

CHAPTER 5
MITIGATION MEASURES AND PLANS

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Environmental impact mitigation measures for the Project are proposed for impacts predicted on three environments; Physical, biological, and socioeconomic and cultural environments. They are described below.

5.1 Measures and Plans for Potential Physical Impacts

5.1.1 Construction Phase

5.1.1.1 Environmental Supervision

It is strongly recommended that the project authority establish an Environmental Management Department in the organization which will be responsible for the implementation of impact mitigation measures. The manpower required are an Environmental Officer, 1 Scientist (fisheries background), one Technical Assistant (Chemistry background), 2 Research Assistants (Fisheries background), one sociologist and 6 other assistants (miscellaneous works). The task of the Cell will be to coordinate specific studies, to carry out environmental monitoring and to evaluate implementation of environmental mitigatory measures. The Environmental Cell will report to the appropriate authority having adequate powers to implement the required measures.

5.1.1.2 Soil Stability

A large amount of earth and sand generated during the construction work of the dam itself or in constructing roads should not be dumped in the valley to let them flow into the river, but should be recovered and dumped at the designated disposal site which is provided with measures to prevent their flow into the river. Some of such disposal sites may disturb the scenic beauty of the landscape, so the slopes should be stabilized by vegetation as soon as possible after the sites have completed their purpose.

Construction of access roads often causes landslides. Good drainage may need to be provided at cliffs on both sides of the road and faces of slope stabilized by vegetation to prevent surface collapse.

Steeply sloping banks are liable to landslides, which can be controlled by drainage. The other erosion hazard, that of surface erosion of the bank, is best controlled by vegetation, but the difficulty lies in growing vegetation on steeply sloping banks. Engineering solutions such as surface drainage, sub-surface drainage, toe protection and rock bolting can be used. Landslides can be stabilized by several methods – engineering or bio-technical measures alone or a combination of these.

The stripped material will have to be collected and dumped in the designated muck disposal area which will have check dams to prevent the mucks to flow down to the river.

5.1.1.3 Water Quality

While crushers are introduced in construction, water is used in drilling rocks. Water drained from the crushers will contain high concentration of suspended particles, thus the drained water will need to be treated before its disposal. For this treatment, utilization of a settling tank should be considered. The total quantity of effluent generated will be about 9 m³/hr from the crusher at the dam site. Likewise, 3 m³/hr of effluent will be generated from the crusher at the power house site. Settling tank is proposed to provided at the dam site and the power house site.

Muddy water generated in tunnel digging will also require treatment in a settling tank. The sludge from the various settling tanks can be collected once in 15 days and disposed at the site for disposal of solid wastes from the labor camps. The sludge could also be used as cover material of the municipal wastes.

For proper sewage disposal, drainage system will have to be installed at the community latrines for living quarters. At peak construction phase, there will be an increase in population by 5,000. To ensure that the sewage from the labor camps do not pollute the river water it has been estimated that about 250 community latrines and 10 septic tanks need to be constructed. A typical layout of the septic tank is given in Fig.5.1.

5.1.1.4 Air Quality

One main cause for air pollution is dust which leaks from crushers. This requires cyclone filters to be installed. The two crushers to be located, one each at the dam site and at the power house sites needs to be provided with cyclones to control the dust generated while primary crushing the stone aggregates. The captured dust is sprinkled with water to prevent its dispersion.

5.1.1.5 Construction Vehicle

Transporting materials and equipment by large-sized vehicles and performing construction work operations can cause noise, vibration, exhaust gas and dust to occur. Traffic accidents are also another concern. To minimize these impacts on local residents, low noise type of construction machines will be used and vehicles will be required to observe the traffic rules and reduce their speed when passing in or near residential areas. Traffic density will also need to be regulated. Vehicles which comply with the environmental standards established in Bhutan should be used and water sprinkled as required to minimize rising of dust. The time in a day for construction work and transportation should be managed and work at night minimized.

5.1.1.6 Waste

A method will have to be developed to collect municipal wastes produced by workers' households and convey them to the landfill disposal site. The beds of the disposal sites should be covered with some impervious material so as to ensure that leachate from wastes at the sites will not seep into the soil resulting into water pollution.

The labor colonies will generate substantial amount of municipal wastes. In view of the condition that might exist in the labor camps most likely the solid wastes will contain majority of vegetable matter followed by paper and glasses.

About 5,000 persons are likely to congregate during the construction phases resulting in generation of about 1.8 tonnes of solid waste/day. Adequate facilities for collection conveyance of municipal wastes generated to the disposal site should be developed. A covered truck to collect the solid waste from the common collection point and transfer it to the disposal site needs to be put to service. A suitable landfill site can be identified and designed to contain the municipal waste from all the project townships, labor colonies, etc.

5.1.2 Operation Phase

5.1.2.1 Soil Stability

After the construction, it is recommended to surveillance of stability at steep slope around disposal site where dispose sands from construction activities. Moreover, with regard to possible collapse of brittle parts of protection shore through operation of the reservoir, unstable ground part should be examined and necessary reinforcing measure may be taken in advance. The proposed Environmental Cell would implement these surveillance work on a regular bases.

5.1.2.2 Water Quality

At the operation phase, there will not be found major pollutant source which affects water quality of the river. Settling tanks which were installed at the construction phase can be used for treatment of sewage from labor camps. The proposed Environmental Cell is recommended to check water quality on a regular bases for surveillance of water degradation.

5.1.2.3 Traffic

At the operation phase, not so many amount of additional vehicle is anticipated. However it is required to observe the traffic rules carefully by operational worker, maintenance worker and manager.

5.1.2.4 Waste

Waste disposal system which is established at the construction phase can be used after construction.

5.2 Measures and Plans for Potential Biological Impacts

5.2.1 Construction Phase

5.2.1.1 Afforestation

Cutting trees for construction should be minimized. After its use, the bare land will need to be revegetated with plants of the same species as those around it. For the purpose to prevent cutting down trees as fuel by labors, appropriate fuel will be required to supply to laborer's camps.

The Forest and Nature conservation Act of Bhutan, 1995, does not stipulate guidelines for compensatory reforestation for conversion of forest lands for non-forest purposes. However, in absence of Bhutanese guidelines, the measures generally adopted in similar conditions in India have been suggested for this project. The Indian Forest Conservation Act (1980) stipulates:

- if non-forest land is not available, compensatory plantations are to be established on degraded forest lands, which must be twice the forest area affected or lost, and
- if non-forest land is available, compensatory forest are to be raised over an area equivalent to the forest area affected or lost.

The total forest loss in the submergence and other appurtenance and temporary facility and disposal area is about 83.6 ha. Likewise, the alignment of the Transmission Lines (Alternative-A) is likely to lead to acquisition of the forest land. The total forest land to be acquired is $(83.6+323.4)$ 407 ha. Thus, double the amount of forest land $(407*2)$ 814 ha could be afforested. The recommended tree species are given in Table 5.1. The indigenous species have been selected for afforestation. The location to be selected for afforestation is a prerogative of RGB and therefore, the afforestation could be done by RGB and the project authorities would near the money available to the concerned authorities of Bhutan.

Table 5.1 Recommended Tree Species for Afforestation

S. No.	Botanical Name	Local Name
1	<i>Pinus roxburghii</i>	Chirpine/dhub
2	<i>Alnus nepalensis</i>	Utis
3	<i>Dalbergia pinnata</i>	Allashemo
4	<i>Ficus semicordata</i>	Khaniun
5	<i>Albizia procera</i>	Seto siris
6	<i>Bombax ceiba</i>	Simal/Pema Geyser
7	<i>Syzygium cuminii</i>	Nyasse Shing/Jamun
8	<i>Dalbergia sericea</i>	Pchang
9	<i>Banhinia purpuria</i>	Tanki
10	<i>Eurya cerasifolia</i>	Bara Jhingni
11	<i>Toona ciliata</i>	Toona/Rawa shing

5.2.1.2 Wildlife Protection

As per the available data the project and its surrounding areas do not have much of wildlife. However, stray animals have been reported in and around the project construction, etc. During construction and operation phases especially, during the construction the increased human interference can have adverse impact on wildlife in and around the project area.

Regarding the impact of the project on wildlife, particular attention may be drawn to the impact of transmission lines on the wildlife. The proposed transmission line route will pass areas where Royal Government of Bhutan and WWF has designated as biological corridors between the national parks, sanctuaries etc.

It is recommended that check posts are installed along the three major construction sites and the labor camps to prevent anti-poaching activities. It is proposed to have 6 check posts. Likewise along transmission routes, 6 check posts have been suggested during the construction phase. Each check post will have 4 guards to ensure that poaching does not take place in the area. Four range officers will supervise the guards of various check posts.

5.2.1.3 River Conservation

Appearance of river sections affected by river diversion may exert adverse effects on the aquatic biology. As a measure to minimize these effects, the minimum flow rates for river condition conservation specified in the plan should be secured properly. The final flow rate should be determined after detailed data on the river is available. It is necessary to confirm the depth with the minimum flow rates for river condition conservation at the time when the discharging is tested during construction stage. For minimizing the impact on aquatic biology by muddy water from construction work, it is required to have setting basin. Some workers may indulge in illegal fishing activities using bombs or

poaching activities during the construction period. To prevent such activities, check posts should be installed not only at the dam construction site, but also along the routes of transmission lines.

5.2.2 Operation Phase

5.2.2.1 Afforestation

At operation phase, the proposed Environmental Cell is required to confirm condition of afforested trees on a regular bases.

5.2.2.2 Wildlife Protection

At operation phase, the proposed Environmental Cell is required to survey status of aquatic and terrestrial fauna on a regular bases.

5.2.2.3 Fishery Species Conservation

Because reservoir and river diversion may give some impacts on fish species found in the river, it may be required to take measures for protecting fish species.

A fish farm is recommended to built in the project area for sustenance of endemic fish species. The area requirement for each unit is given in Table 5.2.

Table 5.2 Proposed Fish Farm Facility in the Project Area

Units	Size (m)	Number	Area (m ²)	Rate of flow (l/m)
Hatchery building	20.0x15	1	300	
Hatching units each with four hatching troughs with 4 trays	2.0x0.5x0.4	30	-	3.0-5.0
Nurseries (concrete)	5.0x1.0x0.5	15	75	20-25
Rearing tank (concrete)	10.0x2.0x1.0	10	200	50-60
Stock raceways (concrete)	25.0x3.0x1.5	8	600	100-150
Water storage cum stock tank (concrete)	100x30x5.0	1	3000	-

5.3 Measures and plans for potential socioeconomic and cultural impacts

5.3.1 Construction Phase

5.3.1.1 People resettlement plan

A proper program for resettling local residents should be developed. A land expropriation committee and a special team to address resettlement problems should also be established as required in order to persuade the local people into the resettlement.

(1) Rehabilitation and Resettlement Plan

Population relocation for development, as a subsystem of the Punatsangchu Hydropower Project, is of course designed to achieve the goal of the whole PHP (Punatsangchu Hydropower Project). This can be thought as its highest objective. Moreover, the other objectives of the population relocation for development plan includes the exploitation of local resources and raising of the living standard to a well to do level.

The Punatsangchhu Hydropower Project is committed to the development and implementation of project resettlement and rehabilitation programs that are based on the principles of social responsibility. The primary objective of the plan is that “those families disrupted by the project should be accorded absolute dignity and respect, and provided just compensation to minimize, to the maximum extent possible, any interruption in livelihood that may be caused by the project”.

The R&R plan has the following objectives

- to improve or at least maintain the current standard of living of the displaced population
- Relocate families according to their preferences, making sure that they are fully integrated into the community where they are resettled. The plan also involves acquiring land that would be submerged, and compensating the resettled families so that they could acquire new housing, jobs, etc. Although the plan is based on a survey of households that included 6 households that may need to be resettled
- The plan indicates that about 39 people would need to be resettled from 4 villages, many of which lagged in terms of the level of economic development relative to surrounding areas. Of this group, 2 households were particularly vulnerable and would need some form of economic rehabilitation. The plan also proposes income-generating opportunities for resettled people and proposed various self-employment schemes.

It is proposed to develop a "model" rehabilitation and resettlement package that is compassionate and responsive to the needs of the people. As the rehabilitation plan is still in the early stages of planning,

the following proposed elements are considered a starting point for what could become a model rehabilitation and resettlement program worthy of emulation:

Fair and generous compensation, conforming with the government guidelines, for acquired lands and structures including remuneration for personal property, cultivable lands, and fruit trees.

Free supply of electricity for domestic use to the rehabilitated people, paid for or provided directly by Punatsangchu Hydropower Project.

Upgradation of local schools, the establishment of health clinics, market areas, parks, public transportation depots and religious observance areas, which will be the hallmark of the Punatsangchu Hydropower Project.

Retraining of evacuees through grants of assistance, so that any lifestyle change of the evacuees caused by the project can be overcome with minimal disruption to those mostly affected by the project.

Scholarship opportunities for qualified students of evacuees to the many high-quality area technical schools and institutions in the country.

Employment priority for the potential jobs that will be created during the construction period and for the jobs that will be created for the operational life of the facility to qualified evacuees, men and women from the project area so that those most affected will realize the most benefit from the project.

(2) Compensation and Resettlement

Inevitably there will be some need for relocation and resettlement caused by the need to take some land and houses for construction purposes, because they fall within the headrace adit area, fall close to the dam in the upstream submergence area, fall within the area of access roads, or requires removal to facilitate works. Provision for compensation and resettlement has to be made and the protection of vulnerable groups assured.

From the surveys conducted it is estimated that about 6 households with a total of about 27.1 ha of private land will be affected and will have to be compensated.

Vulnerable groups and adversely affected persons form a very small minority of the population within the project area. For these 6 households resettlement will be necessary and there seems to be sufficient land available nearby to accommodate resettlement. The government prefers to allocate land for land where possible but this poses some problems in areas of steep slopes where flat land is at a premium.

There is provision for compensation under the 1996 Land Compensation Rate, Ministry of Home Affairs, involving land for land (the RGoB preferred option), cash for land or combined options.

A further problem arises from the compensation regulations, as it appears that in order to receive compensation; the affected land has to be resurveyed. The measurements of existing land ownership were based on the original Survey of India work, which in some cases, have been found to under-measure plots. Compensation for land requires the landowner to pay for the additional land before compensation can be paid. This process assumes that the farmer can afford to pay for the additional land, which is not always the case.

Actual plot areas affected are surveyed by the concerned Dzongkhag Administration and compensation is based on the plot areas surveyed by the Dzongkhag. This data should form the basis for estimating approximate households affected by the project and the likely extent of resettlement and compensation.

It is necessary to include a framework for resettlement and rehabilitation for affected households into the project design, so as to provide a safety net for vulnerable households whose livelihoods or buildings may be affected by the project. So far no such framework exists.

The framework has to address three broad categories of loss, which require mitigation:

- Loss of assets, including land and house
- Loss of livelihood or income opportunities
- Collective impacts on groups, such as loss of common property resources such as grazing rights or firewood collection.

Loss of land and houses are covered under the provisions for compensation in the 1996 Land Compensation Rate. The entitlement unit for such assistance is the household or family. Compensation is usually either of land for land or cash for land, or a combination of the two.

Land for Land is generally the preferred option of Villagers. However, because of the time delay in re-establishing productive capacity, replacement land should be of equal or better productive value for those losing substantial amounts of land (i.e. >25% of their holdings), or where loss of land threatens the economic viability of the household. If the compensation offered to those affected by the project is not acceptable, they should have recourse to appeal to the DoP and to the Dzongkhag, if a settlement cannot be reached.

Loss of housing can be particularly traumatic. Project design should make every effort to ensure that replacement housing is available before people are required to relocate. Affected households should be allowed to retain salvaged materials and be assisted to transport them to the new site, free of cost.

In cases where the project leads to loss of livelihood, either temporarily or permanently, assistance should be given to the adult members of affected households. In projects, a common loss is of the displacement of rural housing and land. Provision should be made for assisting with the relocation of the structure.

In doing this, due notice must be paid to the Ministry of Home Affairs, Rules and Regulations for the Construction of Temporary, Semi-Permanent and Permanent houses on either sides of roads, published in 1995. Generally, this problem arises in the urban areas and at certain points in rural areas, frequently near bridges, where there has been considerable development in the form of restaurants and shops.

In the case of landless families who suffer partial or total loss of livelihood as a result of project works, land can be allotted free of cost to such families as permitted under the Land Act 1979.

5.3.1.2 Compensations

Measures should be examined to prevent the lowering of the living standards of the residents subject to land expropriation and resettlement. To prevent and mitigate ill feelings or hostility toward the project, sufficient consultations will need to be held with the landowners to determine the satisfactory compensation money and method.

(1) Norms for Compensation

① Land

Land can be acquired by the government by requisition, any land if it is required for the benefit of the country, in accordance with the provisions of Ka-6(8) of Land Act, 1979, and the acquired lands shall be compensated as per the provisions laid in Ka-6(9) of the Land Act. Moreover, the rate of compensation as per the Land Compensation Rate [Notification No. Ka(10)-19/96 dated 7.11.96] that shall be as given is as below:

1. Wet Land (Chuzhing)	@ Nu 35,000 per Acre
2. Dry Land (Kamzhing)	@ Nu 20,000 per Acre
3. Shift cultivation Land (Tseri)	@ Nu 5,000 per Acre
4. Grazing Land (Tsamdo)	@ Nu 200 per Acre

However, as per Ka 6.9(B), as far as possible, the government shall give substitute land instead of cash compensation while acquiring land. Besides, as per the provisions laid in Ka 6.9(E), allotment of substitute land shall be from the same Dzongkhag.

② Homestead

Depending on the type of structure, i.e., RCC/Brick/Stone masonry or Traditional style, the valuation of the homestead structure will be carried out by a qualified engineer of the Public Works Department and the compensation would be fixed pertaining to the Bhutan

Schedule Rates (BSR). In all there are about 6 homesteads that would be affected due to the commissioning of this project. Secondly, it is to be understood that, in the study area, most of the homesteads are located not far from their cultivation lands, rather they are located either within the farm itself or in its vicinity. Therefore, it leads to the conclusion that households losing land would be losing homesteads and vice versa. Thus it is suggested that the affected household shall be provided with alternative homestead plot in addition to the land that they shall receive as compensation for loss of cultivable land.

③ Fruit Trees

Compensation for fruit trees will be paid in accordance with 5 (a), 5 (b) and 5 (c) of the Land Compensation Rates, 1996. The rates are as given below:

(A) Compensation Rates (Nu Per Tree) for Main Fruit Trees

Crop	Age-wise compensation rates								
	0	1	2	3	4	5	6	7	8
Apple	121	196	346	421	496	821	1021	1221	1221
Orange	130	233	336	439	542	589	639	739	839
Walnut	177	278	379	480	581	682	781	881	981
Arecanut	43	81	109	161	241	281	321	321	321
Peach	124	217	310	373	416	423	523	623	623
Pear	98	178	258	338	418	498	578	618	718
Plum	105	194	283	372	461	550	611	711	761
Apricot	124	213	302	391	480	569	630	780	780
Cardamom	7.40	8.40	9.40	10.40	11.40	15.40	16.40	17.40	18.40

(B) Compensation Rates (Nu Per Tree) for Other Fruit Trees

Crop	Age-wise compensation rates								
	0	1	2	3	4	5	6	7	8
Lemon	89	189	289	339	364	364	414	464	464
Jackfruit	102	274	286	498	610	722	834	896	934
Avocada	106	186	266	336	426	456	476	476	526
Lime	73	113	153	193	203	213	233	253	303
Litchi	155	267	379	491	603	665	677	715	765
Guava	93	144	195	246	297	298	321	396	396
Mango	121	256	391	526	661	796	931	946	1596
Banana	57	87	117	187	187	187	187	187	187
Papaya	60	75	90	95	95	95	105	105	115
P/granate	72	134	196	258	290	312	328	352	352
Olive	114	234	354	474	594	714	834	914	1114

(2) Options for R&R

As part of the social assessment, the likely to be affected households were asked about their performance for compensation, if their Lands and/ or Homesteads were to be acquired due to the proposed project. The responses and options are summarized in table below.

Option for R&R

Dima	HH1 Sharecropper HH2 Sharecropper Land Owner	} Cash for Homestead + Employment / land for Landless scheme Whatever Government decides
Lawakha	HH1 Caretaker Landowner HH2 Landowner	No. Compensation: will go back to his village Land for land Land for land
Dingthi	HH1 Landowner	Land for land
Uma	HH1 Landowner	Land for land or Cash for land

(3) Compensation Measures

Land based R&R is probably most desirable option for rehabilitation assistance. This is also highlighted in the options preferred by the affected households. The plot of land including the land for house envisaged to be allotted to each family includes residential as well as agricultural plot. It is hereby suggested that the RGB may decide the quantum of land to be disbursed to each of these affected families as per the RGB norms. Making adequate amount of land available for

R&R especially near the existing affected villages or within the study area is a sole prerogative of RGB. This would ensure reducing the trauma considerably amongst the affected households, which is evident while being displaced from their place of residence for decades. Various minimum facilities to be made available and the approximate cost of such R&R master plan is given below.

① Measures for Land Compensation

In conformity with the guidelines elaborated in section 5.8.7 (i), it is suggested that substitute land shall be given in order of priority as follows to the land-losing household:

1. In the nearest village, adjacent to the present residential village
2. In any village within the study area
3. Within the same Dzongkhag

It is felt that the first two options would be the least traumatic for the displaced households, as there would not be much change in the environmental and social interaction and linkages, as compared to the last option. It is highly likely, that the substitute land could be located at one end of the Dzongkhag; where there might be a completely differing socio-economic and environmental conditions which may lead to a complete transformation of the displaced households.

It is also suggested that the land losing households shall be paid the cost of shifting to the location of the substitute land. The cost shall be borne by the Government/ Project Authority.

In all there are about 27.1 ha of land that would be acquired for the project from different villages for different purposes. While there are 6 households that are in possession of this land that would be required for the project as suggested, 'land for land' option of compensation is preferred. However, there are two households in Dima village who do not own any land and they share-crop in other's land. It is therefore suggested that these two households may be considered for 'allotment of land, free of cost, by the government, under Ka 6.9(A) of the Land Act. While all other households will be eligible for 'land for land' compensation.

② Measures for Homestead Compensation

In line with the compensation guidelines highlighted in Section 5.8.7 (ii), it is therefore suggested that the families being evicted from their homesteads shall be provided with a housing plot in conformity with the norms set by the RGB. Secondly, the affected households shall be permitted to retrieve construction materials from their existing

homesteads. Thirdly, they shall be provided free transportation by the government/ project authority to shift retrievable material and household belongings to the new relocation area. Last but not the least, the affected household shall be disbursed with House construction assistance, which shall be a lumpsum amount of Nu 100,000/-.

Apart from providing the above housing relocation assistance, the project proponent/ government shall have to provide the following civic amenities in the prescribed scale and manner in the new relocation area.

- Piped drinking water facility separately for each homestead
- Homesteads should be electrified, with at least one electric bulb connection.
- Toilet facility for each homestead, either within the structure or separately.
- Access facility in the form of a properly constructed pavement to the nearest road-head.
- Schooling facilities for the children of the relocated households. In addition to this they could be given assistance in the form of scholarships, as part of compensatory measures.
- Free medical treatment shall be made for the members of these households in the nearest medical facility from the relocation area. Identification cards could be issued for these persons to avail free medical treatment.

Item	Unit cost	Total Cost/ Requirement (Nu)
Housing Plot	200 sqm for each household @ Nu 40,000/plot	240,000
House construction assistance	Nu. 100,000 per household	600,000
Piped drinking water	@ Nu.20,000 Per house	120,000
Electrification	@ Nu. 30,000 Per house	180,000
Toilet facilities	@ Nu. 20,000Per house	120,000
Total		1,260,000

③ Measures for Fruit Tree Compensation

In all there are about 2,477 fruit bearing trees and about 0.7 acres of land under vegetable garden that would have to be paid compensation. Compensation for trees would be disbursed with 'cash compensation'. The rates of compensation is highlighted in Table (A)

& (B) under section 5.3.2(1)③. However, since the exact age of the trees is not known, an average age for the trees is taken. This is done primarily for the purpose of arriving at costing figures for compensation. Moreover, it is suggested that prior to disbursement of compensation, the age census should be carried out to ascertain the exact costing.

Fruit Trees (types)	Total Trees	Unit Cost	Total Cost (Nu)
Orange	1,065	@ Nu 542 per tree	577,230
Mango	109	@ Nu 661 per tree	72,049
Guava	413	@ Nu 297 per tree	122,661
Banana	890	@ Nu 187 per tree	166,430
Total			938,370

The compensation for the vegetable garden would be disbursed with 'land for land'. Attempt would be made to compensate this land on similar lines as suggested for cultivated lands.

The total budget for R&R shall be Nu 2.198 million (1.26 + 0.938).

④ Measures for Rehabilitation

Out of the 6 households, there are 2 households who are landless cultivators, who sustain themselves by sharecropping on another's land. With the commissioning of the project and with land acquisition, these two households would be rendered completely vulnerable. Therefore it is suggested to provide at least one member from each household with a job in the project. Thus two jobs may be reserved for two members of these two households. It is felt that such assistance would invariably help these households to regain their present economic conditions.

A project of this size will definitely have huge employment requirements that some of the displaced people can undertake whatever the capacity maybe. In fact this is what some of the displaced family members have asked for when they were asked what their preference would be. In this way the project would greatly help some of the displaced people, especially the most vulnerable ones who would not receive any compensation directly as they sharecrop on the landowners fields and they are landless.

The project proponents could also ensure that the places that the displaced families resettle in have basic social infrastructure such as schools, health facilities, access to markets, etc. The new environment that these people have to live in should not be worse than the one that they presently live in, especially in the field of social infrastructure and facilities.

Moreover, if the place that some of the displaced families are relocated in is not very far from their present location (project site), the project should provide them with free connection and electricity for a certain period of time after the project is in operation. This would not cost very much and would be appreciated by these people.

Such assistance to the displaced people could contribute towards the upgradation of living conditions of the resettlers.

5.3.1.3 Public Health

Increases in waterside provide favorable habitats for the growth of vectors of various diseases and they are likely to increase the incidence of water-related diseases including malaria. Preferred habitats for anopheline mosquitoes (malaria vectors) are stagnant or slow moving fresh water open to sunshine. Malaria control measures should be taken to destroy their habitats and interrupt the life cycle by physical, biological or chemical means. First-aid posts should be installed at the construction sites. Dispensaries should also be installed near the sites.

A population of about 5000 is to congregate during the construction phase. These labors will be concentrated at three sites namely dam site, access tunnel site and the power house site. There is no medical facility in the immediate vicinity of the project area. It is recommended that one Dispensary should be developed at a site which is easily accessible from the three labor colonies.

3 Doctors can be employed in the dispensary and will reside in the staff quarters adjacent to the dispensary. The para-medical staff required for assistance to these doctors is given in Table 5.3.

Table 5.3 Details of Para-Medical Staff for Dispensary

Para Medical Staff	Nos.
Auxiliary Nurse	9
Male Multipurpose Health worker (MPW)	4
Attendants	4
Driver	3
Total	20

A first aid post is to be provided at each of three major construction sites, so that workers are immediately attended to in case of an injury or accident. The first aid post can be housed in temporarily erected structure and should be managed by one Health Assistant and assisted by one dresser/first aid attendant. Doctors from the dispensary can attend First Aid post regularly every day at a fixed time.

In water resources schemes it is imperative to develop a proper surveillance system. The systematic surveillance may be followed as Mosquito control activities and Health Extension Activities. There

should be regular sprays of insecticides in the areas where water is likely to be stagnant, to prevent the growth of malarial larval. The frequency of monitoring could be once in 15 days.

5.3.1.4 Area Development

As many local residents as possible should be employed as construction workers. Vocational training may be required for them. The workers should be paid their wages to established wage standards. It is desirable that the constructor should be obliged to report the number of workers.

Moreover, it may be recommended to examine about arrangement of transportation, telecommunication, medical facilities and educational facilities for regional development around the project site. One example is shown below. Contents and expenditure must be examined by local government and organs concerned.

(1) Accessibility

In order to assist the villagers gain accessibility to various services and goods and most of all, better and speedy in access to the project area (which would be a ready market) it is suggested to create connectivity network in the study area. On the left bank, it is learnt that the project proposes to construct a permanent bridge near the Power house Switchyard area, and construct a road from the Wangdue – Tsering Highway to the powerhouse.

(2) Communication Facilities:

It is suggested to improve the communication facilities in all these 35 study area villages. Communication facilities, in the form of telephones could be installed in the villages. These phones could be installed, as a community property, at the village Gup's residence.

(3) Medical Facilities

In order to improve further accessibility to medical services, it is suggest to start construct a Hospital in the project area. This hospital could be constructed near the project officers colony. The hospital should be large enough to accommodate about 50 beds; and the facilities should be available to all, including projects from the study area. Also an ambulance may be started in this hospital for these villagers. Access to the telephone would enhance communication, and road-link would improve transport facilities.

(4) Educational Facilities

It is suggested to improve the educational facilities such as building a new primary school, scholarship for Children and bus-services.

5.3.2 Operation Phase

5.3.2.1 Resettlement

It is required to monitor condition of residents such as the resettlement has been done in appropriate scheme, the level of life has not been worse than before moving, etc.

5.3.2.2 Public health

It is recommended to use some facilities which is installed at construction phase. The facilities will be used for preventing and curing of disease and injury.

5.3.2.3 Are Development Activity

Facilities and systems that is established at construction phase can be used after construction.

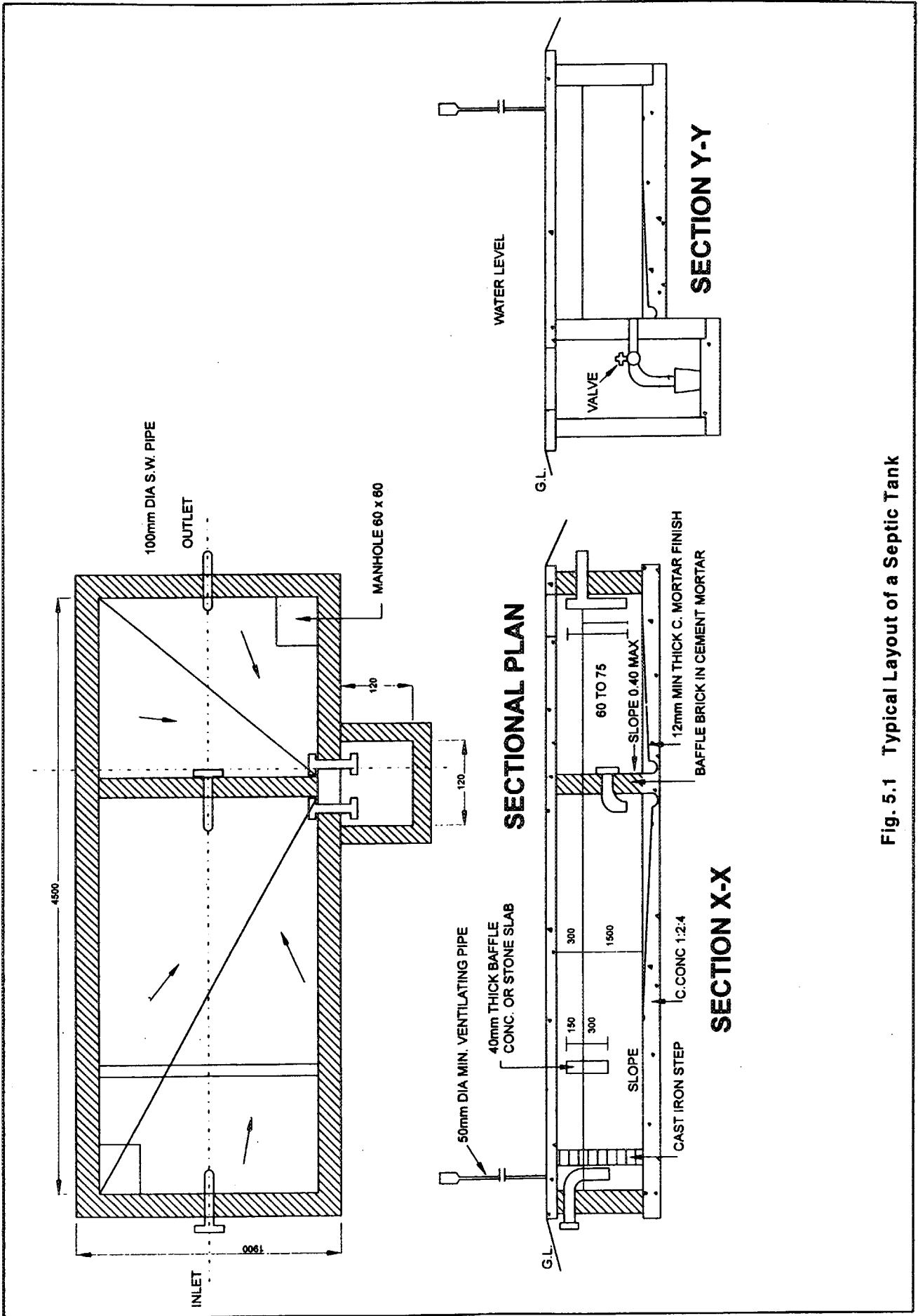


Fig. 5.1 Typical Layout of a Septic Tank

CHAPTER 6
ENVIRONMENTAL MONITORING PLAN

CHAPTER 6 - ENVIRONMENTAL MONITORING PLAN

A proposed environmental monitoring program has been developed for the Environment Management Plan. It is divided in two phases: construction and operation. It is described below.

6.1 Construction Phase

6.1.1 Soil Stability

The areas with the risk of occurrence of landslides will need to be monitored to ensure that the measures taken are working effectively. This confirmation work will be done by the Environmental Cell.

6.1.2 Water Quality

Measures will be taken to provide drainage and waste treatment equipment and systems to treat drainage and waste from the labor camps. Research into water quality should be made or other measures taken to ensure that these equipment and systems are working well within the limits permitted by Bhutanese law. This confirmation work will be done by the Environmental Cell.

6.1.3 Noise, Vibration, Air Quality

Research into noise, vibration and dust generated by construction machines will be necessary to ensure that local people's quotidian life is not disturbed. This confirmation work will be done by the Environmental Cell.

6.1.4 Construction vehicle

An increase in the traffic density of large-sized vehicles can lead to increases in the risk of occurrence of traffic accidents and in the obstruction of local transportation. There is also concern about accidents, injuries and damage to health due to construction operations. The Environmental Cell will need to be made to collect information on these problems.

6.1.5 Waste

It is recommended to confirm that the collection, transport and disposal system for municipal waste produced by workers' households works appropriately. This confirmation work will be done by the Environmental Cell.

6.1.6 Employment

As many locals as possible will be employed during the construction phase. The number of workers and the level of their wages will need to be monitored. The proposed Environmental Cell will implement this work.

6.1.7 Resettlement

If the amount of compensation for land expropriation and resettlement of local residents does not meet their expectations, they may bear ill feelings against the project. Relevant information will need to be collected from the land expropriation committee and others to monitor the progress of land expropriation and resettlement operations including payment of compensation. Enquiries into local people's response to the project may also have to be made for monitoring. It is desirable that the levels of their revenue and welfare after the resettlement continue to be monitored for several years. This work will be done by the Environmental Cell.

6.2 Operation Phase

6.2.1 Water Quality

To monitor the deterioration in water quality due to the appearance of river sections affected by river diversion, water quality survey should be conducted periodically to ensure that it meets the Bhutanese standards. Researches should also be made into the distribution of river water and the fauna and flora in those river sections.

The quality of the reservoir and surface water of Punatsangchhu, and the soil in the river basin should be monitored for their change. This work will be done by the Environmental Cell.

The sampling sites shall be:

- 1.0 km upstream of the dam site;
- 1, 2, 4, 6, and 8 km downstream of the dam site.
- 1.0 km downstream of the confluence of the tail tunnel from power house.

The proposed parameters to be monitored along with the frequency of monitoring given in Table 6.1.

Table 6.1 Details of Water Quality Monitoring

S. No.	Parameters	Frequency
A	pH, EC, TDS, DO, BOD	Once in 3 months
B	TSS, Turbidity	Once in a month

6.2.2 Soil

The soil and slopes will need to be monitored for its erosion and their stability, respectively to confirm the effectiveness of the soil conservation measures. The frequency recommended to monitor would be twice a year. The study can be done by the technical staff engaged on the maintenance of the project.

Moreover, the following soil parameters need to be monitored:

Electrical Conductivity	Ammonical Nitrogen
Texture	Manganese
pH	Boron
Organic matter	Sulphates
Potassium	Chlorides
Phosphates	

Soil samples can be taken from at least 10 sites in the catchment area. The samples can be collected twice a year, i.e. summer season and post-monsoons.

6.2.3 Fishery

Monitoring of essential parameters of the reservoir will be essential to achieve sustainable yield of fish. Some of these parameters are phytoplankton and zooplankton population, benthic life and fish composition which need regular monitoring. Based on human resource and facilities available monthly observation in time and space can be considered by proposed fish farm. These parameters can be monitored on monthly basis in the selected sites. These sites can be :

- 1) 1.0 km upstream of the dam site
- 2) 1, 2, 4, 6 and 8 km downstream of the dam site
- 3) 1.0 km downstream of the confluence of tailrace tunnel from power house.

6.2.4 Ecology

Researches should be made into the progress of plantation and changes in the ecology of aquatic and land animals. Status of afforestation programmes, changes in migration patterns of the aquatic and

terrestrial fauna species should be studied. The staff at the proposed Environmental Cell can undertake the work. The study could be undertaken with a frequency of 5 years till the design life of the dam.

6.2.5 Public Health

Researches should be carried out on the types of water-related diseases and their location, effectiveness of the measures taken and their remedies, and the health of the local people.

Frequency of monitoring could be four times a year with the help of data maintained in the government dispensaries/hospitals. Public Health Department at Wangdue town could be a Implementing agency of this work.

6.2.6 Resettlement

For the purpose of ensuring that the resettlement and compensation have been implemented properly, enquiries should be made by the proposed Environmental Cell into whether (1) the resettlement has been carried out based on the resident resettlement program, (2) any problems have occurred at the resettlement sites, (3) compensation has been paid as planned and determined, and (4) the level of living has been almost the same as or better than that before the resettlement.

CHAPTER 7
COST-BENEFIT ANALYSES

CHAPTER 7 - COST-BENEFIT ANALYSES

7.1 Cost of Implementing Mitigation Measures

The total cost required for implementation of the measures for environmental impact mitigation is estimated to be Nu 211.56 million. The details are shown in Table 7.1.

7.1.1 Maintenance of Environmental Cell

It is recommended that Project authorities establish an Environmental Management Cell. The task of the Cell will be to coordinate specific studies, to carry out environmental monitoring and to evaluate implementation of environmental mitigatory measures. Costs for the first ten years (including 10% annual price increase) are estimated as follows:

Salaries (including 30% overheads)	Costs per year
Environmental Officer @ Nu 25,000 per month	Nu 300,000
One Scientist (fisheries background)@ Nu 18,000 per month	Nu 216,000
Three Technical Assistants @ Nu 10,500 per month (one of chemistry and 2 of fisheries and aquatic ecology background)	Nu 378,000
One sociologist @ Nu 15,000 per month)	Nu 180,000
One field assistant (Fisheries background) @ Nu 8000 per month	Nu 96,000
One Veterinary doctor @ Nu 15,000 per month	Nu 180,000
Office expenses, travel, etc.	Nu 600,000
Total	Nu 1950,000
Costs for 10 years (10% annual price increase)	Nu 31.082 million

Note : Office accommodation and equipment is deemed to be included in the Project's Cost Estimate.

7.1.2 Stabilization of Muck Disposal Sites

It is proposed to construct check dams along the river bank so as to stabilize the muck disposal sites. Cost for construction of these check dams is estimated Nu 25.0 million. However, this cost is likely to be modified, once, detailed design of the check dams are available.

7.1.3 Environmental Management in Road Construction

Landslides can be stabilized by several methods – engineering or bio-technical measures alone or a combination of these. A provision of Nu 10.0 million can be earmarked for this purpose.

7.1.4 Construction of Settling Tanks

Settling tanks are proposed to be provided at the dam site, the power house site and the access tunnel site. The total cost for constructing the three settling tanks works out to Nu 0.50 million. The details of various settling tanks are given in Table 7.2.

Table 7.2 Details of Various Settling Tanks

S. No.	Site	Length (m)	Width (m)	Depth* (m)	Cost (Nu million)
1	Dam site	5.0	2.5	1.6	0.20
2	Power house site	2.0	2.0	1.5	0.10
3	Access Tunnel Site	5.0	2.5	1.6	0.20
Total					0.50

7.1.5 Sanitary Facilities in Labor Camps

At peak construction phase, there will be an increase in population by 5,000. To ensure that the sewage from the labour camps do not pollute the river water it has been estimated that about 250 community latrines and 10 septic tanks need to be constructed. The total cost required will be Nu 5.25 million (refer Table 7.3).

TABLE 7.3 Cost Estimate for Sanitary Facilities for Labor Camps

S. No.	Unit	Rate (Nu/unit)	NUMBER	Total cost (Nu million)
1.	Community latrines	15,000	250	3.75
2.	Septic Tanks	150,000	10	1.50
Total				5.25

7.1.6 Control of Air Pollution

The two crushers to be located, one each at the dam site and at the power house sites needs to be provided with cyclones to control the dust generated while primary crushing the stone aggregates. A

provision of Nu 2.00 million can be earmarked for constructing and commissioning of the cyclones at the two sites.

7.1.7 Solid Waste Collection & Disposal System

A covered truck to collect the solid waste from the common collection point and transfer it to the disposal site needs to be put to service for which a provision of the Nu 3.0 million can be earmarked.

7.1.8 Compensatory Afforestation

The total amount of land could be afforested would be 814 ha (407ha*2). The total cost of afforestation works out to Nu 25,000/ha. Hence, the total expenditure involved for afforestation of 814 ha at the rate of Nu 25,000/ha will be Nu 20.35 million. The details are given in Table 7.4.

TABLE 7.4 Cost of Afforestation per Hectare

S. No.	Item	Unit Rate	Cost (Nu)
1	Survey and Planning	6 x 50	300.00
2	Site Clearance	40 md* x 50	2,000.00
3	Alignment & Slaking	10 md x 50	500.00
4	Pit digging	20 md x 50	1,000.00
5	Lifting & transportation of seedlings from nursery to planting site	20 md x 50	1,000.00
6	Planting in holes (pits, Cowbar holes)	20 md x 50	1,000.00
7	Seeding cost (2 m x 5 m)	1600 @ Nu 3.50/Seed	5,600.00
8	Barbed wire (5 strands)	85 kg @ Nu 38/kg	3,230.00
9	Unails	3 kg @ Nu 38/kg	114.00
10	Fencing posts including royalty	45 @ Nu 10/unit	450.00
11	Dressing & coltaring of posts, digging holes, fixing of posts, stretching & fixed barbed wire including carriage	15 @ Nu 50/unit	750.00
12	Maintenance for 3 years	Nu 3000/yr	9,000.00
Total			24,944.00

Source: Forestry Survey Division, Thimpu, Royal Govt. of Bhutan.

Note : md – man days

7.1.9 Wildlife Conservation

It is recommended that check posts are installed along the three major construction sites and the labour camps to prevent anti-poaching activities. It is proposed to have 6 check posts. Likewise along

transmission routes, 6 check posts have been suggested during the construction phase. Each check posts will have 4 guards to ensure that poaching does not take place in the area. Four range officers will supervise the guards of various check posts. The cost involved on this account will be of the order of Nu 38.58 million.

The details are given as below:

48 guards @ Nu 5000 per month	Nu 2,880,000
Four range officers @ Nu10,000 per month	Nu 480,000
Total cost for one year	Nu 3,360,000
Cost for 7 years (Assuming 10% increase per year)	Nu 3138 million
Cost of construction of check posts (Nu 600,000 x 6) and provision of arm & ammunition, communication system, etc.	Nu 7.20 million
Total Cost	Nu 38.58 million

7.1.10 Sustenance of Riverline Fisheries

A fish farm is recommended to built in the project area for sustenance of endemic fish species. The details of estimates for each component of fish farm is given in Table 7.5.

Table 7.5 Estimates of Expenditure Required for each Component of Fish Farm

S. No.	Unit	Number	Cost Estimate (Nu million)
1.	Hatchery building including hatching troughs/trays	1	1.5
2.	Nursery tanks	15	1.5
3.	Rearing tanks	10	1.0
4.	Stocking raceway	8	3.0
5.	Water storage tank	1	1.0
Total			8.0

7.1.11 R&R

The cost for compensation of affected homesteads is given in Table 7.6.

The details for payment of compensation for affected horticultural crops is given in Table 7.7.

The total budget for R&R shall be (1.26 + 0.938) Nu 2.198 million, (say Nu 2.20 million).

Table 7.6 Cost for Compensation Off Affected Homesteads

Item	Unit cost	Total cost/ requirement (Nu)
Housing Plot	200 sqm for each household @ Nu 40,000/plot	240,000
House construction assistance	Nu. 100,000 per household	600,000
Piped drinking water	@ Nu.20,000 Per house	120,000
Electrification	@ Nu. 30,000 Per house	180,000
Toilet facilities	@ Nu. 20,000Per house	120,000
TOTAL		1,260,000

Table 7.7 Cost of Compensation for Horticulture Crops

Fruit trees (types)	Total Trees	Unit cost	Total cost (Nu)
Orange	1,065	@ Nu 542 per tree	577,230
Mango	109	@ Nu 661 per tree	72,049
Guava	413	@ Nu 297 per tree	122,661
Banana	890	@ Nu 187 per tree	166,430
Total			938,370

7.1.12 Control of Water-Related Diseases

There need to develop medical facilities and systematic mosquito control system for water-related diseases. The cost is estimated as follows.

A. Expenditure on salaries

Dispensary

Post	Nos.	Monthly Emoluments (Nu)	Annual Expenditure (Nu)
Doctors	3	20,000	720,000
Nurse	9	10,000	1,080,000
Male MPW	4	8,000	384,000
Attendants	4	4,000	192,000
Drivers	3	3,000	108,000
Sub Total			2,484,000

First Aid Posts

Health Assistants	3	5,000	180,000
Dressers	3	3,000	108,000
Sub Total			288,000
Total Expenditure (A)			= Nu 2,772,000

B. Expenditure on Material and Supplies

Dispensary

i) Non Recurring

3 Vehicles (Closed Jeep)	Nu 900,000
1 Van for mosquito control spray	Nu 300,000
Furniture, etc.	Nu 100,000
Total	Nu 1,300,000

ii) Recurring

Sprays for control of insecticides Drugs and Medicine Nu 100,000/month	Nu 1,200,000/yr
Malaria control-dosage of chloroquine, Spray for mosquito control, blood testing, etc.@ Nu 50,000/month	Nu 600,000/yr
Contingencies	Nu 100,000/yr
3 First-Aid Posts at construction sites	Nu 100,000/yr
Total	Nu 2,000,000/yr

C. Infrastructure

Dispensary: Considering the number of rooms, staff quarters and open space etc. it is estimated that 10000 sq.feet (i.e. 930 sq.meter) of plot will be required for dispensary, out of which about 8000 sq.feet (743 sq.meter) will be built-up land which includes staff quarters, etc. The construction cost for RCC structure will be Nu 600/sq.feet excluding land cost. The land will be provided by the Royal Govt. of Bhutan. The cost of construction of Dispensary will be Nu 4.8 million.

3 First Aid Posts: These are of temporary nature and will be constructed with sheets, bamboos, etc. It will cost @ Nu 100,000/First Aid Post. Thus, the total cost for constructing First Aid Posts will be Nu 0.3 million.

Thus, the total cost for developing the infrastructure will be (4.8 + 0.3) Nu 5.1 million.

The total expenditure for implementation of various public health measures shall be about Nu 61.0 million. The details are given as below:

A. Recurring Expenditure

Expenditure on salaries	Nu 2,772,000/yr
Expenditure on materials & supplies	Nu 2,000,000/yr
Total	Nu 4,772,000/yr
Total expenditure for 8 years (construction period)	Nu 54.59 million

B. Non-Recurring Expenditure

Infrastructure (Construction Dispensary & 3 First aid posts)	Nu 5.10 million
Expenditure on materials & supplies	Nu 1.30 million
Total	Nu 60.99 million

7.1.13 Area Development Activity (ADA)

Social-infrastructure improvements of transportation, communication, medical facilities and educational facilities for development of the area around the project site is estimated as incidental assistance. This is just an example which is shown below. Contents and expenditure must be examined by local government and organs concerned.

Table 7.8 Cost estimates for Area Development Activities

			Nu	Unit Cost (Nu)	Total Cost (Nu)
1	Accessibility				
	(a)	Road WBM	30 km	50,000	1,500,000
2	Communication				
	-	Telephone Connection	1 in each S.A. village	50,000	1,800,000
3	Medical Facilities				
	-	Hospital with 20 Beds	1 at Project area	10,00,000	1,000,000
	-	Ambulance	2 in the Project Hospital	5,00,000	1,000,000
4	Educational Facilities				
	-	Upgradation of Gaseloo Primary School to a High School with 3 additional rooms	1	3,00,000	300,000
	-	Contract Hostel accomodation at Gaseloo School: 1 building with 2 rooms (dormitories) 1 kichen cum dining room, 1 study room, WC facility.	1	3,00,000	300,000
	-	Construction of a 2 room Primary School at Hebesa.		2,00,000	200,000
	Total				46,00,000

7.2 Cost of Implementing Environmental Monitoring Plan

The cost required for implementation of the environmental monitoring program is estimated to be Nu 1.92 million/year. The details are shown in Table 7.9.

7.2.1 Soil Quality

Soil samples can be taken from at least 10 sites in the catchment area. The samples can be collected twice a year, i.e. summer season and post-monsoons. A provision of Rs.0.10 million has been made for analysing 20 soil samples @ Nu 5,000 per sample.

7.2.2 Water Quality

The proposed parameters to be monitored along with the frequency of monitoring and costing given in Table 7.10.

Table 7.10 Details of Water Quality Monitoring

S. No.	Parameters	Frequency	Unit cost of analysis (Nu/sample)	Total no. of samples	Total cost (Nu million)
A.	pH, EC, TDS, DO, BOD	Once in 3 months	1200	28	0.0336
B.	TSS, Turbidity	Once in a month	500	84	0.0429
Total					0.0756

7.2.3 Ecology

Status of afforestation programmes, changes in migration patterns of the aquatic and terrestrial fauna species should be studied. A provision of Nu 0.50 million per year can be kept for this purpose.

7.2.4 Riverline Fisheries and Aquatic Ecology

Monitoring of essential parameters of the reservoir will be essential to achieve sustainable yield of fish. Nu 0.50 million per year would be required to meet the recurring expenses of conducting the monitoring studies for fisheries and aquatic ecology.

7.2.5 Public Health

Identification of water-related diseases, sites, adequacy of local vector control and curative measures, status of public health are some of the parameters which should be closely monitored four times a year

with the help of data maintained in the government dispensaries/hospitals. Annual cost for this work will be Rs.0.50 million.

7.2.6 Scholarship to Students (as part of ADA)

Scholarship to student around the project site is estimated as incidental assistance. This is just an example which is shown below. Contents and expenditure must be examined by local government and organs concerned.

No. of students	Cost for a month/student	Annual cost
100 students	@ Nu 200/month/student	Nu 240,000/year

Table 7.1 Cost for implementing Environmental Management Plan

S. No.	Item	Cost (Nu million)
1	Maintenance of Environmental Cell	31.08
2	Stabilization of muck disposal sites	25.00
3	Environmental Management in road construction	10.00
4	Construction of settling tanks	0.50
5	Sanitary facilities in labor camps	5.25
6	Control of air pollution	2.00
7	Solid waste collection & disposal system	3.00
8	Compensatory afforestation	20.35
9	Wildlife conservation	38.58
10	Sustenance of riverine fisheries	8.00
11	Resettlement and Rehabilitation (R&R)	2.20
12	Control of water-related diseases	61.00
	Sub-total	206.96
(13)	*Area development activity (ADA)	4.60
	Total	211.56

* - Cost for ADA is just a sample and may categorised as a part of additional support item.

Table 7.9 Cost for implementing Environmental Monitoring Program

S. No.	Item	Cost (Nu million/year)
1	Soil quality	0.10
2	Water quality	0.08
3	Ecology	0.50
4	Riverine fisheries and aquatic ecology	0.50
5	Public health	0.50
	Sub-total	1.68
(6)	*Scholarship to students (as part of ADA)	0.24
	Total	1.92

* - Cost for scholarship is just a sample and may categorised as a part of additional support item.

CHAPTER 8

**COMPARISON BETWEEN THE PROJECT AND THE
“DOING NOTHING” CASES FOR THEIR MERITS AND
DEMERITS**

CHAPTER 8 - COMPARISON BETWEEN THE PROJECT AND THE "DOING NOTHING" CASES FOR THEIR MERITS AND DEMERITS

In case that the project is carried out, it is possible to develop an energy source through abundant hydro power, which is essential to the improvement in the socio-economic and standard of living that Bhutan is aiming at by vitalizing the domestic industry. The hydroelectric power generation project is in line with the national policy of having priority to develop hydroelectric power. It is estimated that the implementation of this project will generate an annual electric power of 4,330 GWh and bring in revenues of approx. 6,900,000,000 Nu/year (in terms of 1.5 Nu/kwh) from the sales of electric power. In addition, it will contribute to the local economy by creating employment, roads maintenance, and stimulating the growth of other sectors such as manufacturing industry.

On the other hand, if this project is not carried out, Bhutan can neither break dependence on petroleum nor acquire foreign currencies from export of electric power to India. This will be a telling blow to the socio-economic of this country, which depends on imports for various agricultural products and quotidian goods.

CHAPTER 9
CONCLUSION AND RECOMMENDATIONS

CHAPTER 9 - CONCLUSION AND RECOMMENDATIONS

Hydro power, a recyclable energy, generated by the planned Puna Tsang Chuu hydro-powerhouse will contribute to the socio-economic of this country and the improvement of standard of living.

The construction and operation of the Puna Tsang Chuu hydro- powerhouse will bring the following benefits.

- An annual electric power of approximately 4,330 GWh will be supplied.
- The construction and operation will contribute to a domestic economic growth.
- The construction and operation will have no great impact on the environment.

The proposed generating facilities are essential to sustain the economic growth and improve the standard of living of this country.

Through the implementation of this project, the following environmental and economic condition is predicted.

Environment

- Air, water, and noise pollution from the construction can be minimized by taking proper measures.
- There is little possibility that the water quality of the proposed reservoir may deteriorate because water circulates relatively quickly.
- The impact on biology can be reduced by providing a minimum flow for river condition conservation in the river sections affected by river diversion.
- Although no more than six households need to resettle, the resettlement and compensation based on the plan are desired.
- The water quality, biology, stabilization of slopes, resettlement of inhabitants, etc. should be monitored and reported to agencies concerned.
- The route of transmission line should be determined with results of farther survey and investigation during the detail design stage.

Economy

- Contribution to local employment
- Supply of electric power meets a predicted growth in electric power demand and contributes to the acquisition of foreign currencies by exporting electric power.

This project will give little impact on the neighboring environment because the water circulating speed in the reservoir is relatively high and a minimum flow for river condition conservation is provided in the river sections affected by river diversion. It is desired that the project be carried out.

CHAPTER 10
LAST OF REFERENCES

CHAPTER 10 - LIST OF REFERENCES

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ANNEX

ANNEX

**ANNEX 1 Establishment of the Minimum Flow for River
Condition Conservation**

**ANNEX 2 Public Consultation Proceedings on The Development of
Punakha Tsangchhu Hydropower Project**

ANNEX 1

Establishment of the Minimum Flow for River Condition Conservation

The relevant river is filled with large amount of flow with its annual minimum flow of around 60 m³/s. With its relatively steep inclination and its riverbed consisting of large and small stones, flow of the river is diversified. Although flow rates have been observed for the past ten years, information on flow velocity and river sections has not been clarified yet. In examination of the minimum flow for river condition conservation, to what extent the depth or width of the river can be maintained will be an important element to be considered. Data on the flow velocity and the shape of the river section necessary to calculate this have not been obtained yet.

The river flow is not uniform. Even when the flow rate remains unchanged, the river flows quickly when its inclination is large, and it flows slowly when its inclination is gentle. Further, water becomes shallower in the place where the river is wider, while water becomes deeper in the place where the river is narrower, and when water stays in deep water, the river depth increases. However, since the river water is washed out by the flow coming down from the upstream, and then water remains in the torrent before next deep water. If sufficient amount of water is supplied from the upstream, this action is repeated and river water will not be interrupted up to the downstream.

In this way, with a certain flow rate maintained, water goes on running also in the river section affected by river diversion. However, depending on the conditions of the river width, flow velocity, inclination and form of the river section, the river which vary in different points and therefore, various aspects are presented.

Consequently, in examining the minimum flow rate for river condition conservation based on limited information, a case study was performed on the relations between the river width and depth accompanying the changes in flow rates and flow velocity.

Conditions for the Case Study

Flow Velocity:	0.5-1.0 m/s (Calculated with several virtual section areas and river inclinations by applying the Manning formula)
River Width:	5-50 m (5 m pitch; based on the current average river width of 50 m)
Minimum Flow:	Approximately 5% (3 m ³ /s), 10% (6 m ³ /s) and 15% (12 m ³ /s) of the annual minimum flow rate

Results

As elaborated in Table A1.1

With the flow rate being 0.5-1.0 m/s, the water depth of the cases where water flows in a virtual width of 25 m (approximately half of the actual average river width) and in a virtual width of 15 m (approximately one third of the actual average river width) are as follows:

Virtual Minimum Flow \ Virtual River Width	3m ³ /s	6m ³ /s	12m ³ /s
15m	20~40cm	40~80cm	60~120cm
25m	12~24cm	24~48cm	36~72cm

Although the river width and depth are not uniform but apt to change case by case depending on flow rate, flow velocity and physiography, protection of biology-inhabiting environment and conservation of scenic views should be contrived. It is provided in India, a neighboring country to Bhutan, that water depth of 1.0 m should be ensured in establishing the minimum flow for river condition conservation when fishery is practiced in the river section affected by river diversion. Since no fishery is practiced in the river section affected by river diversion covered by this project, it will not be necessary to secure water depth of 1 m for the entire district. However, from the viewpoint of biology protection, it would be considered the minimum flow of around 50 cm should be established as a standard.

Based on this viewpoint, around 6m³/sec is considered reasonable as the minimum flow for river condition conservation. However, as a matter of fact there are places, deepwater and torrents where the river flows in narrower width. If the water flowing in from the branch river is taken into account, the river depth will be more than the above in some parts.

Table A1.1 Case Study of the Minimum Flow for River Condition Conservation

Conditions for the Case Study

Flow Velocity : 0.5~1.0 m/s (Calculated by applying the Manning formula)

River Width : 5~50m (5m pitch; based on the current average river width 50m)

Minimum Flow : about 5% (3m³/s) , 10% (6m³/s) , 15% (12m³/s) of the annual minimum flow rate

3 m³/s

Flow vel. (m/s)	Minimum Flow (m ³ /s)	Section (m ²)	Width (m)	Depth (m)
0.5	3	6	5	1.20
0.5	3	6	10	0.60
0.5	3	6	15	0.40
0.5	3	6	20	0.30
0.5	3	6	25	0.24
0.5	3	6	30	0.20
0.5	3	6	35	0.17
0.5	3	6	40	0.15
0.5	3	6	45	0.13
0.5	3	6	50	0.12

6 m³/s

Flow vel. (m/s)	Minimum Flow (m ³ /s)	Section (m ²)	Width (m)	Depth (m)
0.5	6	12	5	2.40
0.5	6	12	10	1.20
0.5	6	12	15	0.80
0.5	6	12	20	0.60
0.5	6	12	25	0.48
0.5	6	12	30	0.40
0.5	6	12	35	0.34
0.5	6	12	40	0.30
0.5	6	12	45	0.27
0.5	6	12	50	0.24

9 m³/s

Flow vel. (m/s)	Minimum Flow (m ³ /s)	Section (m ²)	Width (m)	Depth (m)
0.5	9	18	5	3.60
0.5	9	18	10	1.80
0.5	9	18	15	1.20
0.5	9	18	20	0.90
0.5	9	18	25	0.72
0.5	9	18	30	0.60
0.5	9	18	35	0.51
0.5	9	18	40	0.45
0.5	9	18	45	0.40
0.5	9	18	50	0.36

Flow vel. (m/s)	Minimum Flow (m ³ /s)	Section (m ²)	Width (m)	Depth (m)
1.0	3	3	5	0.60
1.0	3	3	10	0.30
1.0	3	3	15	0.20
1.0	3	3	20	0.15
1.0	3	3	25	0.12
1.0	3	3	30	0.10
1.0	3	3	35	0.09
1.0	3	3	40	0.08
1.0	3	3	45	0.07
1.0	3	3	50	0.06

Flow vel. (m/s)	Minimum Flow (m ³ /s)	Section (m ²)	Width (m)	Depth (m)
1.0	6	6	5	1.20
1.0	6	6	10	0.60
1.0	6	6	15	0.40
1.0	6	6	20	0.30
1.0	6	6	25	0.24
1.0	6	6	30	0.20
1.0	6	6	35	0.17
1.0	6	6	40	0.15
1.0	6	6	45	0.13
1.0	6	6	50	0.12

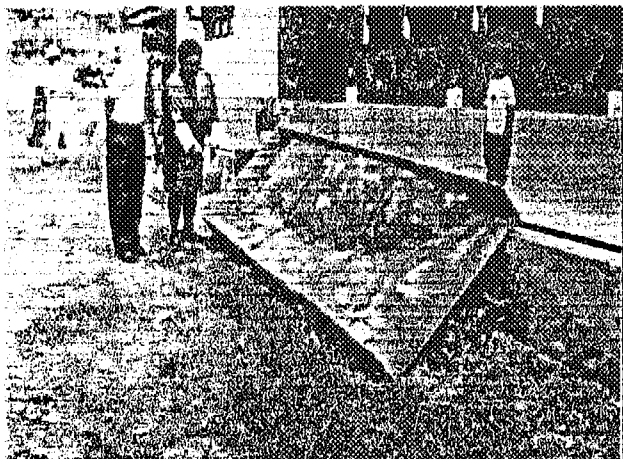
Flow vel. (m/s)	Minimum Flow (m ³ /s)	Section (m ²)	Width (m)	Depth (m)
1.0	9	9	5	1.80
1.0	9	9	10	0.90
1.0	9	9	15	0.60
1.0	9	9	20	0.45
1.0	9	9	25	0.36
1.0	9	9	30	0.30
1.0	9	9	35	0.27
1.0	9	9	40	0.24
1.0	9	9	45	0.20
1.0	9	9	50	0.18

Results

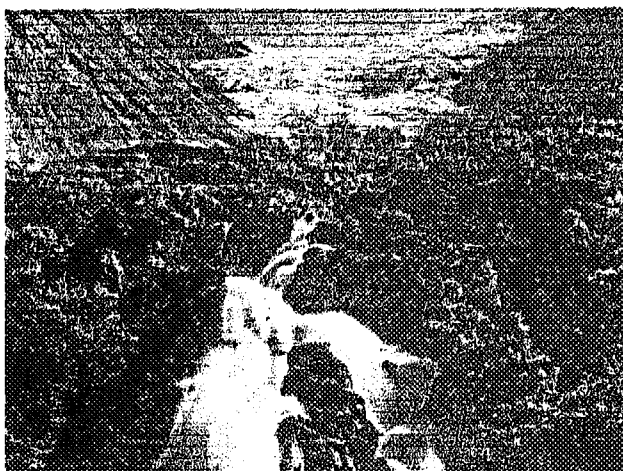
With the flow rate being 0.5~1.0 m/s, the water depth of the case where flows in a virtual width 25m which is about half of the actual average river width and in a virtual width 15m which is about 1/3 of the actual average river width are as follows:

Width	Minimum flow for conservation		
	3m ³ /s	6m ³ /s	12m ³ /s
15m	20~40cm	40~80cm	60~120cm
25m	12~24cm	24~48cm	36~72cm

ANNEX 2

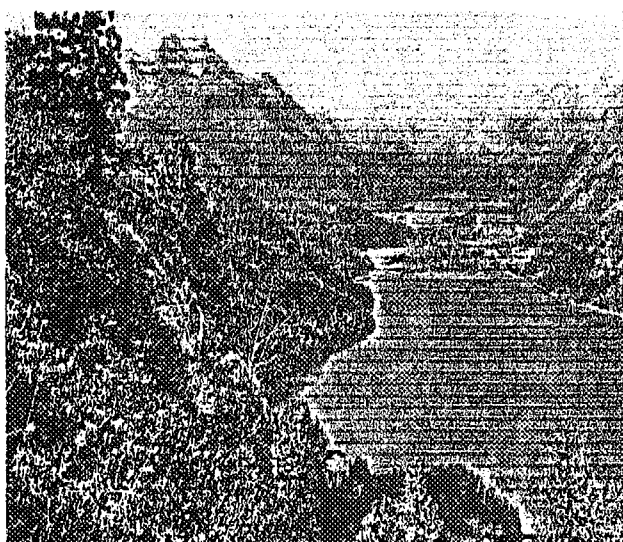


JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
DIVISION OF POWER
MINISTRY OF TRADE AND INDUSTRY
THE KINGDOM OF BHUTAN



**PUBLIC CONSULTATION
PROCEEDINGS
ON
THE DEVELOPMENT
OF
PUNAKHA TSANGCHHU HYDROPOWER
PROJECT**

20TH – 21ST JULY 2000



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ANNEXES

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3. List of People consulted, those living upstream of the Dam, under Ruepisa Geog
4. List of People Consulted, those living between Dam and the Tailrace

1. INTRODUCTION

The decentralization of decision-making in Bhutan goes back to 1981 through the establishment of Dzongkhag Yargye Tshogchung (District Development Committee) followed by further decentralization at the Geog level in 1991 with the introduction of Geog Yargye Tshogchung (Block Development Committee). This devolution of power from the Central Government have led to people's active participation and decision-making at the Dzongkhag and Geog level.

The Environmental Guidelines - 1999 issued by the National Environment Commission (NEC) strongly requires public consultation (PC) at all stages of the project implementation particularly for a complex project such as the proposed Punakha Tsangchhu Hydropower Project. The PC forms an important part of the environmental assessment (EA) process.

The PC for the proposed project was based on the findings of technical feasibility study and environmental impact assessment.

2. OBJECTIVES

The main objectives of having PC are to:

- inform the local people about the project details and present environmental and social findings; and
- invite views and suggestions on the project in order to minimize the negative impacts and enhance the positive impacts.

3. PROGRAM AREA

While the project area falls mainly in Ruepisa Geog, it also includes parts of Gasetsho Gom, and Gasetsho Om geogs. As the villages within this area are rather scattered on the slopes it has become necessary to undertake the program in a suitable location rather than in a geog as a whole.

4. PROGRAM FOR CONSULTATION

- 19th July 2000: briefing the local government authority (or Dzongkhag officials) by the official of DoP about the project findings and discuss on the modality of involving local people in the PC;
- 20th July 2000 (morning session): consultation with Gasetsho Gom and Gasetsho Om Geog people at Gaselo - these geogs are located upstream of the dam site.
- 20th July 2000 (afternoon session): consultation at Hesothangkha with people living upstream of the dam and near the quarry site (villages fall under Ruepisa Geog);

- 21st July 2000: consultation with the people of Jala, Aula, and Ruishakha of Ruepisa Geog. The villages are located in the vicinity of the dam, adit, switchyard, powerhouse and the tailrace of the project.

5. METHODOLOGY

Paper mash model of size 2.5 feet x 6 feet covering the whole project area was used as an appropriate tool to illustrate the project to the locals as it was difficult to make them understand clearly through verbal explanation. Photo No. 1. depicts the paper mash model used for the consultation. The model delineates the project area with related features of the project such as the land occupation that will be required for permanent as well as temporary use. Photographs and maps of the area have been used to support the model.

Dzongkha has been used as a medium of communication as it is the mother tongue of the locals. The equal representation of males and females were emphasized for the consultation. The domination of discussions by some vocal people were avoided and every one was given a chance to express their views and suggestions in the light of the need for optimizing project benefits. Dzongkhag representative and their Gup were requested to facilitate the consultation.

In order to avoid hesitation and fear on the consequences of what they said, the locals who expressed views were not asked to mention their names. The proceedings were noted carefully to enable proper documentation.

6. TEAM MEMBERS PRESENT DURING CONSULTATION

Representative from Wangdue Phodrang Dzongkhag

- - Mr. Bishnu Prasad Rai, Senior Planning Officer

Representative from Study Team (JICA)

- Mr. Susumu Tsunoda, Project Manager
- Mr. Minaichi Takeoka, Senior Civil Engineer
- Mr. Katsuma Hasegawa, Project Coordinator
- Mr. Ryozo Ohno, Technical Advisor, Environment
- Mr. Nobuo Hashimoto, Advisor, Civil Engineer

Representative from Department of Power

- Mr. Dorji Namgay, National Project Manager
- Mr. Karma Drupchu, Counterpart to EIA
- Mr. Dhendup, Assistant Engineer

Public Consultation

- Mr. Pashu Pati Sharma, Junior Engineer
- Mr. J.B.Basnet, Surveyor, Hydrology
- Mr. J.N.Sharma, Asst. Hydrology

Local Consultant

- Mr. Karma Jimba, Consultation facilitator cum Rapporteur.

7. PROCEEDINGS

7.1. Consultation on 20th July 2000: Morning Session.

Venue:	Gaselo, Junior High School
Attendance:	168 Household (83 Women : 85 Men)
No. of villages represented:	15
No. of Geogs (Blocks):	2

Note:

- List No. 1: people consulted under Gasetsho Gom & Gasetsho Om Geogs (as originally submitted by Gups)
- Photo No. 2: consultation with the people of Gasetsho Gom & Gasetsho Om Geogs.

Introduction by Mr. Bishnu Prasad Rai, Senior Planning Officer, Wangdue Dzongkhag

Mr. Rai introduced the team members representing JICA study team and DoP officials to the people. He emphasized on the importance of the day's discussion especially because it will give them the opportunity to know about the details of the proposed Punakha Tsangchhu Hydropower Project. He urged the people to pay good attention to the presentation on the project study findings and put queries where clarifications are required. Mr. Rai also made clear that the people have the opportunity to share their views and opinions with the officials here for the mutual benefit of the project and the local people. He then gave the floor to Mr. Susumu Tsunoda.

Address by Mr. Susumu Tsunoda, Project Manager, JICA Study team

Mr. Tsunoda introduced himself and said that JICA study team members along with DoP officials are here to discuss about the proposed Punakha Tsangchhu Hydropower Project's feasibility study findings with the people of the locality. As this exercise is very important to make the study complete, he requested them to actively participate in the discussion by bringing out their views and comments on the findings' presentation, which will be very helpful in the preparation of project design. He then passed the floor on to Mr. Dorji Namgay.

Address by Mr. Dorji Namgay, National Project Manager, Punakha Tsangchhu Hydropower Project Feasibility Study, Department of Power

After introducing about himself briefly, Mr. Dorji Namgay said that they are here today with guests from outside to discuss with the people about the study findings of the Punakha Tsangchhu Hydropower Project. He informed them that to have consultation with the relevant stakeholders on such project is the policy required both by the Royal Government of Bhutan and international organizations. Mr. Dorji then briefly gave an overview of Bhutan's hydropower potentials. He stated that Bhutan has some 30,000 MW of hydropower potentials, of which so far an installation of only 360 MW has been achieved, a mere 2% of the total potential. "As Bhutan has plenty of rivers running freely without much use at the moment, hydropower construction is the country's core policy of economic development. By the end of 2007, with the completion of Tala, Kurichhu and Basochhu, Bhutan will have some installed hydropower capacity of 1500MW", said Mr. Namgay.

Talking about the proposed Punakha Tsangchhu Hydropower Project, Mr. Namgay said that the study of the project consists of two important components:

- Technical and economic feasibility; and
- Environmental impact assessment.

"The whole study is scheduled to complete within 2 ½ years, of which 2 years have already been spent and only another 6 months remain. As per the study the hydropower potential of Punakha Tsangchhu is estimated at 874MW, which will cost approx. US\$ 789.00 million. The power generated from this project will be mainly exported to India as our country's internal requirement is only about 70MW. Among 25 potential hydropower sites across the kingdom, the Punakha Tsangchhu Project has the maximum potential. The study also concludes that Punakha Tsangchhu has the potential to generate 200 or approx. 5 US Dollars per second, the value of which so far has not been realized in any terms", said Mr. Namgay.

Mr. Namgay also informed the people that the economic benefits that the present project will bring to the country in terms of annual income would equal present yearly national budget.

He cautioned the gathering that due to the involvement of huge costs for the project it is important that the feasibility study is done very carefully and in great detail, as mistakes done at this stage would have a multiplying cost effect in the later project stages. Mr. Namgay also reiterated that the project is only at the feasibility study stage and that people should not expect its construction activities to commence immediately.

Mr. Namgay also urged people to raise their views and comments on the presentation of the study findings so that the project can be designed to optimize the positive impacts and reduce the negative impacts.

Having briefed the people about the project background the floor was then given to Mr. Karma Drupchu to explain about the project features and related anticipated impacts.

Presentation by Mr. Karma Drupchu, Counterpart to EIA on the Detailed Features of the Project

Using the paper mash model of Punakha Tsangchhu Hydropower Project, Mr. Drupchu firstly oriented the people to the project site by delineating the existing infrastructures such as roads, Wangdue Phodrang Dzong, the Punakha Tsangchhu river, their villages and the project area. He then switched over to the project features beginning from the Dam.

Presentation of the Dam location and anticipated impacts:

The location of the dam will be further downstream of Lawakha village towards Tsirang Dzongkhag and the type of the dam will be a run-of-the-river scheme with a water storage capacity of approx. 800,000 m³. The total height of the dam from foundation would be 141 m while the height of the dam from the river bed will be 81m and the crest length 265 m. With such a high dam there would be a water backlog of approx. 3 km.

For the dam and the intake construction the quarry site has been located just below Department of Roads Mechanical Workshop at Hesothangkha and the labor camp at the right bank of Lawakha.

The anticipated negative impacts to the locality due to Dam location are the submergence of 53 ha of land due to water backlog that includes 2 households at Lawakha and their surrounding farm lands, 7 ha of land for temporary occupation for labor camp, approx. 6 ha for access road construction and quarry sites, the land required for muck disposal, and batching & aggregate plant. There will also be an increase in air and noise pollution and the land use of the area may get changed. As the project will need some 1000 people for construction activities there will also be cultural and other related impacts such as firewood pressure, garbage disposal and water pollution problems. Also explained are the mitigation measures set forth in the EIA document for each type of impacts. Having given adequate information about the activities and related impacts due to dam location, the locals were then asked to give their views, comments and suggestions.

A farmer said that the government has hired experts from foreign countries to conduct feasibility studies for the Punakha Tsangchhu Hydropower Project with the aim of uplifting the socio-economic well being of the people. The people are very grateful to such provisions and they definitely have no reason to go against the proposed project. The little negative impacts that might be associated with the project are a peanut compared to the huge benefits the project will ultimately bring, which is within anybody's comprehension. The view was unanimously endorsed by the other local people present.

Another farmer raised the concern of submerging three more houses due to water backlog that the team might have overlooked. To this query Mr. Hashimoto clarified the doubt.

Presentation of 600 m diversion road through tunnel at the dam site:

Mr. Drupchu explained the need for diverting the existing road and the mode of muck disposal.

A farmer out of curiosity said that it would be the first tunneled road ever built in Bhutan and wished for the early start up of the project.

Presentation of Adit & related impacts

Adit is proposed here to facilitate the tunneling work that will take place in two directions to achieve better work progress. The adit location will involve construction of bridge over Punakha Tsangchhu and construction of access road. The modality of muck disposal and the sites identified for disposal were also explained.

The negative impacts due to adit location, Mr. Drupchu said, will be a relocation of two houses at Dima village and temporary occupation of agricultural land around the same village. Before the floor was opened for discussion the property compensation proposed by the EIA has been made clear to the people.

A farmer representing the affected household said that it is only the few households that will be affected by the project for which the government has the provision of compensating the affected people satisfactorily. Even if more households are to be relocated they are ever willing to compromise in the light of the project's long term benefits to the government and its people. There was a general agreement on this.

Presentation on Powerhouse & related impacts

Mr. Drupchu said that the location of the powerhouse would be inside the mountain, which will house 6 units, each producing approx. 145MW. The length of the powerhouse will be 114 m. The surge tank, which would control the flow, will be outside for which an access road and a permanent bridge is proposed. This bridge and the access road would benefit villages such as Jala and Aula, which are presently been constrained by the lack of motor roads.

The land area that will be required for labors camp, steel yard, muck disposal, surge tank, batching plant, and road construction has been explained to the people. The people were asked for their views.

One farmer said that since the locations of these structures are in the empty government land that is at the moment of little use to the people except for grazing they foresee no problem at all. Other participants accepted the opinion.

Presentation of Switchyard & related impacts:

Mr. Drupchhu explained that the switchyard which will have the facility to control power will be adjacent to the powerhouse but outside the mountain unlike the powerhouse. The switchyard area that will partially be obtained by dumping the spoil of the powerhouse tunneling was also explained. Due to this location the negative socio-economic impacts will be the relocation of two houses, one on the opposite bank of the switchyard, in Uma Village. The agricultural land in the Uma village will need expropriation, as the permanent operators' camp will be established here. Farmers were then invited for their views.

A farmer said that as expressed earlier, they are in line with the government's policy because if the government is rich, its people will automatically become rich. They fully rely on the Government to decide on their behalf.

Presentation of tailrace & related impacts

Mr. Drupchu explained that the tapped water will finally be discharged through two outlet tunnels with a length of 357m and another of 317 m with the tunnel diameter of 7.4 m. Also explained are the spoil disposal methods. As there will be abrupt change in river volume beyond this tailrace outlet, there may be some impacts on the people and animals living around the place. In order to reduce the risks, mitigation measures have been arranged to warn the people before the water of this volume is released suddenly.

To this, a farmer said that all mitigation measures are proposed as negative impacts are predicted. If we have any views it would be like teaching alphabets to Lord Buddha, reiterated the farmer.

Presentation of river stretch between dam and the tailrace

Mr. Drupchu said that during the low water level i.e. winter, water will be tapped to maintain the reasonable power production, but a certain amount of water flow will be maintained for the survival of fishes and other animals both wild and domestic that depend on this river.

To this a farmer said that given enough habitat the wildlife wouldn't be harmed much by this activity. He said the benefits far outweigh costs entailed.

Another farmer thanked the team for coming all the way from Japan to their village to explain about the project details. So far the farmers have never been consulted in great detail about the development projects happening around them. They are now fully aware about the proposed Punakha Tsangchhu Hydropower Project and they hope the project works start soon.

Vote of Thanks by Mr. Dorji Namgay, National Project Manager

Mr. Namgay on behalf of the team, expressed his gratitude to the people for attending the gathering to discuss about the proposed Punakha Tsangchhu Hydropower Project despite their busy schedule with the cultivation works. He stressed on how important it was for the team to have the views of the local people and similarly said that it has equal importance to the people.

The gathering adjourned with disbursement of Nu. 50/head as a daily subsistence allowance for the locals represented in the consultation.

7.2. Consultation on 20th July 2000: Afternoon Session

Venue:	Hesothangha
Attendance:	20 Household (9 Women : 11 Men)
No. of villages represented:	5
No. of Geogs (Blocks):	1

Note:

- List No. 2: people consulted, those living upstream of the dam location, under Ruepisa Geog (as originally submitted by Gup).
- Photo No. 3: consultation with the people living upstream of the dam, under Ruepisa Geog.

The procedures and the contents of presentation was kept same as the previous:

1. Introduction by Mr. Bishnu Prasad Rai, Senior Planning Officer, Wangdue Dzongkhag
2. Address by Mr. Susumu Tshonoda, Project Manager, JICA Study Team
3. Address by Mr. Dorji Namgay, National Project Manager, Punakha Tsangchhu Hydropower Project
4. Presentation by Mr. Karma Drupchhu (Counterpart to EIA), on the detailed features of the project

In response to Mr. Karma Drupchu's presentation, the Gup of Ruepisa Geog said that from the presentation it is evident that the livelihoods of some households will be affected. While the benefits of the project will be shared across the country, impacts caused on few households have to be compensated fairly adequately.

To this enquiry Mr. Drupchu replied that compensation for the property/livelihood loss through any kind of project activity have been proposed as per the government's existing rules and regulation for compensation. He also said that special compensations might be given in some very special cases.

A lady said that until now they have only heard rumors on the Punakha Tsangchhu Hydropower Project, about water backlog that will submerge all their villages, etc. This presentation has made clear that negative impacts are going to be peanuts compared to what has previously been rumoured. She thanked the team for clarifying the doubts of the village folks.

Another lady said that though their village Japhu is close to Wangdue Dzong they are not yet connected with electricity. With the construction of Punakha Tsangchhu Hydropower Project they hope their villages to get connected with electricity.

Another villager confirmed the consultation that they see the project as a boon rather than a problematic yoke around their neck. With the beginning of the project employment opportunities and markets for farm products will rise due respectively to huge construction works and big labour force.

The consultation ended with a remark of thanks from Mr. Droji Namgay as in the previous gathering and disbursement of Nu. 50 per head to the locals as a daily subsistence allowance for the consultation presentation.

7.3. Consultation on 21th July 2000

Venue: Rurichhu

Public Consultation

Attendance:	44 Household (15 Women : 29 Men)
No. of villages represented:	3
No. of Geogs (Blocks):	1

Note:

- List No. 3: people consulted, those living between dam and the tailrace, under Ruepisa Geog (as originally submitted by Gup).
- Photo No. 4: consultation with the people living between dam and the tailrace, under Ruepisa Geog.

The procedures and the contents of presentation was kept same as the previous:

1. Introduction by Mr. Bishnu Prasad Rai, Senior Planning Officer, Wangdue Dzongkhag
2. Address by Mr. Susumu Tshonoda, Project Manager, JICA Study Team
3. Address by Mr. Dorji Namgay, National Project Manager, Punakha Tsangchhu Hydropower Project
4. Presentation by Mr. Karma Drupchhu (Counterpart to EIA), on the detailed features of the project

After completion of Mr. Drupchu's presentation a farmer said that all the project features are located on the land that has little value to them. Though there will be some impacts on 6 households, most of the affected households are fairly rich people, who should be able to deal with the problem.

On the enquiry if there are any important historical or cultural sites that may be affected by the project proposal, a villager confirmed that there are no sites of that nature.

Another villager expressed his appreciation for the project and said that he did not see any impact on their livelihoods other than the benefits from such a project. He said that this river Punakha Tsangchhu has practically no use to the local people and if government could earn millions out of power sale, it is only sensible that the proposed project go ahead, if possible immediately. He also reiterated the fact that as long as the government is rich the people of Bhutan will become rich automatically.

Like in the previous sessions, here too the farmers thanked the Royal Government of Bhutan and the Consultation Team for making the rural folks know about the project details, which has made their doubts about the project and related impacts very clear.

The consultation ended with vote of thanks from Mr. Droji Namgay as in the former sessions and with the disbursement of Nu. 50 each as a daily subsistence allowance to the locals represented in the consultation.

8. CONCLUSION

The public consultation could be rated highly successful, as people are very receptive for the project. People said Punakha Tsangchhu has no practical usage for the locals either for irrigating their agricultural land or transporting goods and services. Given the immense benefits the project would bring for the general benefit of the government and the people using this river, the people are wholly supportive of the project and even expressed their readiness to help the project in any forms that may be required. This is a clear positive indication of acceptance of the project by the people.

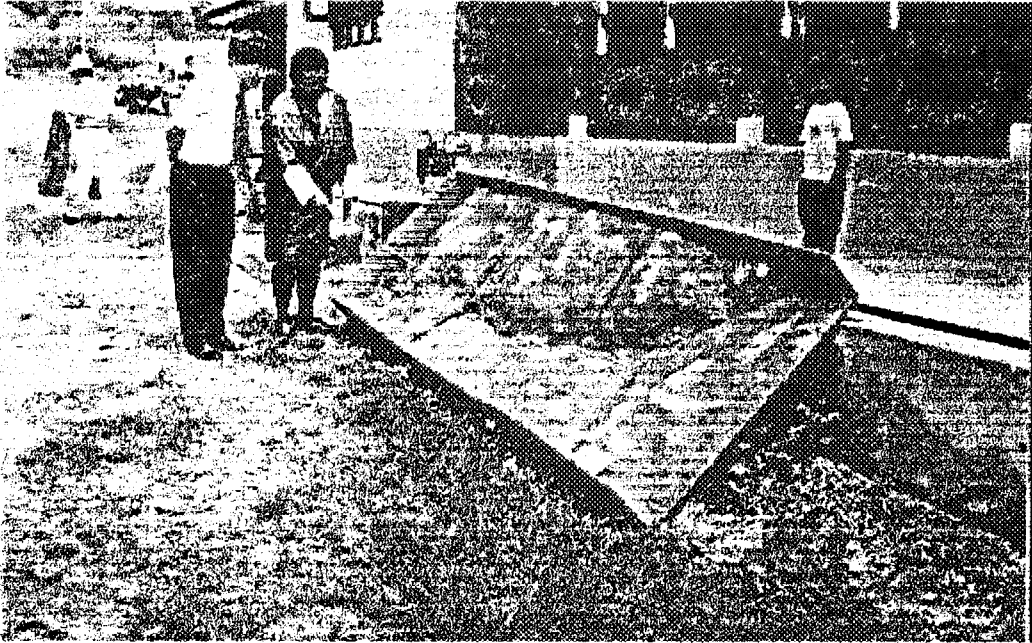


PHOTO NO. 1: PAPER MASH MODEL USED FOR THE CONSULTATION



PHOTO NO. 2: CONSULTATION WITH THE GASETSO GOM & GASETSO OM PEOPLE

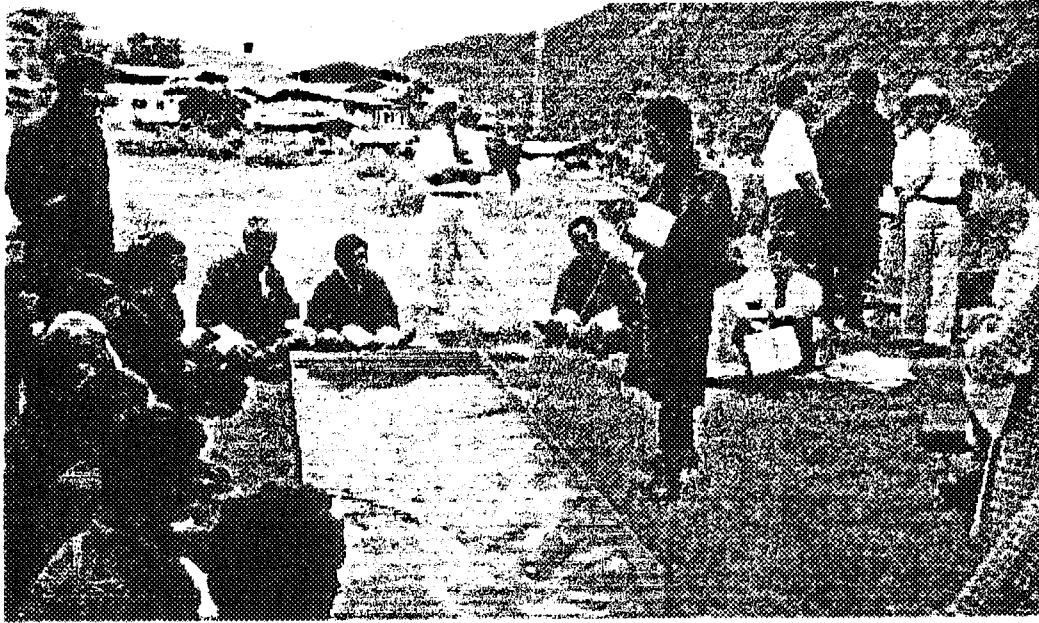


PHOTO NO. 3: CONSULTATION WITH THE PEOPLE LIVING UPSTREAM OF THE DAM



PHOTO NO. 4: CONSULTATION WITH THE PEOPLE LIVING BETWEEN DAM & TAILRACE

LIST NO. 1: PEOPLE CONSULTED UNDER GASETSHO GOM GEOG (CONTINUATION...)

2. 2019/1/24 30/11/2020
 3. 2019/1/24 30/11/2020
 4. 2019/1/24 30/11/2020
 5. 2019/1/24 30/11/2020
 6. 2019/1/24 30/11/2020
 7. 2019/1/24 30/11/2020
 8. 2019/1/24 30/11/2020
 9. 2019/1/24 30/11/2020
 10. 2019/1/24 30/11/2020
 11. 2019/1/24 30/11/2020
 12. 2019/1/24 30/11/2020
 13. 2019/1/24 30/11/2020
 14. 2019/1/24 30/11/2020
 15. 2019/1/24 30/11/2020
 16. 2019/1/24 30/11/2020
 17. 2019/1/24 30/11/2020
 18. 2019/1/24 30/11/2020
 19. 2019/1/24 30/11/2020
 20. 2019/1/24 30/11/2020

Sl. No.	Date	Name	Gender	Signature
1	2019/1/24	...	M	✓
2	"	...	M	✓
3	"	...	F	✓
4	"	...	23	✓
5	"	...	23	✓
6	"	...	23	✓
7	"	...	23	✓
8	"	...	23	✓
9	"	...	23	✓
10	"	...	23	✓
11	"	...	23	✓
12	"	...	23	✓
13	"	...	23	✓
14	"	...	23	✓
15	"	...	23	✓
16	"	...	23	✓
17	"	...	23	✓
18	"	...	23	✓
19	"	...	23	✓
20	"	...	23	✓

~ 2 -

21	ભાગીચી	મહામુખી	સી	✓
22	"	પુલિયા	સી	✓
23	"	ભાગીચી	-	
24	"	મહામુખી	સી	✓
25	"	સીવોલ	"	✓
26	"	કુલિયા	"	✓
27	"	ગામગુમ	સી	✓
28	"	ગામગુમ	સી	✓
29	"	મહામુખી	"	✓
30	"	મહામુખી	"	✓
31	"	મહામુખી	સી	✓
32	"	મહામુખી	"	✓
33	"	મહામુખી	"	✓
34	મહામુખી	મહામુખી	સી	✓
35	"	ગામગુમ	"	✓
36	"	મહામુખી	સી	✓
37	"	મહામુખી	સી	✓
38	"	મહામુખી	સી	✓
39	"	મહામુખી	સી	✓
40	"	મહામુખી	"	✓

(2)

69	-	1251	ଅମଳାସିନୀ	ଝା	✓
62	-	"	ଶ୍ରୀମତୀ ସୁମିତ୍ରା	"	✓
62	-	"	ସୁମିତ୍ରା	ଝା	✓
65	-	"	ଲକ୍ଷ୍ମୀକାନ୍ତ	ଝା	✓
64	-	"	ଠାକୁରାଣୀ	ଝା	✓
66	-	"	ସୁମିତ୍ରା	ଝା	✓
67	-	"	ସୁମିତ୍ରା	"	✓
68	-	"	ଶ୍ରୀମତୀ ସୁମିତ୍ରା	"	✓
69	-	"	ସୁମିତ୍ରା	"	✓
70	-	"	ଠାକୁରାଣୀ	ଝା	✓
71	-	"	ଠାକୁରାଣୀ	ଝା	✓
72	-	"	ଠାକୁରାଣୀ	ଝା	✓
73	-	"	ଠାକୁରାଣୀ	"	✓
74	-	"	ଠାକୁରାଣୀ	"	✓
75	-	"	ଠାକୁରାଣୀ	"	✓
76	-	"	ଠାକୁରାଣୀ	"	✓
77	-	"	ଠାକୁରାଣୀ	"	✓
78	-	"	ଠାକୁରାଣୀ	"	✓
79	-	"	ଠାକୁରାଣୀ	"	✓
80	-	"	ଠାକୁରାଣୀ	"	✓

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87-	ಅಭಿವೃದ್ಧಿ	ಇಲಾಖೆ	ಹೌದು	✓
88-	"	ಅಭಿವೃದ್ಧಿ	ಹೌದು	✓
89-	"	ಅಭಿವೃದ್ಧಿ	"	✓
90	ಅಭಿವೃದ್ಧಿ	ಅಭಿವೃದ್ಧಿ	"	✓
91	"	ಅಭಿವೃದ್ಧಿ	ಹೌದು	✓
92	"	ಅಭಿವೃದ್ಧಿ	"	✓
93	"	ಅಭಿವೃದ್ಧಿ	ಹೌದು	✓
94	"	ಅಭಿವೃದ್ಧಿ	"	✓
95	"	ಅಭಿವೃದ್ಧಿ	ಹೌದು	✓
96	"	ಅಭಿವೃದ್ಧಿ	"	✓
97	"	ಅಭಿವೃದ್ಧಿ	ಹೌದು	✓
98	"	ಅಭಿವೃದ್ಧಿ	"	✓
99	"	ಅಭಿವೃದ್ಧಿ	ಹೌದು	✓
100	"	ಅಭಿವೃದ್ಧಿ	ಹೌದು	✓

(6)

- ၂၀၁ - ဗဟိုဌာန၊ ဝန်ကြီးရုံး ၎င်း ✓
- ၂၀၂ - " ဒုတိယ ၎င်း ✓
- ~~၂၀၃~~ - " " " " ✓
- ၂၀၄ - " " " " ✓

အထွေထွေအဖွဲ့ဝင်များ၏ အကြံပြုချက်များကို အခြေခံ၍
၂၀၁၇ ခုနှစ် ဇူလိုင်လ ၂၀ ရက်နေ့

1115	ସିନିଆ	ସୁଲିଆ	11
1116	"	ବ୍ରହ୍ମପୁର	"
1117	"	ବ୍ରହ୍ମପୁର	10
1118	"	ସୁଲିଆ	"
1119	ବ୍ରହ୍ମପୁର	ବ୍ରହ୍ମପୁର	10
1120	"	ସୁଲିଆ	10
1121	"	ସୁଲିଆ	"
1122	"	ସୁଲିଆ	"
1123	"	ସୁଲିଆ	10
1124	"	ସୁଲିଆ	"
1125	"	ସୁଲିଆ	"
1126	"	ସୁଲିଆ	"
1127	"	ସୁଲିଆ	"
1128	"	ସୁଲିଆ	"
1129	"	ସୁଲିଆ	"
1130	ସୁଲିଆ	ସୁଲିଆ	"
1131	"	ସୁଲିଆ	"
1132	"	ସୁଲିଆ	"
1133	"	ସୁଲିଆ	"
1134	"	ସୁଲିଆ	"
1135	"	ସୁଲିଆ	"
1136	ସୁଲିଆ	ସୁଲିଆ	"
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1141	"	ସୁଲିଆ	"
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1144	"	ସୁଲିଆ	"
1145	"	ସୁଲିଆ	"
1146	"	ସୁଲିଆ	"
1147	"	ସୁଲିଆ	"
1148	"	ସୁଲିଆ	"
1149	"	ସୁଲିଆ	"
1150	"	ସୁଲିଆ	"
1151	"	ସୁଲିଆ	"
1152	"	ସୁଲିଆ	"
1153	"	ସୁଲିଆ	"
1154	"	ସୁଲିଆ	"
1155	"	ସୁଲିଆ	"
1156	"	ସୁଲିଆ	"
1157	"	ସୁଲିଆ	"
1158	"	ସୁଲିଆ	"
1159	"	ସୁଲିଆ	"
1160	"	ସୁଲିଆ	"
1161	"	ସୁଲିଆ	"
1162	"	ସୁଲିଆ	"
1163	"	ସୁଲିଆ	"
1164	"	ସୁଲିଆ	"
1165	"	ସୁଲିଆ	"
1166	"	ସୁଲିଆ	"
1167	"	ସୁଲିଆ	"
1168	"	ସୁଲିଆ	"
1169	"	ସୁଲିଆ	"
1170	"	ସୁଲିଆ	"
1171	"	ସୁଲିଆ	"
1172	"	ସୁଲିଆ	"
1173	"	ସୁଲିଆ	"
1174	"	ସୁଲିଆ	"
1175	"	ସୁଲିଆ	"
1176	"	ସୁଲିଆ	"
1177	"	ସୁଲିଆ	"
1178	"	ସୁଲିଆ	"
1179	"	ସୁଲିଆ	"
1180	"	ସୁଲିଆ	"
1181	"	ସୁଲିଆ	"
1182	"	ସୁଲିଆ	"
1183	"	ସୁଲିଆ	"
1184	"	ସୁଲିଆ	"
1185	"	ସୁଲିଆ	"
1186	"	ସୁଲିଆ	"
1187	"	ସୁଲିଆ	"
1188	"	ସୁଲିଆ	"
1189	"	ସୁଲିଆ	"
1190	"	ସୁଲିଆ	"
1191	"	ସୁଲିଆ	"
1192	"	ସୁଲିଆ	"
1193	"	ସୁଲିଆ	"
1194	"	ସୁଲିଆ	"
1195	"	ସୁଲିଆ	"
1196	"	ସୁଲିଆ	"
1197	"	ସୁଲିଆ	"
1198	"	ସୁଲିଆ	"
1199	"	ସୁଲିଆ	"
1200	"	ସୁଲିଆ	"

LIST NO. 3: PEOPLE CONSULTED, THOSE LIVING UPSTREAM OF THE DAM, UNDER RUEPISA GEOG

No.	Name	Address	Signature	Date
1
2
3
4
5
6
7
8
9
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15

24
23
22
21
20

