

# **Environmental Assessment for the Construction of the Nahi Feeder Road**

## **PROJECT PROSPECTUS DOCUMENT**

**Second revised Draft 05/98<sup>1</sup>**

### **1. INTRODUCTION**

Nahi is one of the 15 Gewogs under Wangdue-Phodrang Dzongkhag, western Bhutan. To reach Nahi, it is two and half hours car drive from Thimphu to the Wangdue Bridge Point and three hours walking from Bridge Point to the Primary School, which is centrally located in the Gewog and is end point of the proposed road. The second approach is from the Gaselo road which requires two walking hours to the School. The upper valley village, Nabisa , could be approached from Thimphu crossing the Helela ridge, above Simtokha. The stream Nabi Rongchu runs in an easterly direction and is an important source of irrigation water for paddy fields in Nahi Valley and outside gewogs like Gaselo and Thetso gewog (Rinchengang). It also feeds a small hydro-power station at Hisothangkha which supplies electricity to some villages.

The whole gewog forms a natural watershed and has undulated terrain with partly steep slopes. It ranges from an altitude of about 1200 m at the Eastern-most corner to an altitude of about 3600 m in the West. About 90 % of Nahi valley is covered by forest which is habitat of a wide range of wild animals. Thus, barking deer and wild boars often come out to destroy the wet and dryland crops which are cultivated on terraced farms.

### **2. PROJECT DESCRIPTION AND PLANNING**

In the early planning stages, the Forestry Development Corporation (FDC) proposed to construct a road along the Southern slope of the gewog, that is from Gaselo to Nahi in order to be able to exploit the mixed broadleaved forest and other forest products in the upper part of the watershed.

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<sup>1</sup> (prepared by Akey Dorji, FR/BG-SRDP and Reinhard Wolf, Team Leader GTZ/BG-SRDP)

Since a road from Tsirang Highway to Gaselo is already existing, the required road length would have been only 5 km. The proposed road along the Southern slope, however, would not touch the Northern part of the gewog where 90% of the settlements are located (see map attached).

Therefore, the people of Nahi expressed their concern, that they would not benefit much of this road and requested the Dzongkhag administration of Wangdue-Phodrang and the Bhutan-German Sustainable RNR-Development Project (BG-SRDP) for alternative arrangement. Accordingly, FSD Management issued a directive to DFO/Wangdue for alternative road alignment from Wangdue bridge to Nahi primary school, so that most of the households of Nahi would benefit. Argument for such a road from side of better-off farmers are mainly : improved marketing possibilities for agriculture produce and to a limited degree being able to sell minor forest products. All the inhabitants including the teachers and the Village Health Worker (VHW) would appreciate a road for easier access to health facilities.

Due to these reasons, gewog has already made a petition at the Dzongkhag level for the construction of the road. Villagers explained that they would be ready to contribute labour from each household for support in road construction. They also state that they would be ready to carry out minor maintenance. Regarding the question of compensation for lost agricultural land through which were to pass, the gewog has apparently already signed a communal agreement stating that this would be regulated internally, and would not be expected from the government.

The results of a number of studies, conducted by BG-SRDP (KIEVELITZ, 1995; NAMGYEL 1996 and RICHTER 1997) confirmed, that the people of Nahi would greatly benefit from the alternative road alignment.

Accordingly, numerous discussion were held between the Dzongkhag administration of Wangdue-Phodrang, BG-SRDP and the people of Nahi and it was concluded to prepare a road alignment from Wangdue Bridge to Nahi Pry. School. The road survey (road length 12 km) was then carried out from February to May 1996 by a trained engineer from FDC.

Take-off point starts about 100 meters from Wangdue bridge on the way to Tsirang and it mainly follows a trail on open grassland and degraded open Chirpine forest.

## **2.1 Type of project**

The road is classified as a feeder road of 12 km length with width of 5 meters. The design for roadside ditches and other drainage facilities are based on the amount of rainfall in the area (details are mentioned under drainage). The average gradient for the proposed road is 8%.

## **2.2 Project Objective**

The main objectives of the project are:

- To improve the socio economic condition of the rural population of Nahi

- Sustainable management of the forests of Nahi valley

### **2.3 Location of the project**

The Nahi Valley is located between 89°45'36" and 89°54'14" East and 27°24'00" and 27°29'46" North. The land area of the Gewog is estimated 764.7 km<sup>2</sup>.

The take-off point (alternative II) lies about 100 meters from Wangdue bridge on the highway to Tsirang and the alignment mainly follows an existing trail on open grassland and degraded open Chirpine forest.

Alternative II was chosen as the most feasible one, since it does not touch any wetland, ecologically sensitive areas, private land or residential areas. The attached map shows the proposed road alignment.

### **2.4 Materials required**

Materials required for the construction are mainly stone, mud and timber for bridge construction (all locally available), and cement.

### **2.5 Anticipated schedule and financing**

Road survey, design and planning for 12 km of feeder road was done by a trained engineer of FDC from February to May 1996 with assistance from BG-SRDP.

The total costs of the road construction is estimated to 12 Million. Nu. A grant of 500,000 DM (approx. 10 Million. Nu) from the German government through GTZ has been reserved.

In case of approval by RGOB to the road construction and the timely conclusion of the financing agreement between RGOB and GTZ, the construction of the road may start by September 1998 and be completed by end of 2000.

## **3. ENVIRONMENTAL INFORMATION**

With careful planning and implementation of the road construction, negative environmental impacts will be avoided as much as possible.

According to the Manual on Environmental Assessment (NEC 1997a) the project can be classified as category C (impacts moderate, projects repetitive).

### **3.1 ASSESSMENT OF IMPACT**

#### **3.1.1 Ecological Impacts**

Naturally there will be a disturbance to ecosystem when human disturbs the nature. Since the road alignment is passing through an area, which is ecologically not sensitive (open chirpine

forest and grassland, no habitat for endangered or rare species), negative ecological impact are expected to be minimal.

### **3.1.2 Effect on flora and fauna**

The project does not fall in any of the declared protected areas the road alignment is mainly using an existing trail, crossing grassland and degraded open chirpine forest, therefore 50 nos of chirpine trees have to be removed and about 10 numbers of Alnus needs to be felled near the endpoint. It does not touch any important track and other important habitat of wildlife. Of course the environmental degradation could be fairly high, if the construction is carried out by bulldozer and uncontrolled explosives.

### **3.1.3 Human Settlement impact**

With the proposed road alignment, it has been avoided to touch any sort of private land and residential areas, therefore nobody will be displaced or private land will be occupied.

### **3.1.4 Potential impacts on cultural and heritage resources**

The project does not hold any adverse implications to the archaeological, historical and cultural artefact, structures and environment features that are of religious or ritual significance.

### **3.1.5 Impact on Infrastructure**

The major infrastructure that could be affected by the road construction are an irrigation canal of Rinchengang and some portion of the water way (Nabirongchu) for Hisothangkha hydro power. By using the cut and fill method it will be avoided that falling debris and rock could bring major damage to the Rinchhengang canal or cause siltation of the source stream (Nabirongchu).

## **4. IMPACT MITIGATION**

The purpose of the mitigation in the EIA process is to :

- a) Look for better ways or alternatives of doing things so that negative impacts are avoided or reduced and
- b) to avoid loss to public and individuals which are higher than the benefits they receive.

The following are the proposed mitigating measures:

### **4.1 CONSTRUCTION AND APPROPRIATE TECHNOLOGY**

#### **4.1.1 Road Formation**

In general the project area is steep within average side slope more than 50% it is important to use appropriate technique. The "Cut and Fill" method is found most appropriate for the site. In the depressions or gullies, retaining walls with hume pipe culverts should laid before being filled with

excavated materials. An hydraulic excavator should be used to avoid excessive, side-cast fill slopes on steep hillsides and to minimise disturbances to soil/slope stability.

Where there are no depressions found nearby to dump the cut material it should be transported despite longer distance. A site for dumping the cut material should be prepared in order to avoid the cut material to slide downhill. In this way vegetation damage downhill is minimised, reducing soil erosion.

#### **4.1.2 Drainage**

It is known that one of the most important factors for the durability of the road depends on proper drainage systems. For the proposed feeder road the longitudinal drains designed are V-shape drain. As the project area has low rainfall (600 mm), it recommended that *50 cm x 50 cm V-shaped drain* for soil section and *30 cm x 50 cm in rocky section* would be adequate to discharge the runoff smoothly. Based on the natural drainage system (depending on gullies and depressions ) *87 hume pipe culverts with 90 cm diameter*, a *timber bridge of 14 metre span* over Nahi rongchu and *1,558 m<sup>3</sup> of retainig wall* and breast wall in fragile area are recommended.

#### **4.4.3 Recommended Construction Equipment**

1. Excavator	I no.
2. Bulldozer	1 no.
3. Rock driller	1 no.
4. Roller	1 no.
5. Truck	3 nos.

## **4.2 BLASTING TECHNOLOGY**

Since there are only few rocky areas along the road alignment, small quantities of explosives would be used very carefully and under strict supervision of the Working incharge, in order to avoid hazards to the surroundings.

### **1. Qualification and appointment of shortfirers and assistant personnel<sup>2</sup>**

- The shotfirer should be preferably at least 21 years old and be stable temperament and have a practical experience working with a shotforer for at least one year
- The shotfirer should have attended a recognized course of training covering the theoretical, practical and legal aspects for the use of explosives for all types of blasting work.
- To qualify for the shotfirer assistant, a person should be atleast 18 years old and be stable temperament.

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<sup>2</sup> Environmental impact Assessment, Dakpai- Buli Road, ISDP - Zemgang, Dec. 1997.

- The assistant should have short course dealing with the main hazards in the handling and use of explosives.
- Where the blasting operation is so extensive that shotfirer are , one should be appointed as having an overall control

## **2. Choice of explosives and initiating systems.**

- Explosives recommended are power Gel 801 and special Gelatine SG 80, however Power Gel 801 is preferable.
- Electric Delay Detonator (EDD) of the same electrical sensitivity and produced by the same manufacturer should be used. Detonating cord or cordex should be the connecting wire between holes.
- The series of holes are intended to detonate instantaneously and subsequent series after few milliseconds.

## **4.3 BIOENGINEERING METHODS**

It is obvious that for the first few years there will be landslides, to mitigate this problem it is recommended to take some suitable bioengineering measures like: planting of cuttings, direct seeding of suitable tree species and Grass seeding.

**Cuttings:** *Omshing* and *Poplar* in the drier area and *Erythina* and *Willow* in wetter area.

**Direct seeding:** *Dodonia* and *Chirpine* in the drier region and *Alnus* in wetter region and *Kiku* grass in loose soils mainly for surface protection.

## **5. SOCIAL, ECONOMICAL AND CULTURAL INFORMATION<sup>3</sup>**

### **5.1 Some characteristics of the valley<sup>4</sup>**

The Nahi gewog constitutes six villages, with a total of 103 households dispersed across the whole south-western mountain slope in dotted settlements except for the village of Hali which is on the northern half. The Nahi community is highly heterogeneous with people present from outside the gewog and Dzongkhag. This was because Nahi was en route the old East-West travel route before the Thimphu- Wangdue motorable road opened just over two decades ago.

The remote valley is still not linked by an access road. Nonetheless, a web of small footpaths and mule tracks going up and down the steep valley link the houses with the field and outside world. All goods brought in and out of the valley have to be transported by porters or on horseback. A

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<sup>3</sup> For more Socio-economic details of Nahi gewog, please see reports of *working paper No. 3* by Kievelitz, *Occasional Paper No. 1* by Phuntsho Namgay and *Working paper No. 13* by Richter.

<sup>4</sup> Marlene Richter, Working paper No.13.

walk from a hamlet to Wangdue, the nearest town takes from two upto five hours, depending on the location of the starting point. Owing to the topography of Nahi valley and lack of a road, communication with outside is greatly reduced. There is no electricity and telephone.

Nahi valley consists of different hamlets or blocks whose populations are of different origin and status. The settlements are scattered deep into the valley and up the higher slopes.

The majority of the inhabitants of Eusagom and Eusawom hamlets seem to belong to the early settlers in Nahi valley and constitute the noble families.

Hebesa is mainly inhabited by share-croppers who cultivate the land owned by different monastic bodies, in addition to their own small plots.

Nabesa is, among others, inhabited by former serfs (some of them coming from Gaselo, where several noble families released serfs following the king's order in 1958)The serfs obtained land in the valley when serfdom was abolished. Migrants from other parts of the country as well as Nepalese, who stayed after the construction of road to Thimphu was finished, are also inhabitants of Nahi valley.

An agglomeration of more than four to five houses is very rare. The settlement pattern reflects the difficulty of finding adequate land on the slopes suitable for terraced farming. This contributes to the time consuming communication and lack of coordination between the inhabitants of different hamlets. Mobility is greatly reduced in the valley because of long distance and difficult and strenuous footpaths.

## **5.2 Improvements by opening up the valley**

Lack of access to the market or other facilities (hospital, family members outside, communication) was always mentioned as a major constraint for the improvement and expansion of the village life. Income generation facilities determine motivation for additional production in general. An access road is seen as the principal remedy for a lot of existing problems. However, on closer inspection, all these problems could not be solved by road. However, a number of economically feasible opportunities in fruit and vegetable growing, tourism (trekking) and improvement will enable young and better trained villagers to enjoy the living conditions in the valley. A road is a means of hope for change toward a better life.

Realistically, it can be expected that the connection of Nahi valley to Wangdue - Thimphu road will lead to substantial changes in the social and economic life of the Nahi people.

### Social change

Improved access to the valley by an access road would facilitate the possibility of leaving the valley and visiting people in the valley. A greater exchange with businessmen, merchants and tourists may inspire and Borden mutual understanding. New contacts and experiences could be

made, thus changing the view of development and the appreciation of the outside world. New settlers might come with professions, such as tailoring and shopping, and skills already practised in urban areas. services would be available in the valley. Certainly the access to medical facilities would be improved. Access to Government services including training and credit would be facilitated.

Economic change

Access to the valley by a motorable road would not only allow ‘niche products’ (high value, low weight) to be produced and sold, but would open up wide range of marketable goods to be cultivated, regardless of their weight and storage capacity. Furthermore, a cost-effective use of natural resources would be possible. Surplus products could be easily transported to the market, fruits like apple, orange might be prepared for export. Cash crop like potatoes are another option for the farmers. The exploitation of the forests for timber would be easier. The transport cost would be decreased and labour and time saved would therefore be available for cash crop production.

Through the connection to the outside business world, dealers and craftsmen would have easy access to goods and customers. More commercial exchange would be established between Nahi valley and Wangdue. Heavy technologies like power tiller and a milling machine could be transported without any problem.

Impacts

The positive and negative impacts of an access road might be as follows:

**Table 1: Pros and cons of an access road**

<b>Positive impact for villagers</b>	<b>Negative impacts for the villagers</b>
<ul style="list-style-type: none"> <li>• reduction in time and transport costs to reach outside markets</li> <li>• more frequent communication with Government offices</li> <li>• faster access to health services and hospitals</li> <li>• more frequent visits from outside (information exchange, in-migration)</li> <li>• new investment opportunities due to cost reduction, availability of skilled labour, technical services, better education etc.</li> </ul>	<ul style="list-style-type: none"> <li>• exposure to stronger competition with products/services from outside</li> <li>• out- migration/higher fluctuation of people</li> <li>• changes in values, rising expectations</li> <li>• negative role models and examples,</li> <li>• selling -out of land houses.</li> </ul>

Evaluating the pros and cons of the access road to Nahi valley and the changes associated with it, decision-makers need to seriously consider the construction of the road. The expressed intention of the Dzongkhag to build the road should be supported, thus satisfying one of the most urgent needs frequently expressed by the people of Nahi.

Table no. 2 provides selected socio-economic information for Nahi Gewog

**Table 2: Selected socio-economic Information**

Village	No of house holds	Wet land (acres)	Dry land (acres)	Cattle	Horse	Pigs	Avg. Annual cash income (Nu)	Avg. Annual exp. (Nu)
Nabisa	24	54.12	16.94	135	26	40	30,000	30,000
Eusagom	26	58.47	8.02	143	16	50	25,000	26,000
Eusawom	21	32.93	6.89	133	9	40	20,000	25,500
Hebisa	17	36.72	8.92	203	17	30	25,000	29,000
Khujula	9	4.60	9.56	58	3	5	20,000	21,500
Pangsho	6	22.64	5.85	45	2	10	15,000	20,000
<b>Total</b>	<b>103</b>	<b>209.48</b>	<b>56.18</b>	<b>717</b>	<b>73</b>	<b>175</b>	<b>1,35,000</b>	<b>1,52,000</b>

Source: FRC/BG-IFMP Occasional Paper NO.1 by Phuntsho Namgyal

### 5.3 Existing social services and infrastructure

Inside Nahi Valley, there are only six major institutions at present:

- the **agriculture extension worker**, has an office close to Yesawom. He gives extension in the fields of wetland and dryland cultivation, mostly regarding improved rice and wheat varieties, tests and evaluates them together with farmer and advises on crop pests.
- the **animal husbandry extension worker**; has an office in the same building with agriculture extension worker. He gives extension in the fields of animal breeding health care and raising back yard poultry farm.
- the **gup**, represents the public in all matters coming from the Dzongkhag, such as in the trimestrial Dzongkhag planning meetings;
- the **local primary school** which has five teachers and about 190 students. The school is basically a boarding type, with more than 100 children staying in hostel. Only about 50% of

all households in Nahi Valley presently send their children to school, as a census of 1995 revealed.

- The **village health workers** (VHW), who are elected volunteers from the village, carrying out aid in cases of minor health problems. Presently three VHWs are found dispersed over Nahi Valley. They usually go monthly to Wangdue to collect medicine which is often required in the gewog, but according to a number of villagers, very often they do not have the necessary medicine and as they have not received any formal training, they can be of little help only;
- The monastic institutions are represented in Nahi Valley by different temples. One can distinguish three categories of temples as : **Government temple, Community temple and Private temple**. Most of the monasteries own land which is usually cultivated by sharecroppers on a “one-third (monastery) -two-third (farmer) “ or even on a “fifty- fifty” basis. These monasteries perform important functions not only for religious practice of the village, but also regard to spiritual healing.

Beside above facilities all the villages are supplied with tap water.

#### **5.4 Workforce requirement**

For the road construction, about 150 labourers might be required and some temporary hut might be constructed for them. About 60% of the workforce might be recruited from non-local source.

#### **REFERENCES**

JIMBA, KARMA ET AL (1997): Environmental Impact Assessment Dakpai-Buli Road, ISDP-Zhemgang, Bhutan

KIEVELITZ, DR. UWE (1995a): Training Modules for the RRA/PRA - Training Project Paper No. 2

KIEVELITZ, DR. UWE (1995b): Analysis of the Environmental and Social Situation in Nahi Gewog, Wangdue - Phodrang Dzongkhag

NAMGYEL, PHUNTSHO (1996): Beyond timber: What Value? A Rapid Rural Appraisal Study on Non-Timber Forest Products in the Nahi Gewog, Wangdue - Phodrang Dzongkhag; FRC/BG-SRDP Occasional Paper No. 1

NEC (1997a): Preparing a Project Prospectus

NEC (1997b): Institutionalizing and Strengthening of the Environmental Assessment Process in Bhutan  
- Draft - NEC, Thimphu May 1997

NEC (1997c): Bhutanese Environmental Assessment Sectoral Guidelines

PRADHAN / Range Manager, Engineering Division, BLC Thimphu (1996): Nahi Road Plan and  
Estimate

RICHTER, MARLENE (1997): "The Motorable Road of Hope". Resource Management by Rural  
Households in Nahi Gewog/Wangdue - Phodrang Dzongkhag  
BG-SRDP Working Paper No. 13

## **ANNEX**

- Maps of Nahi Valley with road alignment

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