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Evaluation mission to Himachal Pradesh

Sector: Rural Water Supply

Purpose : Evaluation of the Logwalti-Bomson Water Supply Scheme

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CHAPTER 1 INTRODUCTION

1.1. Description of the Logwalti-Bornson Water Supply Scheme

This water supply scheme is situated in the foothills of the Himalayas, some 80 miles North-West of Simla. It is a heavily eroded area, built up of slopes with only a few terrasses on the ridges and at the bottom of the river valleys.

The area is sparsely populated and most of the villages are located on the ridges. They are linked by small roads, of which only a few are jeepable. Rainfall is scarce and falls mainly in the monsoon. The rain is hardly absorbed by the eroded slopes and flows directly into the riverbeds. There are a few springs, but far to little too cater for the need of the population. To overcome this scarcity, the people cut caves in the rocks, in which the rainwater and the little groundwater there is, are collected. They are called Khatris and the problem is, that they are too small to serve people and cattle throughout the year. Also, because they are stagnant and not fully covered, contamination takes place easily The scheme now realised is based on water collected in the riverbeds, then pumped to reservoirs constructed on high spots on the ridges and subsequently distributed to the standpipes in the various villages and hamlets. The static heads are considerable, e.g. from the riverbed to the first reservoir is 270 m. Population served is around 30000, divided over 89 villages, and the costs are 112 lakhs of rupees. Execution took three years during which many difficulties were encountered due to the few roads the steep slopes and the lack of building materials.

1.2. Evaluation mission

To evaluate this scheme, which is almost totally financed out of Dutch aid-funds, a mission was organized to visit the project area. Members were:

Mr. W. Kluft	1e Secretary Dutch Embassy
Prof. Nitish R. De	sociologist
Dr. Sunil K. Dhawan	sociologist
Mr. H. Kiestra	sanitary engineer

Objectives of the mission were follows:

- to assess the efficiency of operation of the completed scheme
- to assess the quality of the executed works
- to justify the efforts being made to attract resources and to stimulate further developments
- to verify whether the whole of the population has access to the water supply facilities, taking into account the particular socio-economic position (and therefore the requirements) of the poorest population groups
- to indicate areas where complementary inputs could improve the overall effectiveness of investments in rural water supply

1.3. Participation of the Netherlands Government

In 1976 the Ambassador of the Netherlands in Delhi was invited to visit the area. During his visit he was much impressed by the difficult position of the local population in regard to the availability of safe drinking water. The Irrigation and Public Health Department in the Hamirpur district, lead by Shri Sarkar, had already started the construction of the project, but progress was slow due to lack of funds. It was than agreed, that the Dutch Ministry for Development Cooperation would finance the completion of the scheme.
During the execution one Dutch expert visited the area in January 1978 to assess progress. The construction was then in full swing and it was decided that after the completion and putting into operation of the scheme, an evaluation should take place. It should not only be an evaluation, but also an identification of possible new projects to be presented to the Dutch Government for financing.

1.4. Identification of the water-supply schemes: Deotsidh, Bani Barsar and Bhota

On arrival in Hamirpur, the mission mentioned in 1.2. was presented with three more projects to be considered for financing.
To identify these, the mission visited the areas concerned and the works already in progress.

1.4.1. Deotsidh

This scheme will provide some 99 villages with water from a nearby river. The scheme is based on treatment, pumping to high reservoirs and distribution by gravity flow. The stable population numbers 19202 and there are also 4020 students in the area. The head reservoir will be located on a hill-top, which is also a well-known place of pilgrimage for Hindus. Except for the treatment the system is similar to the Logwalti Bomson scheme. The costs are estimated to be 86.80 lakhs of Rupees.

1.4.2. Bani Barsar

In this scheme 103 villages with a current population of 22017 and 8335 students will be supplied with safe drinking water. The source here is the same stream as in Deotsidh. Part of the treatment works has already been executed. The costs of completion are estimated to be 124.45 lakhs of Rupees. The water will be extracted from the riverbed, treated, pumped to high reservoirs on the ridges and supplied.

1.4.3. Bhota

The Bhota Scheme will comprise 39 villages with a population of 5484 and 2608 students in the first phase and 5117 and 2346 students in a further 18 villages in the second phase. Both phases are to be built simultanously. The Bhota Scheme also relys on a stream and the water has to be treated. The scheme, of which a small part has been accomplished, will need about 31.18 lakhs of Rupees to complete.

1.5. Tikkar-Dam project

Another interesting project in the Hamirpur district is the possibility of erecting a dam at Tikkar in the nearby Khad. This will not only serve as source for drinking water but more important, it will boost agriculture by the supply of irrigation water. This project is still in the initial stage where studies have to be made of the exact location, the volume to be created, the yield of this Khad, the area to be irrigated, the number and kind of crops that will be feasible and the water supply aspect.

CHAPTER 2 EVALUATION OF LOGWALTI-BOMSON

2.1. Introduction

The scheme in short is to supply safe and sufficient drinking water to the population of this area. To see whether it actually is meeting this requirement and whether improvements in the health situation have been achieved the mission jointly investigated as much of the area as possible in the short period of 6 days.
Though the mission could only work sample-wise, the information gathered has been sufficient to evaluate this scheme. In this chapter the technical aspects are discussed. The socio-economic aspects are considered in the report of Mr. De and Mr. Dhawan. The joint approach has been most fruitful to identify in the first days the problem areas on which attention should be focused.
Because the visit was spread over about one week, the reliability and other time-dependent factors have also been observed.

2.2. Criteria for the selection of scheme

The Logwalti-Bomson area has been selected on the basis of:
- scarcity of water and long walking distance
- poor quality of present source
- health condition of the population
- a potential for agriculture and small scale cattle-breeding
- the population is willing and able to pay a contribution
- the availability of spring water in a nearby Khad

Socio-demographic criteria, such as the presence of a large number of ex-service man in the area, is taken into account in the social report.
When selecting schemes in the sector of rural water supply, the problem arises that a number of the criteria overlap or can even be conflicting. In this case conditions have improved and this will stimulate people to intensify their efforts in agriculture and the breeding of live-stock. This in its turn will lead to the need for more water and in view of the availability of water, the distances and the height differences, more water can only be made available at great cost.
This area was not selected on its grow-potential. There are possibilities, but in general it is a poor area.
Criteria, such as political ones, are not easily admitted to have had the highest priority and the mission has not spent time in investigating this aspect.

The scarcity was indeed striking and in summer the walking distance to the nearest available source could be up to several miles. The quality of the source varied. Water collected in Khatris, beeing underground reservoirs, mainly originates, from direct run-off and only little from seepage. It remains stagnant for many months and is used by both humans and cattle. Though the awareness exists that water touched by cattle is not longer fit for human consumption and the entrance to the Khatris is fenced off, still the hazard is there. In the social report reference is made to the health condition of the people as illustrated by data from dispensaries and health centres.
A large part of the cases is reported to have water-related or/and water-borne diseases like: dysentry, diarrhoea, typhoid, hepatitis, and worms. Up to now no significant improvement has been observed, but this may be due to the intermittant service of the scheme, so that people still use their khatris. It is known, that the use of safe water over a long period decreases the resistances against water-borne and water related diseases.
It is thus of great importance to secure a continuous supply and, in the case of unavoidable break-downs, people should be instructed to boil their water.
The potential for agriculture and smalllive-stock has been mentioned as forming the only present the only source of income. At the moment some of the men are in government service or working in other parts of India but this number will decrease, due to new regulations, and only the above mentioned potential will be left. It is clear that selecting a scheme where there are only limited or no means for employment, the provision of drinking water will give the population the hope that development has begun and soon they will expect further help (and funds).
The Logwalti-Bomson area has only limited space which is arable and not yet cultivated.
The mission is of the opinion that the development of the area will now need follow-up by the Government. Guidance and instruction in the use of improved crops, soil-conservation, re-afforestation, use of fertilizers, cattle-breeding and possibly the introduction of small home-industries have to be taken up.
The two other selection criteria are self explanatory. Without the willingness of the people to contribute, the scheme will soon degenerate because of lack of maintenance and abuse.
The financial capacity of the population is sufficient to ensure this contribution. The present contribution however, is in no relation to the actual costs. The mission feels, that in new of the improvement in quality, reduction of time spent in fetching the water and the paying capacity of the population, the contribution should be doubled or even tripled. As soon as the improvements to the present system are realized and continuous supply is secured, the collection should be organized regularly.

In regard to the target group that is always described in the guidelines for selecting projects for financing by Dutch Aid, the social report mentions that the average income is relatively higher. However, a small part of the population has an income which is low and these people also benefit from the scheme. But it may be stated here, that the income position in general does not comply with the definition: the poorest income group.

In short, it is the scarcity and bad quality of the traditional sources that justify the selection.

2.3. Design criteria

The scheme was originally based on the supply of 15 gallons per day per capita. This was been revised during the execution to 10 gallons per day per capita. The distribution is to be by means of standpipes. No house connections are foreseen. No schedule has been set up of fixed hours of supply, but the aim is to supply in the morning and in the evening. Pumping hours are 16 per day. The reservoirs are to be dimensioned on a half day storage capacity. There will be no pumping to the reservoirs from 18-21 hours. Rising mains are designed with a peak-factor of 1.5. The terminal head should be at least 20 feet.
In general the design criteria should be in accordance with the Indian standards as laid down in the relevant manual.
The mission is of the opinion that these standards are realistic in this case and should be met. Observations in the field showed however that this is not yet the case.

2.3.1. Consumption

The scheme is not meeting the demand. Some taps even do not supply water for months (i.e. Paunch).
The peoples enthusiasm for this scheme is an important factor in the success, in particular in relation to revenue collection, operation and maintenance and abuse. At present the supply is intermittent and not reliable. The amount of 10 gallons is only rarely met. In a separate note the mission has mentioned which measures are to be taken. These measures has been discussed and agreed with the Chief-Engineer Mr. Mirchandani and with Mr. Sarkar (see appendices).
The scheme will be able to supply the required amount after these up-datings.
The consumption of the cattle has not been taken into account, so this may create shortages in future, when the khatris are empty. Increase of population and consumption is to be expected.
The quantity of water that now is available for cattle because of the not yet full use of the 10 gallon per capita per day will thus be reduced. Emphasis has to be laid on only limited expansion of this live-stock.

No preference has been observed in the location of the taps. These are equally divided over the various ethnic and religious groups.
Only the number of houses served by one tap varied from 4 to 37 households. In this aspect updating is also necessary to avoid long waiting-times.

2.3.2. Hydraulics

As already stated, the scheme will be able to supply the design quantity only after updating. Checks on the calculation showed certain shortcomings. Part of this is due to the lack of proper contour maps, which make the design more accurate. Differences between the assumed alignment and reality cause underrating of head losses. The assumed friction losses form another factor. The quality of the laid pipes may be such that the internal friction losses are higher because the finishing of the inner wall is less smooth.
The capacity of the reservoirs has in some cases been underrated.
This fact has already been remarked by the Chief-Engineer and reconstruction will be undertaken soon. The capacity of the pumps is lower than expected and an increase will be necessary. These measures are to be found in the technical note, prepared by the mission and already submitted in May 1980.
Most of the complaints will cease after this updating, though there will remain an occasional breakdown due to leakages, blowing of joints or power-cuts.

2.3.3. Mechanical/Electrical aspects

The perfomance of the equipment is determined by the supply of sufficient power of high enough voltage.
The second important factor is the capacity of the pumps.
The installed capacity is less than the calculated design capacity.
This may be due to less efficiency of the pump and/or motor. Even if there is enough power the capacity is critical. An additional pump should be installed in the pumping-station in the Khad-valley.
Furthermore a schedule of pumping hours for each pumping station should be drafted and the distribution should take place on the basis of this schedule. The present operation, is too irregular and leads to discontinuous supply. See also the social report in this respect, where a list is given of pumping hours of the various stations during a certain period.
The electrical installation itself is satisfactory and will give no cause for further serious break-downs.
The pumps should be checked regularly for their capacity, as the impression is that this is gradually decreasing.
But the key factor is the supply of power. Especially as there will be an extra pump, the electricity board should be convinced of the importance of continuous supply.

2.3.4. Distribution

The distribution system is based on gravity flow from the reservoirs. The taps are mounted on standposts and of a type that shuts itself off after use. Thus spilling is prevented, though the inventivity of the local population is limitless in avoiding this shut-off. But in general the taps are in good working order. The desire to keep the tap permanently open is due to the intermittent and irregular supply. If the tap is open one can see or even hear the moment the water arrives and this saves a lot unnecessary tries. Another reason may be that filling is easier as one does not need to hold the tap all the time. To construct a tap which overcomes these problems and stands up to abuse is a continuous challenge to equipment-suppliers and water-supply engineers all over the world.
The pressure varies, which is no surprise as there is such a difference in altitudes. In one place it takes 18 seconds to fill a 4 gallon container, in another over two minutes.
Especially in cases where many taps are connected to one feederline, the last one may get almost no water. This can be solved by installing small reservoirs fitted with a ball-valve at places with high pressures. Mr. Sarkar has already made such a design. The supply is far from satisfactory. There are a number of reasons.
The first is, that the design is not yet perfect. The second is that the pumps do not meet their design capacity. The third is frequent power cuts. The fourth is that the operators are still in the running-in period and have to set up and stick to pumping-schedules and fixed supply hours. The fifth is that part of the scheme has just been put into operation and that the traditional problems arise of leaking joints and clogged pipes due to sand or gravel, that has seeped into the pipes during construction or repair.
The Irrigation and Public Health Department of Hamirpur is busy up-dating and it may be expected that within half a year, especially after constructing the extra reservoir, rising mains and pump, the scheme will supply its 10 gallon per capita per day.

2.4. Construction

The construction work was done in accordance with Indian Standards and made a good impression. Building and structures were well designed and executed. Pipes were laid in difficult ground and the mains mostly follow the roads. The following observations were made regarding the pipes:

- frequent leaking joints
- insufficient cover

The whole system suffers from frequent breakdowns due to these leakages. It is not known if this is caused by inferior jointing material or imperfect execution. In any case this aspect needs close attention and the engineer in charge assured us that a number of pipefitters will be kept in readiness to overcome this situation.

The situation generally improves after the first running-in and the subsequent repairs.
Insufficient cover was observed in the smaller distribution pipe-lines. Al though this facilitates the detection of leakages the danger of damage is too great.
Standposts themselves were well placed and provided with a small platform and some sort of drainage.
The only comment on the quality of the pipes is that the visual inspection showed them to be satisfactory and technically there is no reason to perform tests at present.

2.5 Operation and maintenance

The organization of operation and maintenance has to face the inheritance of design and execution. The large number of occasions where the operation is hampered by breakdowns of either equipment, pipes or power-supply demand a lot of improvision. During the visit irregular pumping and leaking joints were observed. The cause of the trouble could no always be repaired as there was only a limited number of repair crews and communications are difficult. No shortage of spares was reported.
The mission has the impression that during this starting-up period the number of crews could be increased.
The operation of this scheme with its high lifts, complex layout, the great demands inter-dependence, high pressures and a not to reliable power-supply demands constant and skilful supervision. The mission observed the good intentions of the operators, but also the lack of schedules and manuals to instruct them, especially when there are irregularities.
Schemes like this are not easy to handle and the on-the-job training needs many months.
The engineering staff in Hamirpur realise this and will give the matter full attention during the coming months. Funds have been made available for O & M and thus there is no reason for delay. Sufficient skilled manpower is not always available.

2.6 Tariff structures and revenue collection

Reference is also made to the social report in which the inadequate collection so far is mentioned. There seem to be considerable arrears in collection.
The mission observed the following:
- the tariff structure is not based on actual costs
- in large areas no collection is made
- no survey has been carried out to assess the paying-capacity of the population.

Since sound revenue collection is a precondition of the aid programme in order to involve the population and to ensure sufficient funds for O & M, the administration and methods of revenue collection should be revised.

The mission found that there is ability and willingness to pay for an adequate supply of water in the area.
No evidence has so far been found for the theory that failure to pay the contribution is caused by dissatisfaction of the consumer, because of irregular or insufficient supply. Payments are made and complaints are also made.
As soon as the scheme is updated and the costs for O & M can be determined more definitly, it is recommended to revise the present tariff to a more realistic level and to introduce this after sufficient preparatory instruction to the users.

3. APPRAISAL OF RURAL WATER SUPPLY SCHEMES IN DEOTSIDH, BANI BARSAR AND BOTHA

3.1. General

During the visit of the mission, the project-estimate for these three schemes was submitted. The execution of these schemes, for which the designs were made many years ago, has made very slow progress due to lack of funds. They are in various stages of progress and since they are supposed the meet the criteria set by the Dutch Government for providing aid, a visit to these areas was scheduled.

3.2. Description

The key data for each project are given below:

- Deotsidh

Population at present	:	19202 + 4040 students
Source	:	river
Rate of supply	:	8.8 gallons/cap./day
Daily requirement	:	230126 gallons/day
Treatment	:	sedimentation + slow sand filtration
Type	:	lift, with maximum static head of 231 m
Installed HP for pumping	:	3 x 66
Estimated costs	:	86.81 lakh Rupees
Already spent	:	10 lakh Rupees
Cost per capita	:	Rps 452

- Bani Barsar

Population at present	:	22017 + 8335 students
Source	:	river
Rate of supply	:	8.8 gallons/cap./day
Daily requirement	:	271716 gallons/day
Treatment	:	sedimentation + slow sand filtration
Type	:	lift, with maximum static lead of 231 m
Installed HP for pumping	:	200 + 30
Estimated costs	:	161.4 lakh Rupees
Already spent	:	35.95 lakh Rupees
Cost per capita	:	Rps 593

- Bhota

Population at present	:	10601 + 4954 students
Source	:	river
Rate of supply	:	8.8 gallons/cap./day

Daily requirement	:	134153 gallons/day
Treatment	:	sedimentation + slow sand filtration
Type	:	lift, with maximum static head of 162 m
Installed HP for pumping	:	20 + 40
Estimated costs	:	38.2 lakh Rupees
Already spent	:	7.03 lakh Rupees
Cost per capita	:	Rps 360

The areas are hilly and not so eroded as the Logwalti-Bomson area. No socio-economic survey has been made to establish the income strata and growth potential.

3.3. Selection criteria

After visiting the area it was clear that the majority of the villages can be classified as scarcity village.
No data were available on the income position.
The main occupation is farming and some additional in come is derived from resin-tapping in the forests.
Communications are good as most of the roads are paved or metalled.
There is less erosion than in the Logwalti-Bomson area and it seems that there is more rainfall. The slopes are less steep and the possibilities for agriculture are better.
The present sources for drinking water are wells and springs, of which most go dry at the end of the summer. No data were available on the presence of water-related and waterborne diseases.
After studying the various schemes and already executed works and with the experiences of the Logwalti-Bomson scheme available, the mission proposes to consider the Deotsidh-scheme for financing.
The Bani-Barsar scheme has already progressed too far influence the design. Moreover, the Consultant considers this a relatively costly scheme with its cost per capita of 593 Rupees.
A selection was then made between the others with the motivation that only one scheme was to be financed at this time. The biggest, Deotsidh, was selected on the basis that it could most easily be modified.
Also the stream of pilgrims each year gives this project more urgency.

3.4. Design procedures and parameters

The scheme is based on a river source. The Consultant wondered if there was any groundwater potential.
Mr. Mirchandani and Mr. Sarkar arranged to have a geo-hydrological survey made at once and this report made it clear that the selection of the river was logical. The report, and we wish to express here our respect for its quality and the short time in which it was realised, indicates that there is only limited potential for groundwater and then only at certain places. Thus the river remains the only reliable source.

The mission prepared a technical note regarding the design. This note which has already been submitted, describes in outline how design can be modified. For the construction of slow sand filters the mission recommend the WHO-standard. A copy has been sent to Mr. Sarkar. If necessary Mr. Sarkar could orientate himself on the latest developments in this field by a visit to the International Reference Centre in the Hague and to other Institutes in the Netherlands.
The rate of supply has been reduced to 8.8 gallon/cap./day which is in accordance with the Indian Standards. It is felt, that once the experience of Logwalti-Bomson is incorporated in this scheme there will be little doubt about its performance.
We must not forget that the scheme was the first of its kind in Himachal-Prades and maybe even in India.
A point that must be mentioned here is that no account has been taken of the consumption by cattle. Either they will rely on the wells and in summer on the river, or the human consumption has to be decreased to balance for the use for cattle.

The conclusion of this chapter is that if the technical notes prepared by the mission and the experience already built up are taken into account, the design will be sound.

3.5. Construction and procurement

Now there is the opportunity to follow this project from the beginning, the mission wishes to propose that all administration and procurement procedures are set up in such a way that expenditures can be taken in at a glance.
Construction will be in accordance with Indian Standards, in which quality standards are also laid down.
The Mission suggests bi-monthly reviews of direct and contract labour employed, of the raw materials that have been provided by the Government and the number and quality-class of the pipes which have been made available.
A breakdown into the various major items makes also future progress evaluation easier and more effective.
It is further asked that procurement procedures are kept short in order to built up sufficient stock to keep the execution going.
How the financing of these funds by Dutch Aid will eventually be organized, is a matter to be decided by the Dutch and Indian Governments in mutual agreement.
It is also recommended to test the pumps at the factory to avoid difficult replacements and adjustments afterwards.
To follow the progress a planning for the main activities have to be drafted and this could be checked and adjusted every two months.

3.6. Operation and maintenance

What is not mentioned in the proposal is the organization and the responsibilities for operation and maintenance. Yet this is a factor that is of crucial importance. In comparison with a system based on shallow wells ranging from 10-15m, with handpumps, a lift-scheme like this needs a considerable amount of energy and intensive operation and maintenance. However, as the availability of groundwater is said to be unsatisfactory, there is no alternative.
The mission wishes to know how the organization will be set up. The high pressures and long pipelines will make the system sensitive to break-downs and it is suggested to train the staff in the Logwalti-Bomson scheme.
A good stock-pile has to be set up, so that lack of material may not cause unnecessary delays. Resident pipefitters for each group of 8-12 villages will form the backbone of the maintenance. Concerning operation, the same applies as for Logwalti-Bomson, i.e. that schedules and instruction have to be drafted for normal use and for irregularities and break-downs.
Regular inspection by the staff from Hamirpur is recommended, as well as bacterilogical testing every half year.
An introduction programme should be set up, to prepare the local population for the scheme and thus to prevent abuse and spilling.
Furthermore, the population should be consulted on the exact location of the stand-pipes. This will also encourage proper use.

3.7. Water-rate structure

To meet the guidelines of the Dutch Government for Dutch Aid, the population has to contribute to operation and maintenance. This will depend on the paying capacity of the population, but in principle the scheme should be self-supporting, i.e. no extra funds from the State Government should be needed. This should also be explained beforehand to the population. A rough estimate leads to the following figures:

Power charges	:	60 000 Rupees	
Maintenance	:	8 261 "	(structures)
Repair of pipes	:	28 760 "	
Repair for pumps	:	13 768 "	
Chlorines	:	720 "	
Salaries	:	109 440 "	
Total		220 949 Rupees/year	

The present population is 19 202, so this would lead to 11.5 Rupees per capita per year, say 1 Rupee per capita per month. A survey has to be carried out to see whether the population can meet this. Depreciation charges are excluded from this calculation. If people take up part of the maintenance work voluntarily, costs can be decreased.

3.8. Reporting requirement

Notwithstanding the financial procedures, the mission suggests that 6-monthly progress reports should be submitted. The realization will take about two years, so this will require three progress-reports and one final report. The contents may include:

- list of pipes being laid
- list of villages connected
- planning for the next 6 months
- equipment installed
- progress of structural works
- training of operators and maintenance personnel
- explanation of variances

The following reports should be submitted annually:

a. Financial

a.1. actual capital and recurrent expenditures in the previous fiscal year
a.2. capital and recurrent budgets proposed by the Irr/PH Dept. and amounts approved by the State authorities
a.3. all the reports of auditors over the past year
a.4. proposed and approved capital and recurrent forward budgets
a.5. analysis of costs and revenues and implications for tariffs and recommended action

b. Organization and Management

b.1. changes in the organization
b.2. size of the establishment, vacancies
b.3. detailed training plans for the next year and costs
b.4. detailed plans for the management
b.5. any major event affecting the organization over the past year

4. TIKKAR DAM PROJECT

The Tikkar Dam is a promising possibility to combine water supply with irrigation. The project is still in the preliminary design phase and many data have to be gathered to establish the feasibility. It is a fact that the farmers are very enthusiastic and motivated. Throughout the district, the present crops depend on the rain.
High-lift irrigation schemes have been laid out in only a few cases. With the dam, the increased watering will make two or even three crops possible. The soil is fertile and ample manpower is available to cultivate the land and to prepare more land to be watered. The farmers already know exactly what crops to grow, with a good marketing potential. The site looks very suitable on visual inspection, but much more geological data will be needed to select the exact place and type of dam. Investigations also have to be carried out to determine the silt content of the river in order to predict the lifetime of the reservoir. There is much erosion up-stream and the silt content will be considerable.
Another matter is the power-requirement. The water has to be lifted several hundred feet and because of the large quantities the energy costs will be high. The fertile plains of the Punjab are nearby and an economic comparison is necessary to determine whether the new crops with these added costs are still cheaper than the products now brought in by trucks.
The water-supply factor remains, but is in itself no justification for a dam. The mission was however much impressed by the ideal site and suggest that the Dutch Government follow the developments and the findings of the studies. A socio-economic survey to assess the direct and indirect benefits and to establish the incomespattern and the distribution of the farmers now and in the future will also be useful. The Department estimates to have the studies completed by mid 1981.

CHAPTER 5 CONCLUSIONS AND RECOMMENDATIONS

1. The Logwalti-Bomson water supply scheme supplies water, but not in sufficient quantity and not regularly.

2. The hydraulic design of the water supply system is not according to the present Indian Standards. The volume of the reservoirs, the diameter, the gravity-line of 6'' and the actual alignment of some parts of the distribution system is such, that the objective of 10 gallons per capita per day cannot be met.

3. Due to the (present) insufficient capacity of pumps and/or motors in the pumping station in the riverbed and also to frequent power-breakdowns, the design quantity cannot be lifted.

4. There are frequent leakages in the rising mains as well as the distribution system and though there are a number of pipefitters, repairs are often not effectuated until more than one day later.

5. The design and construction of the pumping stations is reliable and sturdy. The construction of the main lines has also been carefully executed, there are sufficient supports and almost all bends are cast in concrete blocks.

6. The standposts are at first sight reasonably distributed over all parts of the village population. However, the pressure and the yield per standpost is dependent on the elevation of the standpost and therefore not on the number of users. In some cases reservoirs with ball-valves will have to be installed to balance the supply along the distribution lines.

7. The improvements proposed so far are not yet based on a hydraulic calculation in accordance with the Indian Standards.
A technical note will be submitted by the consultant of the mission.

8. No opinion on the bacteriological/chemical quality of the water supplied can be given, as the recent test-results were not submitted to the Dutch-Indian mission.

9. It has been observed that some of the population still use their kathris when the new water supply fails. This is a serious health-hazard, as resistance against water borne-diseases decreases during supply of safe water.

10. The possibilities of sub-soil groundwater reserves in the Deotsidh scheme have not been investigated by means of a hydrological survey. Therefore at the moment it cannot be said with certainity that the source which has now been selected, the river, is be only feasible one. (Has been submitted june 14th).

11. The new water supply schemes proposed, like Bani-Bargar, Deotsidh and Botha, are not quite based on the hydraulic principles laid down in Indian Standards. The quantity of reservoirs, their capacity, the availability of alternative sources, the optimization of distribution schemes have not been realised so far. Moreover, the availability of present sources has not been taken into account. A technical note with modifications will be submitted by the consultant of the mission.

12. The irrigation scheme proposed, i.e. the Tikkar-Dam scheme, will increase the crops productivity and variety per year and thus result in a better income position of the farmers. The relatively high energy costs per unit due to the high lifts of up to 300 m and the only slightly adapted land revenue will mean that agriculture in this area has to be subsidized.

13. The Tikkar-Dam scheme promises a good rate of return on investment because of the multi-purpose design. The dam will not only store water during the dry period, but will also cater for the Hamirpur water supply and the down-stream irrigation and water supply schemes.

14. Training of the operation and maintenance personnel has to be intensified in the Logwalti-Bomson scheme. It should be based on schedules and manuals, so that the crews are prepared for every possibility of failures or break-downs and repairs can be made in minimum time.
OM personnel for the new Deotsidh scheme should first receive training in the Logwalti-Bomson scheme to familiarize themselves with similar situations.

15. The system of water-rates and its organization should be revised and the rates raised to a more realistic level. The paying capacity of the population has to be taken into account.

References

Appendix 1 : Lift water supply Scheme: Logwalti Bomson in Tehsil and District Hamirpur HP

" 2 : Headwise Details of W.S.S. Logwalti-Bomson

" 3 : Himachal Pradesh, Public Works Department Proposals for updating the L.B.W.S.S. by the Chief-Engineer

" 4 : Technical Note regarding the L.B. W.S.S. by ir. H. Kiestra, DHV

" 5 : Technical Note regarding the Deotsidh W.S.S. by ir. H. Kiestra, DHV

" 6 : Account on present pumping practice of 22.03.1980, No. IPHSD-II-WS-I/80 1962-65

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APPENDIX I

LIFT WATER SUPPLY SCHEME
LOGWALTI BAMSON IN TEHSIL
AND DISTRICT HAMIRPUR HP.

Hamirpur District geographically lies within North latitude 31° 35' & 31° 55' and East longitude 76° 16' & 76° 43'. Most part of Hamirpur district are easily accessible and inter-state, high way and local motorable roads forms a family good net work.

District falls in the upper-Middle siwalic Zone. The altitude in the District varies from 375 to 1200 mtrs, but higher levels are restricted to Sola Singhri Dhar and rest of the area represents a rolling topography. The drainage pattern of the district is governed by Man, Kujah and Suker Khad. Man and Kunah are tributory to Beas river where as Sukar Khad is a tributory to Sutlej River. The rainfall is moderate to fair and there is a shortage of drinking water in the district. The district experiences a hot and humid summer and often chilling winter. The wide valleys are intensely cultivated, wheat and Maize are the main crops of the Area. Agriculture is the main occupation of the people, they are sturdy and hard working. Many persons from this area are in the Indian Army and have attained high ranks. There is not a single house in the Hamirpur district from where some member of the family has not joined the Indian Army.

Logwalti Bomson area of Hamirpur district is situated between altiude 800 meters to 1700 metres and between East longitude 76° 36' to 76° 41' and between North latitude 31° 42' to 31° 50'. This area spreads over 8 to 32 Kms on the west of Hamirpur Town. The Longitudinal strip running along Beas River on the North for a distance of 19 Kms to the South. Beyond this is the Bomson area. Most of this area is also not connected by Motorable road.

Hamirpur district as a whole has got scarcity of potable water. The public of Logwalti Bomson area particularly affected in this respect and were suffering badly for want of drinking water. The people had to store water during rainy season in Kucha underground tanks locally known as Khaties. This water was to be used by the people throughout the year. During summer season these khaties get dried up and people has to fetch water from long distance.

Keeping in view the difficulties of the people of this area Government of Himachal Pradesh has completed a water supply scheme costing ~~to~~ Rs. 111.84 lacs. Royal Netherlands Government has provided assistance of Rs. 72 lacs for the completion of this scheme. With its completion potable water has been made available to 89 villages having ponulation 31,912. A long awaited demand of the people of this area has thus been full-filled.

The scheme has been based upon a spring source known as Source spring. The total water requirement of the scheme is 4,59,270 Ltrs. per day. The lean period discharge of the source is only 5,90,900 ltrs per day. The source has therefore been suplemented from underground water available in Jagled Khad. Additional water of 9,50,00 ltrs. has been tapped from this Khad by constructing 25 meters long in filteration galley accross it.

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This scheme has been constructed in three phases. Since the source is located at a low level water is being pumped at three different places to catre the population. Phase I of the scheme is providing water to 24 villages having 7603 population. Water from spring source and infilteration gallery has been collected in a clear water reservoir of 345000 ltrs. located near the source. Water has been lifted with the help of two numbers 160 H.P. pumping sets to a storage tank of 4 1300 litres capacity near village Purli against a static head of 270.36 metres. Out of these two pumping sets one is acting as stand-by. The rising main consist of 200 mm dia mild steel seamless pipe having a length of 2123 mtrs. This pumping machinery is also delivering water to storage tanks of 13650, 27250, 34000 and 22700 ltrs. Capacity near village Surah, Banalag Jandru and Thana Tikkar. The rising main to this side comprises of 80,65,50 and 40 mm dia pipes having lengths of 1052, 3935, 1689 and 2159 mtrs. respectively.

Water is being lifted against a static head of 361-25 mtrs towards Surah side and 109.6 mtrs towards Thana Tikkar. For distribution of water 60.26 Kilometers G.I. Pipe line having diameter 15 mm to 100 mm has been laid at site. The completion cost of the phase I is 39.12 lacs. 91 Public hydrants has been provided for distribution of water.

Phase II of the scheme starts from Purli storage tank onwards. Water has been taken from the storage tank to a clear water reservoir of 45400 ltrs. capacity near village Kunsara, through gravity main of 150 mm dia having a length of 2433 mtrs. From Kuhasar reservoir water has been lifted to two nos. storage tanks having capacity as 40000 and 1, 13,500 litrs. near village Dhal. An intermediate tank of 45,400 ltrs. capacity has also been provided near village Utpur. Two pumps of 100 H.P. each has been installed for lifting water through Rising main of 150 mm dia and a static head of 115 metres. The length of rising main is 4978 metres. This rising main consists of 2222 mtrs, mild steel seamless pipes and rest of G.I. medium and heavy class. Under phase II, 35 villages having 13848 population has been provided with drinking water. For distribution of water 57.38 Kms of pipe line consiting of G,I. pipe from 15 mm to 100 mm dia has been laid. The cost of the IInd phase is Rs. 50.09 Lacs. 133 Nos of public hydrants has been provided for distribution of water.

3rd phase of the scheme starts from village Pari onwards. Water from Kunsara storage tank has been brought by gravity through 200 mm dia pipes to a sump well having capacity of 395000 ltrs. Water has been lifted to storage tank of 1,59,000 ltrs. located near village Panjot. An intermediate tank of 78,100 ltrs. capacity has been provided near village Bhatyat. The rising main of 125 mm dia having a length of 4440 mtrs. has been laid. Two pumps of 30 H.P. each has been installed for lifting water to a static head of 109 Mtrs. Water in the 3rd phase has been supplied to 30 villages having 10468

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population. The distribution system consists of 39. [illegible] from 15 mm to 100 mm. The cost of completion 3rd phase is Rs. 21.83 lac. 122 nos. of public hydrants have been provided for distribution of water.

A part of Logwalti Bamson area has not been provided with drinking water. 13 villages being 3775 + 400 students population were not included at the time of formation of this scheme. There is practically no other source from which where water can be supplied to these villages. Therefore, these villages are also required to be brought under the coverage of this scheme. The coverage is to be provided for 11 villages under Phase-I and for villages under phase III.

Total water requirement with the inclusion of these villages shall be 22,15,960 litres per day. Sufficient water is available in the infiltration gallery and additional requirement can easily be met out as discharge of the infiltration gallery is 73,40,953 litres/per day. However, pumping machinery in 1st phase has to be reviewed and separate pumping sets have to be installed for catering population on the left bank of Jagled Khud. 8 hours pumping seem to be reasonable and pumping machinery of adequate capacity alongwith adequate storage at different places has to be provided.

The locationsof pumping stations are remote and contact with each other is not possible without local communication system. This is urgently required for efficient and proper working of the scheme.

Extension of water supply scheme to 13 nos villages along with providing additional pumping equipment, additional storage capac-ity and telephone facility is likely to cost Rs. 2 5 lac.

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HEADWISE DETAILS OF W.S.S. LOGURTYY BOMSON IN TEHSIL AND DISTRICT, HAZARA (H.P).

1st Phase.	
a)Approach road	Rs.1.50 lacs.
b)Transmission line . Supply of power.	Rs.4.18 lacs.
c)Rising main 8" dia, 3"dia, 2½" and 2".	Rs.19.60 lacs.
d)Distribution system	Rs.10.40 lacs.
e) Pumps and Motors and pumphouse etc.	Rs.2.05 lacs.
f)Tanks at various places.	Rs.1.47 lacs.
g)Stand posts.	Rs.0.43 lacs.
h)Infiltration gallery	Rs.1.77 lacs.
i)Misc. of pillars anchor,blocks emplacement etc.	Rs.0.40 lacs.
	Rs.41.34 lacs.
2nd Phase.	
a)8" gravity main	Rs.17.18 lacs.
b)6" rising main	Rs. 5.79 lacs.
c)Distribution pipes and specials	Rs.29.01 lacs.
d)Pumping machinery and motors.	Rs.1.20 lacs.
e)Tanks and civil works	Rs.0.04 lacs.
f)Transmission lines.	Rs.1.43 lacs.
g)Stand posts.	Rs.0.56 lacs.
h)TRP compressors etc.	Rs.0.86 lacs.
i)Misc.such as anchor blocks, thrust blocks etc.	Rs.0.28 lacs.
	Rs.57.86 lacs.
3rd Phase.	
a)Rising main	Rs.5.17 lacs.
b)Pumping machinery and motors	Rs.0.42 lacs.
c)Distribution.	Rs.15.65 lacs.
d)Transmission lines.	Rs.0.07 lacs.
e)Tanks and pump house etc.	Rs.1.04 lacs.
f)Stand posts etc.	Rs.0.40 lacs.
g)Misc.such as anchor blocks and thrust block.	Rs.0.18 lacs.
Total:-	Rs.22.33 lacs.

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CENTRAL SECTOR

Ist Phase	Rs.41.36 lacs.
IInd phase	Rs.57.65 lacs.
IIIrd phase	Rs.23.33 lacs.
Total:-	Rs.122.54 lacs.

The above figures including the following additional works to be executed:-

a)Additional storage tank at Parli	Rs.0.50 lacs.
b)do at Kunsura	Rs.0.30 lacs.
c)do at Sant Nagar.	Rs.0.20 lacs.
d)do Extension to left out villages.	Rs.0.80 lacs.
e)Additional pumping machinery	Rs.1.60 lacs.
f)do at Chharu	Rs.0.15 lacs.
g)Extension to schools etc,	Rs.1.10 lacs.
h)Gates at various places.	Rs.0.50 lacs.
Total:-	Rs.5.15 lacs.

Attested
A.E. 24/4
I/c P.H. Sub Div. No.II
M.P.W.D. Hamirpur

Sd/-
(A.C. Verma)
Executive Engineer
I/c P.H. Divn. No. I
M.P.W.D. Hamirpur

HEADWISE DETAIL OF WATER SUPPLY SCHEME LOCALITY BOMSON IN KHUSAL AND DISTRICT BAIRAGAR (S.P)

Ist Phase.	Quantity	Amount.
a) Approach road.	1.75 KM and development of site in Khud.	1.50 lacs.
b) Transmission lines, supply of power.		4.18 lacs.
c)Rising main 200mm dia M.S.pipes.	2198 Mtrs.)	19.60 lacs.
d)-do- 80mm dia.	1052 Mtrs.)	
e)-do- 65 mm dia	5073 Mtrs.)	
f)-do- 50mm dia.	5821 Mtrs.)	
g) Pumps & motors 160 H.P at Boru with pump house etc.	Two sets.	2.05 lacs.
h) Distribution system.	43925 Mtrs.	10.40 lacs.
i)Tanks at various places at Boru Sarak Bamnlay, Jandu & Baru, Thanatikkar & Purli.	6 Nos.	1.47 lacs.
j)Stand posts.	93 Nos.	0.40 lacs.
k)Infiltration gallery.	1 No.	1.27 lacs.
l)Misc. like supporting pillars, anchor blocks & development of site.	-	0.42 lacs.
	Total:-	41.34 lacs.

II-Phase.		
a) 200 mm dia (gravity main) (9" dia C.I pipe class LA)	9576 Mtrs.	17.10 lacs.
b)150mm dia rising main and gravity main.	7300 Mtrs.	5.27 lacs.
c) Distribution pipe & specials of different dia.	57328 Mtrs.	29.01 lacs.
d)Pumping machinery & motors 100 HP motors at Kunsara.	2 Sets.	1.20 lacs.
e)Tanks & civil works, at Kunsara, Uhal & Gowalroo.	4 Nos.	2.04 lacs.
f) Providing transmission lines.	(as per actual amount paid to State Electricity Board)	1.43 lacs.
g)Stand posts.	160 Nos.	0.90 lacs.
h) 125 CFM compressor.	1 No.	0.36 lacs.
i)Misc. such as anchor block, thrust blocks etc.	-	0.5 lacs.
	Total:	57.85 lacs

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III-Phase

a) Rising main 125mm dia & 150mm dia.	4440 Mtrs.	5.17 lacs.
b) Distribution lines of various dia of pipes.	43148 Mtrs.	15.65 lacs.
c) Pumping machinery & motors 30 HP at Bari Mandir.	2 Sets.	0.42 lacs.
d) Transmission lines.	As per actual amount paid to Himachal Pradesh State Electricity Board.	0.27 lacs.
e) Tanks and pump house at Bari Jhenikar and Gageri.	1 No. Pump House 3 Nos. tanks.	1.24 lacs.
f) Stand posts.	125 Nos.	0.40 lacs.
g) Misc. such as anchor block & thrust block etc.		0.18 lacs.
	Total:	23.33 lacs.

GENERAL ABSTRACT.

Ist Phase.	41.31 lacs.
IInd Phase.	57.65 lacs.
IIIrd phase.	23.33 lacs.
Total:-	122.54 lacs.

The above figures include the following additional works to be executed:-

a) Additional storage tank at Purli.	0.50 lacs.
b) Additional storage tank at Kunsara.	0.30 lacs.
c) Additional storage tank at Bari Mandir.	0.20 lacs.
d) Extension to left out villages.	0.80 lacs.
e) Additional pumping machinery at Barsco	1.60 lacs.
f) Additional pumping machinery at Gawarco.	0.15 lacs.
g) Extension to school etc.	0.10 lacs.
h) Sheds at various places.	0.70 lacs.
Total:-	5.15 lacs.

XXXX

Sd/-(A.C.Verma)
Executive Engineer,
I&PH Division No.I,
Hamirpur.

Executive Engr.
I&PH Divn.No.II,
Hamirpur.

Assistant Engineer,
I&PH Sub-Divn.No.II,
Hamirpur.

APPENDIX 3

Himachal Pradesh
Public Works Department

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It has been possible to locate the statistical data showing s-cheduled caste population village-wise on the basis of 1971 census. My staff is working to find out the strength of scheduled caste population as per available figure of 1971 census. Efforts will also be made to find out the present-day scheduled caste population in these villages schemewise to work out the present day benefit which accrued to various sections of the society. Mr. Dey suggests that the National Sample Survey has been carried out after 1977 and as far as possible we should contact the N.S.S. authorities at Simla and see what information could be supplied by them in respect of villages located in Hamirpur District. However, instructions have already been issued to the field division to work out population of each village and the scheduled caste population for the same village which is being covered with drinking water supply scheme every year.

As far as Logwalti Bomson Water Supply Scheme is concerned, the designed population as per 1971 census was 19,850 souls and the present population as assessed from the Panchayat is 23,000 souls. For this population, at the rate of 10 gallons per head/ per day, we need to pump 2,30,000 gallons every day. Our pumps are working for 20 hours and this much quantity of water is being taken into the lines. There may be some short falls in pumping on account of non-supply of electricity or due to some other casual break-downs. However, there is maximum coordination with the Himachal Pradesh State Electricity Board authorities to ensure that the break down in supply of electricity is minimum. To have detailed knowledge of the fact of supply of electricity for efficient working of the scheme, Log Books have been maintained at each and every Pump Station. It should now be possible to study the record and go into the details further. The percentage of actual pumping hours against the designed pumping hours will have now to be worked out from the Log Books.

The distribution system passes through a terrain which is highly undulated. After running the scheme it has been observed that p-eople located at lower levels benefit much more than those whose houses are at higher levels. Moreover the length of the distribution system is very much. The main distribution line from the Source at Boru (Phase I) to the farthest end at Toni Devi(Phase II) is 16 Kms and from Toni Devi to (Panjot in Phase III) is 5½ Kms and the total length of the pipeline under the scheme is about 190 Kms. The storage reservoirs have at the present moment been located at peak points, i.e. Purli, Uhl, Sura, Banalag, Thana Tikkar, Bari Mandir, Panjot and Coetpur. In view of long distance the water takes to travel 6 to 6.30 hours from source to the villages. Everyday due to shortage of pumping in the evening at peak

hours or at any other time due to break down or on account of any other cause, it takes at the tail end about 6 to 6½ hours to reach water and this difficulty is being experienced at the tail end to satisfy the villages. Therefore, the only solution was to re-study the storage reservoirs for the whole scheme so as to have adequate storage on the scheme to cater for casual break down on account of any cause.

It has, therefore, been decided that one tank be constructed at Purli having a capacity of 35,000 gallons. capacity . The existing tank is only for 9,100 gallons capacity and this will just be enough for a population of 3000 souls being served by this tank. 30,000 gallons are required daily in this area. In order to have adequate storage for phase II and Phase III, a separate 35,000 gallons capacity tank is being provided out of State funds.

At Toni Devi area, which is the tail end area of phase-II, the supply is erratic due to withdrawal and use of water in the upper reaches of the scheme. It is, therefore, strongly felt that there should be separate storage at Toni Devi for the tail end villages. The population of villages at Toni Devi and the surrounding area is from 1600 to 2000 souls. Therefore, 20,000 gallons of water is required daily for this area. At least 6000 gallons capacity tank is required. Principally this is considered necessary as at the moment from our practical experience the Executive Engineer informs that he is supplying water once a day which is highly objectionable.

To further sophisticate the scheme and provide water at reasonable pressure in each village, it is necessary that the system should have break-pressure tanks. Each tank will be with ball valve and will serve each village. The cost of providing these balancing or break-pressure tanks will be of the order of Rs.50,000 to 60,000 which is not much.

All the villages situated on the left bank of Jangled khud or at lower level on the storage reservoir at Purli at the right bank, in the morning water is supplied for 2 to 3 hours to the villages on the left bank. While pumping is continuously done and Purli is also being simultaneously filled up but because of the /difference in level of the reservoirs on the two banks the efficiency of pumping towards right bank that means filling of Purli reservoir is low; Also as it has not been possible to stick to 16 hours pumping pumping in spite of best efforts, it will be necessary to raise the pumping capacity. For the time being, the best course open at minimum cost, is to segrigate the pumping for small water ~~reservoir~~ requirements for the villages situated on the left bank of Jangled khud.

The above proposals for providing additional reservoirs and additional pumping set have already been provided in the State Budget for the current year and the Executive Engineer has taken action to call tenders for the pumps and arrange the same. He has also been directed to go ahead with the construction of storage reservoirs. It is heartening to

note that the work has been taken in hand. He is short of cement. However, I have given him instructions to have 500 bags of cement for this work from Giri Irrigation Project Circle, Nahan so that storage reservoirs could be completed . Mr.Verma, Executive Engineer promises to complete the tanks in two month's time.

I am glad that during discussions Mr.Kiestra agrees with the general proposals made out above and a copy of this note has been given to him. He agrees that these changes/ improvements to the present system is consequence of the difficulties encountered so far.

If after further experience of 8 to 10 months it is observed that it is impossible to resort to 16 hours pumping on account of non-availability of power at full voltage then the Public Works Department will take necessary steps to increase the Horse Power of the pumping equipment so that necessary pumping could be done.

(I D Mirchandani)
Chief Engineer.

NO.PW. Dt.Hamirpur, the

Copy to Mr.Kiestra for information please.

Chief Engineer.

APPENDIX 4

DHV

DHV Raadgevend Ingenieursbureau BV

Technical note regarding the Logwalti-Bomson Watersupply Scheme, Hamirpur District, Himachal Pradesh State in India.

by ir. H. Kiestra, DHV
for Ministry for Development Cooperation

date 19 May, 1980

Summary: This note pertains the improvement which should be considered to update the present system to the goals as set in the initial project design. Only the main system is looked into in detail, the distribution system is dealt with in general terms.

1. Pumping hours

First of all the comment has to be made, that if pumping could be performed during the scheduled 16 hours, the scheme would provide the population with the required 10 gallons per capita per day. As there are certain inperfections in the network and the pumps are not transporting the designed quantity due to power cuts and insufficient head, the scheme will not operate satisfactory.
To overcome this operation of the pumps for 16 hours is of paramount importance. This has to be secured as soon as possible.

2. Pumping capacity

The present pumping capacity turns out to be insufficient.
The reason for this may be
- insufficient capacity of the motor
- insufficient capacity of the pump
- the friction inside the pipe is higher than assumed
- there are considerable head losses due to the numerous bends

However to overcome this we agree with the proposal of the Chief-Engineer, Mr. Mirchandani, to install an extra pump at the source, to supply the part of Phase I on the left bank. The capacity should be 2400 gallons per hour with a total head of ± 285 m. Operating hours will be 16.
Furthermore, the existing two pumps should be improved up to a minimum capacity of 12500 gallons per hour (16 hours a day).
The other pumps at the various stations will than transport the design capacity, assuming they are operating according their specifications (and 16 hours).

3. Reservoirs

The first reservoir of 900 gallons in the main line on the right bank (C) has to amplified. The proposal of the Chief-Engineer to build an extra reservoir of 35.00 gallons will be an adequate and necessary improvement.

The reservoir V is located, according to the map, after the pumpingstation. We assume however that this is constructed before the pumping station.

4. Main line

The first gravity line between the reservoirs C and N of 6" diameter is not sufficient. An additional pipe of at least 80 mm diameter has to be laid parallel to the present pipe to transport the design capacity.

An extra pressure line is foreseen between Uhal and Burian. This will be 150 mm diameter and used to transport the water for the villages in phase III. The existing line of 8" (or is it 6"?) will than be used to supply the distribution system of phase II.
It is not clear what diameter has been laid, as the drawing shows 8" and the calculation 6". It should be 6" diamter.
To overcome the present shortfalls it is however strongly suggested to lay an extra pipe of 8" diameter.
This measure, together with 16 hours pumping, will thus secure the supply to phase III.

5. On the design of phase III, pipes and reservoirs, are no comments, this quite up to standard.

6. Distribution system

The pipes to the various standposts are laid along track sand the alignment was not known before hand. It is thus possible, that at some critical points (like Paunch) the alignment includes to many loops and the post itself is located to high. Where necessary, improvements and realignments should be made.

7. Supply hours

At present the supply is irregular. It is suggested to supply two times a day, e.g. from 6-9 in the morning and from 3 to 6 in the evening. If required these hours could be increased, but it is felt that this will be adequate.

General remark

The whole network is laid out on a design capacity over 30 years, including a peakfactor of 1.5.
The installed pumps and reservoris however, are designed to transport the required quantity for the prospective population.
Since it is general practise, to replace the pumps after 10 - 12 years, the second set of pumps should be of increased capacity.

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- The reservoirs at H13, R25, R28, R30, R31 should be designed in such a way that the waterhead before the reservoir can be maintained for the distribution system behind the forementioned reservoirs. When these reservoirs act as normal reservoirs (break pressure) then there will not be sufficient head to supply the remaining part of the distribution system.

5. The reservoir at R1 should be connected directly to the 6" gravity main H-R and not to the reservoir R.
The reservoir at R has been designed to supply both areas S and R. However it is sufficient to use the reservoir at R only to provide the S area with water and to use it as a buffering reservoir between the 24 hour gravity supply form reservoir B and the 16 hours/day pumping of the booster pumps.
A reservoir capacity at R of 16000 gal is then sufficient.

6. Booster station at R: (recalculation)
Pumping period: 16 hours (4.00 - 20.00 hour)
Installed pumps: first 15 year period: 2 pumps 17 Hp (1 standby) with a total pumpcapacity of 2948 gal/hour at a total head of 187 m.
second 15 years period: 3 pumps 17 Hp (1 standby) The total pumpcapacity should be 4000 gal/hour at a total head of 253 m.

7. Rising main R-S: in contrary to the calculated demensions in the report, the main diameter should be 3".
(both 3" and 6" rising mains are designed for a 30 years period with a design factor of 1.5. The above calculated pump capacity and power is in accordance with the stated diameters).

8. It is not clear wether a reservoir has been located in S1 or S1C or at both places. This has to be verified.

Waterquality

9. Water analysis indicates that the water is moderately polluted surface water. Turbidity is low, pollution with bacteria nutrients and organic matter is also moderate. Hardness is within WHO standard Remarks on the analysis sheet reveal that the turbidety of the water may become much higher during raining season. This necessitates slow sand filtration as treatment process preceeded by sedimentation. Chlorination may be added as a safety measure.

10. Depending on the turbidity in the rainy season, the slow sand filters may be operated at design velocities of 0.1-0.3 m/h. Multiple units should be provided for maintenance and safety.

APPENDIX 5

DHV

DHV Raadgevend Ingenieursbureau BV

Deotsidh Water Supply Scheme

Hamirpur District, Himachal Pradesh, India

Technical note

by ir. H. Kiestra, DHV
for Ministry for Development Cooperation
date 21 May 1980

Summary: The Deotsidh scheme has been received to eliminate possible imperfections and to update the calculation to the latest hydraulic design standards as set by the India Government and international bodies like WHO.
The suggestions made are in our view necessary to achieve the designed capacity and to assure a troublefree operation.

1. Pumping station at A: (recalculation)
   Pumping period: 16 hours (4.00 hr - 20.00 hr).
   Installed pumps: - for the first period of 15 years 3 pumps 55 Hp each of which one acts as a standby. The total pump capacity should be 14400 gal/hr. at a total head of 255 m.
   - for the second period of 15 years 4 pumps 55 Hp each (1 standby).
   Total pump capacity 20.000 gal/hr at a total head of 268 m.

2. Rising main A-B: as it is not always clear from the design calculations or the site plan, the diameter of the rising main should be 6".

3. The reservoir at B has been designed for 153500 gal. (= 2/3 day capacity). Considering a 16 hours pumping period and a 24 hours/day gravity supply from the reservoir, the content could be reduced to 76700 gal. For safety reasons and because of peak-supply the reservoir should nevertheless be designed for 2/3 day capacity.

4. Main distribution system:

   Design cirteria:
   - 16 hours/day delivery from pumping station A
   - 24 hours/day gravity supply from reservoir B and all the other reservoirs
   - the main distribution system has been designed for a 15 years period with a design factor of 1.5.
   - because of a peak demand higher than 1.5 all the reservoirs should be designed to contain a ½ day capacity in stead of a 1/3 day capacity, as they have been designed for at this moment.

APPENDIX B

Himachal Pradesh
Public Works Department.

No. IPHSD-II-WS-I/80------ 1962-65. Dated: 22.3.80.

To

i) Sh. Chhangu Rak JE.
Irrig.cum.P.H. Sub Divn.No.II,
HP.PWD., Hamirpur.

ii) Sh. I.D.Verma JE.
Irrig.cum.P.H. Sub Divn.No. II,
HP.PWD., Hamirpur.

Subject:- Regular supply of water in 3rd. Phase.

Sh. Amin Chand JE has reported and also some public complaints have been received that water in 3rd. phase is not being supplied regularly. The timing of releasing water from Ghal tanks has already been told to you many times for compliance but due attention is not being paid in thisconnection I would like to know the reasons why regular supply of water to 3rd phase is not being supplied according to my as well as Executive Engineer's instructions as mentioned below:-

1. Water will be pumped at Baurao 20 Hours for whole scheme daily.

a) Water should be supplied for IInd & IIIrd Phase daily as under.

i)	9.30 PM to 12.00 P.M.	= 2.30 Hours.
	12.00 PM to 6.00 A.M	= 6.00 "
	8.30 AM to 2.00 PM	= 5.30 "
		14.00 "

ii) Water should be supplied for first phase.

a)	6.00 A.M to 8.30 AM	2.30 Hours,	Kakar Bajrol side
b)	2.00 PM to 5.30 P.M.	3.30 "	Surah & Thana Side
		6.00 "	

Further I have also checked the timings for releasing of water at various station and I have observed that there is xxx lot of difference in timings as mentioned below:-

Date.	Water Pumped. at Baurao.	Water released at Ghal towards Tauni Devi.	Water reached in Barin Mandir Tank
10.3.80	20. Hours.	15.25 Hours.	9.00 Hours.
11.3.80	20 "	13.20 "	6.15 "
12.3.80	20 "	13.55 "	5.30 "
13.3.80	16.45 "	10.45 "	4.55 "
14.3.80	20 "	13.15 "	3.75 "

p.t.o.

15.3.80	12.30 Hours.	9.00 Hours	5.75 Hours.
16.3.80	16.30 "	3.10 "	-NIL-
17.3.80	13.30 "	9.30 "	-do-
18.3.80	17.00 "	11.30 "	1.30 Hours.
19.3.80	9.00 "	5.00 "	1.55 "
20.3.80	10.30 "	2.45 "	NIL.
21.3.80	14.00 "	10.30 "	5.00 Hours.
22.3.80	18.00 "	9.00 "	5.3? "

Therefore, you may please give me complete detail of time & explain why the water could not be supplied 8 H. to 10 H. daily to IIIrd phase as already discussed many a times. regarding supply of waterd in IIIrd. phase be assessed and reported to higher authorities. It is most urgent matter to make the supply regular in IIIrd. Phase otherwise both you will be held responsible for any consiquencies arised at letter stage.

Treat it most urgent.

Sd/-
Assistant Engineer,
Irrig.cum.P.H.Sub Divn.No.II,
HP.PWD.,Hamirpur.

Copy to Sh. Amin Chand JE. for information & similar action. He sould also send daily progress for regular supply of water in 3rd phase. He should intimate the progress with faults occured anyd in gravity main and other lines etc.

Copy to the Executive Engineer, Irrig.cum.P.H.Divn.No.I HP.PWD., Hamirpur for information & necessary action please.

Sd/-
Assistant Engineer,
Irrig.cum.P.H.Sub Divn.No.II,
HP.PWD.,Hamirpur.