaction. Willingness had to be established among villagers to join the project partnership as per the principles and policies of the Swajal Panch Pariyojna. Identification and selection of habitation was based on their willingness to share ten per cent of the capital cost of the project, based on the water supply and technology option decided by the village community.

Another criteria was the will to share the full O&M cost of the projects. Apart from this, the Swajal project envisaged assurance from the project gram panchayats for 100 per cent coverage of households with toilets, for which the government offered subsidies. In the case of Naugaon, 100 per cent open defecation free status was achieved even before the water supply scheme was put into place.



Inar water supply project's intake source. Periodic cleaning of the boulder-filled gallery and replacement of boulders is undertaken in order to provide sustainable water supply.

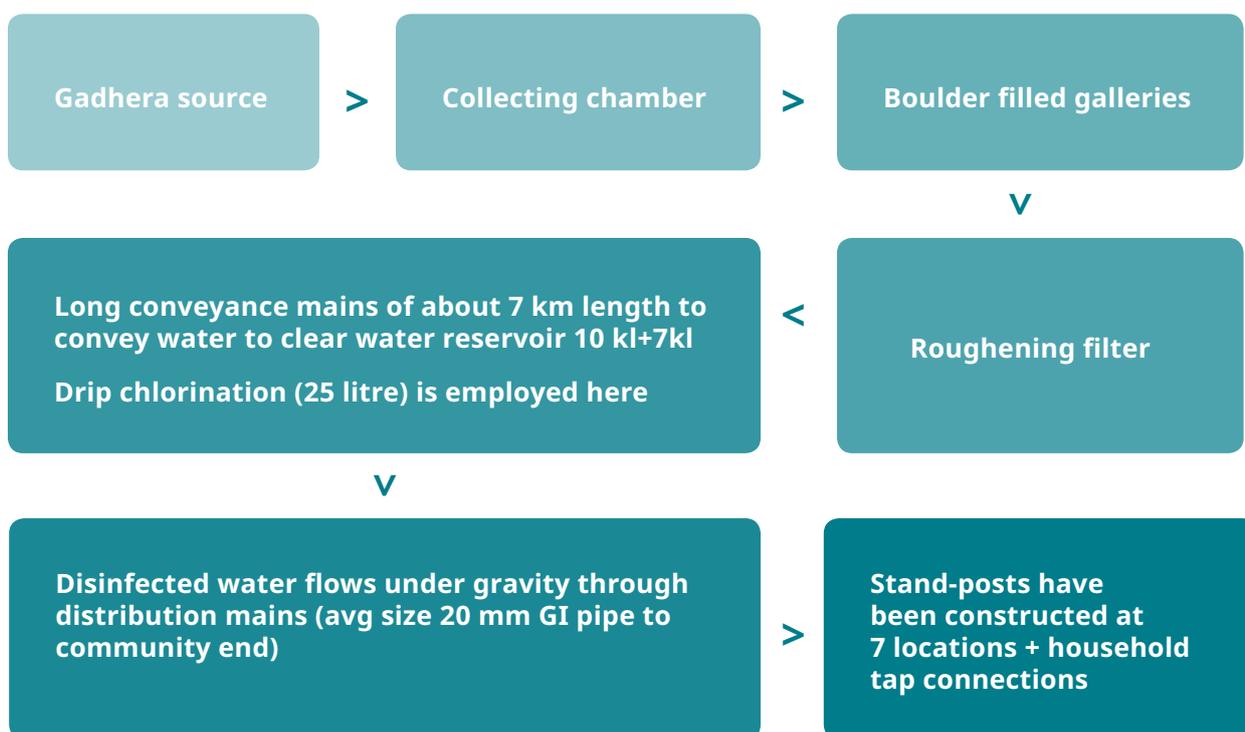
CHIRAG, along with representatives of the community, conducted a reconnaissance and collected details of the existing water supply and the need for rehabilitation of the existing system. During the pre-planning stage, the activities covered were village meetings, focus group discussions, baseline surveys, and Participatory Research Analysis (PRA) to enable villagers to identify and describe local needs and practices. "Community interaction techniques were employed by Swajal DPMU functionaries who had been provided orientation training on the demand-driven participatory approach at the Administrative Training Institute (ATI). Various tools were used for developing the programme content: training camps, exposure visits, audio visual aids etc.," shared Laxmi⁷, Community Mobiliser, DPMU.

TECHNOLOGY

The technology of boulder-filled galleries for source tapping schemes such as the gravity-based gadhera (stream) scheme at Inar has been indigenously developed by the line department of Uttarakhand. An advantage of the gravity gadhera scheme is that it provides gravitational flow up to the community end without any pumping aid and that considerably reduces the recurring cost of operations.

Inar is remarkable as it has been functioning satisfactorily for its design period of 20 years. Periodical cleaning of the boulder-filled gallery and replacement of boulders is undertaken by the community in order to provide sustainable water supply.

⁷ She was with Chirag in 1999 when the scheme was being set up and shifted to DPMU in 2007. She takes an active interest in the scheme even now.



Schematic diagram of Inar piped water supply system

Inar does not suffer from source depletion because of its high discharge unlike some other gravity gadhera schemes where the water supply gets completely interrupted from the beginning of summer till the onset of the monsoon.

The infiltration well could not be constructed at Inar as the pipeline could not be laid at a depth in the river. Therefore, for purifying the water supply, a layer of washed charcoal has been placed along with other filter media inside the roughening filter.

The community has had to deal with the boulder-filled gallery getting choked due to silt-laden water. Boulder-filled galleries are also liable to get washed away even with the adopted design discharge of 180lpm (litres per minute). So, some alteration in design was made.

Gadhera sources are characterised by turbidity particularly during monsoons.

Though Inar has clear water all year round, often it becomes turbid during monsoons. Swajal mandated slow sand filters to be built for gadhera sources that indicate a turbidity value of 10NTU (Nephelometric Turbidity Units) during rainy season. For some reason, the design engineers went against these guidelines and provided a roughening filter instead. This roughening filter required more maintenance, which was difficult for the VWSC to provide. At this point, when the design period of 20 years is towards its end, the roughening filter is damaged and needs to be replaced.

An innovative aspect of the Inar scheme was that a significant part of the old pipeline was reused at location and unnecessary carting of old and new pipelines was avoided. Pipelines starting from the old boulder-filled gallery were later replaced with 65mm galvanized iron (GI) pipes instead of the earlier 50mm GI pipes. In the new scheme, 620m of

the existing 50mm diameter GI pipe was dismantled from its existing alignment and utilised in the feeder main and elsewhere.

The supply main (6262m) had to be carefully constructed as the pipes passed through hard, rocky areas and gully crossings were supported by pillars. The system innovatively undertook a river crossing on a suspension system over two pillars. This helped reduce the distance of intake and thereby brought down the capita cost.

The storage at Naugaon village comprises an old water tank with a capacity of 7kl, a new tank of 10kl, and a 2kl tank-type stand post (TTSP) at the location of the old tank, erected with the consent of the community. Two bucket type chlorinators of 25 litre capacity were provided at the clear water reservoir. These are damaged now and in need of repairs. Stand posts were constructed at important locations selected by the community members and water connections were provided to the houses from supply mains. The distribution main is approximately 988m from the water tank.

CATCHMENT AREA PROTECTION

The proposed water source was a point at a gadhera that lay seven kilometres upstream of the village in a van panchayat. Poor vegetation cover and risk of erosion and landslides were dealt with by undertaking catchment area protection. Also known as the Assisted Natural Resource (ANR) subcomponent of the Swajal 1 project, resource conservation and source sustainability were inbuilt in Swajal 1 projects. A separate plan, though hasty, was made for a spectrum of activities around soil and water conservation and implemented in the project area. Because the village is at a distance from

the source catchment, it was difficult for the VWSC to undertake a source sustainable protection regime for the catchment area.

Institutional arrangements at the source village for protection of the catchment to ensure the sustainability of the source could not be established, even when the physical targets for the work, such as plantation were met. 47 garbage pits, 47 soak pits, 43 toilets and four compost pits were constructed as a part of the project. According to Devraj Singh, head of the van panchayat and the current treasurer of VWSC, some work was also undertaken towards artificial water recharge.

FINANCES

The total cost of the distribution system was INR 2,12,400; storage network was INR 59,700; intake work, INR 16,200; feeder/ supply mains, INR 12,00,500; and treatment work was INR 1,37,700. The total cost of the piped water supply project was INR 18,25,589. The contribution from the DPMU was INR 16,74,522, while community contribution was INR 1,51,067 (labour contribution was INR 1,32,811 and cash contribution was INR 18,256). As on November 2018, the total amount collected for O&M was INR 75,280 while fixed deposits were valued at INR 10,000 and the balance in the passbook was worth INR 16,768.

Investment in capital cost helped build ownership of the piped water supply system in the community. The marginalised sections of the community, who could not pay for an individual connection were provided stand post connections. Some of these were able to shift to the household piped water supply over a period of time. Exposure visits by an NGO or individual were charged at INR 1,000 and this contributed to the O&M fund.

The analysis of expenditure and cost related to O&M of the scheme is below:

Recurring expenditure (Rs.)*	Inception year (1999)	Current year (2019)
Maintenance of work	8,654	17,327
Maintenance and operating staff	6,000	9,000
Chemicals	500	750
5% of above total (as reserve fund)	758	1,354
Grand total	15,912	28,431
Approx. expenditure per annum	15,900	28,450
Per capita O&M cost	33.32	37.73
Income**	Inception year (1999)	Current year (2019)
Tariff for tap stand post per household per month	20	20
Tariff for private connections	30	30
Number of households served by stand posts	17	15***
Number of households served by house connection	58	80
Net income from stand post supply per annum	4,080	3,600
Net income from house connection per annum	20,880	28,800
Total income per annum	24,960	32,400
Profit or loss per annum	+9060	+3950

*Based on DPR projections, Inar water supply scheme **Based on current costs

***11 households of Panaura continue to depend on stand-post apart from 4 households of Inar

The scheme provided water for drinking and domestic use and many houses relied on kitchen wastewater for irrigating their small kitchen gardens. Soak pits were also constructed under Swajal 1. In the last two decades, adaptation of the community management model of Swajal improved the rural water supply significantly in Naugaon, but such cases of community management remain isolated and are unable to become the guiding principle for most rural piped water supply projects.

Community involvement began in the planning stage, then progressed into community participation through all

stages and finally resulted in community management. In the process, responsibility for providing water services completely shifted from the government to the community. A downside of this was that technical support after the construction of the structures was almost non-existent as DPMU, Almora, did not get involved the way it should have in any follow-up related to the scheme.

Swajal, at that time, was not characterised by a target-based approach, so the NGOs as well as the DPMU, laid emphasis on the accomplishment of physical targets with an equal or greater emphasis on establishing associated institutional arrangements.

In 2019, when the present scheme's design period got over, a new project was proposed for Naugaon village by the DPMU. The new project should provide for an auto wash filter; a maintenance-free device suitable for rural situations where the source is far removed from the village. The proposed water supply scheme needs to be linked with watershed development programmes for greater sustainability of drinking water sources.

The rural piped water scheme is regarded as the cornerstone of participatory approach to rural drinking water supply. It was recently covered under an upcoming show on Doordarshan called 'Safar Manzilon Ka', which stars actor Manoj Bajpayee, and brings forth real life examples of swachhagrahis or people working towards the Swachh Bharat Abhiyan.

CHALLENGES

Inar has satisfactorily completed its design period of 20 years in 2019. Like every piped water supply scheme, it does face challenges, typically every monsoon, when a part of the structure gets washed away. The disruption lasts for one to six days, depending upon the damage. But the president and other office bearers of the VWSC rally the community to contribute their labour and repair the system. Typically, around 30–35 people from the village conduct the repairs when it breaks down. The monthly collection of water user charges is used towards material and cartage costs.

CONCLUSION

The project, taken up under the Uttar Pradesh government's Swajal 1, has a demand-driven participatory approach and entails software components where the users have not just been 'involved' but have also played a lead role in planning, designing, constructing, and subsequently managing their piped water system.