August 2014

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BHU: Second Green Power Development Project (Part A: Hydropower Plant Component) Annexes H to Q

Prepared by Druk Green Power Corporation Limited and Tangsibji Hydro Energy Limited for the Asian Development Bank

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Annex H: Terrestrial Ecological Report

Terrestrial Ecological Report

Summary

Three Biodiversity surveys were conducted in the Nikachhu Project area and its surroundings. The First Survey was conducted By BHUCORE, in July 2013 and edited by PWC, and the second was conducted in October by PWC and the third along the Transmission line in December 2013.

A. First Biodiversity report (Prepared by BHUCORE, revised by PWC)

1 Background

The study of Terrestrial Ecosystem in the proposed Nikachhu Hydropower Project was to acquire biological diversity information, the protected species, establish migratory species and routes, assess extent of impact due to project implementation in conjunction to earlier environmental assessment that was concluded in 2011. This study was envisaged mainly due to slight change of Lorim Dam Site (coordinates: from 27' 26' 55.41" N to **27' 26' 59.80 N** and 90' 22' 22.21"E to **90' 22' 20.10"E**) and Power House from Tangsibi to Norbuodi (coordinates: from 26' 27' 29.46"N to **27' 26' 58.9"N** and 90' 27' 17.90"E to **90' 26' 53.30"E**) which were seen geologically more stable as compared to earlier sites. Therefore an update of the environmental assessment study was felt necessary for the extended project location.

2 General Forest Setting

According to broad classification of vegetation zones in Bhutan (A.J Girerson and D.G Long, Flora of Bhutan) Nikachhu Hydropower Project falls under the cool broad leaved forest zone, which is synonymous to Temperate Forest or East Himalayan Wet Temperate forest indicative altitude range of 2000 – 2900 m. The forest in the study area can be classified into eight ecological patterns and they are top canopy, middle canopy, shrubs, ground flora, climbers, Ferns and epiphytes. Figure 2-1 below provides overview of vegetation type.



3 Methods and Tools

3.1 Transacts

The study area covered altitudinal range between 1900 to 2450 m, from the confluence of Nikachhu/ Mangdechhu up to Lorim (Dam) Wangdue/Trongsa National Highway point.

The coordinates of hydropower component locations such as Dam, ADITS, Muck Disposal Sites, staff colonies, temporary camps, surge shaft, power house were obtained from the map that was provided by the Druk Green Power Corporation Limited (DGPCL). These coordinates were entered into the Global Positioning System (GPS) equipment "Etrex Vista HC-X Garmin". Reaching the project site each entered points were tracked to determine the location. Upon knowing the locations the laying of transacts were determined. Transect lines was taken at 90 degrees to contour line. **Table 3-1** provides transact details.

Table 3-1: Transact details

Particular	Length (m)	Coordinates at start of Transact		Number of	Highest Elevation	Lowest Elevation
		Easting	Northing	plots	(m)	(m)
Transact 01	250	90°22'29.30"E	27°27'1.14"N	05	2400	2320

Particular	Length (m)	Coordinates at	Coordinates at start of Transact		Highest Elevation	Lowest Elevation
		Easting	Northing	ning plots		(m)
Transact 02	900	90°23'14.89"E	27°27'13.59"N	18	2404	2248
Transact 03	890	90°24'52.64"E	27°27'9.89"N	17	2543	2213
Transact 04	1000	90°26'19.78"E	27°27'8.12"N	20	2540	2168
Transact 05	780	90°27'24.65"E	27°28'8.48"N	15	2555	2319
Transact 06	1000	90°28'46.72"E	27°29'23.67"N	20	2502	1814

From the start point, 50 meter transect line is marked taking-up slope gradient. Reason, measuring up slope gradient was to choose the difference of altitude location to see vegetation diversity.

At "O" start point transect line, a peg to mark center point of the sample plot as "Transect Start" was fixed. 5 meter (m) either side of the transect line is marked for the sample plot making 10 m by 10 m or 100 square meter (m²) area. A similar sample plot is marked at the end of 50 meter transect line as "Transect End", making 2 sample plots of 100 m² each, or making 200 m² sampling area as two plots were completed. The plot laying thus continued. Length of transect line center to center of plot is 50 m and inclusive of 5m either side of center line makes the transect line length 60 meters end to end. **Figure 3-1** illustrates plot layout.



Figure 3-1: Transact and plot layout (not to scale)

3.2 Enumeration process

Appendix IV provides format to record enumeration of both plant and animal species. Recording of vegetation within sampling quadrant plot 100 m2 was made considering canopy density of the forest cover. All the plants within this quadrant are made, noting the girth class in centimeter, height in meter for all tree species. Also complete recordings of other vegetation within the sample plot quadrants have been recorded taking consideration as shrub (s) Herb (h), climber (c), Fern (f), orchid (o) and Epiphytes.

Apart from complete vegetation recordings within sample plots, other vegetation along the transect lines were all been taken into record. Additional to floral recordings traces of wild life, avifauna, insects, arachnids, and reptiles were been taken into note. Some other information on wild life and fauna were asked to local cattle herders residing in the locality.

3.3 Floral Records

The floral records resulted out of enumeration are categorized into top canopy, middle canopy, shrubs, ground vegetation, climbers, Ferns, and orchids. Each is discussed below.

3.3.1 Top Canopy

Mostly composed of evergreen oaks (*Quercus glauca, Q.serrata, Q.lanata*), with occasional mixture of maple, magnolia, Ex-bucklandia populnea, Carpinus veminii have been noted towards the valley. Maximum tree population of Alder (Alnus nepalensis), have been noted in the study zone starting from Bangla Pokto, Tangsbi, Tashiling, Tshangkha and to Norboudi zone inclusive of Mangdechhu main Dam area. Quercus griffithii, deciduous oak do thrive in the vicinity of Tangsibji and Tshangkha area which were mainly protected by the individual households until recent time for leaf collection for cattle bedding and branches for mushroom cultivation. **Table 3-2** provides record of top canopy trees.

English Name	Botanical name	Local name	Use	National status	IUCN status
Oak	Quercus glauca	Dz[1]=Lathonp	Fire wood	none	NA (Not yet
Oak	Q.serrata.	Dz=Thonap.	Plough, took handle	none	assessed)
		Sha[2]=Thongpu shing		none	N.A
Oak	Q.lanata	Dz=Ghum shing	Fire wood		
				none	IN.A

Table 3-2: Record of Top canopy trees

English Name	Botanical name	Local name	Use	National status	IUCN status
Oak	Quercus griffithii	Dz=Sisi shing	Furniture, fire wood,		
			leave good for organic		
			manure	none	N.A
maple,	Acer campbellii	Dz=Pchalam	Wood Curving material,		
	-	Sha=Sermiling shing	making bowls	none	N.A
magnolia,	Magnolia campbellii	Dz=Ngangong	Cheap construction		
_		Sha=Ngawang shing	wood	none	N.A
	Ex-bucklandia	Lho[3]=Pipla Sha=Lem	Good construction		
	populnea	shing	wood	none	N.A
Ash	Carpinus veminii	-	Sport goods		
wood				none	N.A
Alder	Alnus nepalensis	Dz=Gama	Cheap construction		
			wood,	none	N.A

The figures below illustrate from top canopy vegetation.



Figure 3-2: View of top canopy vegetation

3.3.2 Middle canopy

Comprise of Persea clarkeana, Rhododendron grande, R.arboreum, Rhus chinensis, Lyonia ovalifolia, Sorbus sp Symplocos sp etc. Under grown regeneration noted mainly Alunus sp and Symplocos sp.

English Name	Botanical name	Local name	Use	National status	IUCN status
A family of	Persea clarkeana		Construction timber		
Avacado fruit				none	N.A
Rhododendron	Rhododendron		Leave for butter		
	grande		wrapping	none	N.A
Rhododendron	Rhododendron griffithianum	Dz=Eto Meto rig			N.A
Rhododendron	R.arboreum	Eto-meto	Good flowering		
			Avenue	none	N.A
Rhus	Rhus chinensis	Dz=Choka	Fruit collected for		
		Sha=Roptang	local medicine,		
		shing		none	N.A
Rhus	Rhus hookeri	Sha=Jarshing,	Fruit yield edible black		
		Jarsee Shing	oil	none	N.A
Lacquer tree	Rhus	Dz=Say, Sey	Trunk and Fruit latex		
	succedanea	Sha=Say Shing	used for lacquering or		
			high quality furniture		
			polish	none	N.A
	Lyonia ovalifolia	Dz=Zentoo	Good flowering plant	nono	
Sympleses	Sumplagge on	D-Cha Damahi	Loove on mordent for	none	N.A
Sympiocos	Sympiocos sp	DZ/Sha=Domshi	Leave as mordant for		
			birde and esten by		
			boor	nono	
	Sarbus sp		Deal Barry actor by beer	none	N.A
	Sorbus sp		Derry eaten by bear	none	N.A

Table 3-3:	Record	of I	Middle	canop	y trees
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Figure below depicts middle canopy vegetation.



Figure 3-3: Sample of middle canopy vegetation shrubs

English Name	Botanical name	Local name	Use	National status	IUCN status
Berberis	Berberis aristata	Dz=Kerpa tsang	Bark collected for medicine, vegetable dye	none	N.A
	Viburnum erubescens	Sha=Neptang shing	Good for live hedge	none	N.A
	Viburnum cylindricum	Sha=Ymling Shing	Seed yield oil	none	N.A
Daphne	Daphne sp,	Dz=Denag, Denag, Sha=Shugu-shing	Bark, for Bhutanese paper making	none	N.A
	Edgeworthia gardnesi,	Dz=Deyka	Bark, for Bhutanese paper making	none	N.A
	Eurya serrata			none	N.A
	Zanthoxylum sp,	Dz=Thnigay shing, Sha=Gee- shing	Fruit, Leeh and insect repellent	none	N.A
	Zanthoxylum oxyphyllum	Dz=Dretsang	-do-	none	N.A
smilax	Smilax retusa			none	N.A
	Hypericum sp	sp.Dz=Sonam Choejay	Leaves and young shoot for local tea material, grown for flower	none	N.A
	Desmodium elegans		Purple flower for avenue hedge	none	Least Concern
Rhododendron	Rhododendron edgeworthii	Dz=Tshethrim metok	Flower offered to alter		N.A
	Aconogonum molle	Dz=	Sour young shoot eaten		N.A
		Sha=Chokom		none	
	Ligustrum indicum		Good for hedge and avenue	none	N.A
	Photinia integrifolia			none	N.A

Table 3-4: Record of Shrubs

3.3.3 Ground Vegetation

Table 3-5: Record o	f Ground vegetation
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English Name	Botanical name	Local name	Use	National Status	IUCN status
	Elatastema sp	Dz=Damburu –zuma		none	N.A
		Sha=Grimom -rig			
	Arisaema sp	Dz=Dowo		none	N.A
Fern	Asplenium sp		Indoor pot plant	none	N.A
	Ainslinea aptera			none	N.A
	Oxalis sp	Sha=Nera - Mamphung	Fruit sour test eaten by children	none	N.A
	Hedychium	Sha=Borang saga		none	
	aurantiacum				N.A

English Name	Botanical name	Local name	Use	National Status	IUCN status
	Oenanthe javanica	Sha=Zhemtse	Leaf and young	none	Least
	Piper mullesua	Med[1]: Pi-pi-ling		none	N A
Grass like	Theropogon pallidus			none	N.A
	Ngaphalium sp			none	N.A
	Anaphalis sp			none	N.A
Strawberry	Fragaria nubicola	Dz=Tshema Tsshlu	Berry edible	none	N.A
Clover	Triflorium repens		fodder	none	N.A
	Galium aparine	Md:Zangtse	Med: collected for medicine	none	N.A
	Oxalis sp			none	N.A
Balsam	Strobilanthes sp		Fodder	none	N.A
Jancus	Juncus sp	Md:Dambukara	Marsh plant	none	N.A
	Pilea sp			none	N.A
Grass	Corex sp			none	N.A
	Thalictrum sp	Med:Ngangtsetrey	Root collected for medicine	none	N.A
	Leucas lanata			None (Herb)	N.A
	Scutellaria discolor			None(Herb)	N.A
Gentian	Halenia elliptica	Med:Chaktig	Collected for medicine	none	N.A
Ranunculus	Anemone revuleris	Sha=Wadepa Ngon metok		none	N.A

Climber

Rosa brononii (c), Rubus paniculata Sha=Omsha Zuroo (c), Actinida callosa Sha=Fangkholom sey, E/C= Wild Kiwi (c) Rubia cordifolia Dz=Tseod, Sha=Laningang roo (c) Vitis sp Sha=Janjanpur roo (c), Galium sp. (c), Hydrangea anomala (c) Herpetospermum pedunculosum Sha=Pokpo roo(c).

Table 3-6: Record of Climbers

English Name	Botanical name	Local name	Use	National Status	IUCN status
Rose	Rosa brunonii		Good hedge or		
			flowering plant	none	N.A
climber	Rubus paniculata	Sha=Omsha Zuroo	Leaf taken as Pan		
			substitute in eastern		
			Bhutan	none	N.A
Wild Kiwi	Actinidia callosa	Sha=Fangkholom	Fruit eaten,		
		sey,		none	N.A
Trade name=Manjit,	Rubia cordifolia	Dz=Tseod,	Root good for food		
Manjeto		Sha=Laningang roo	color, used as dye	none	N.A
	Vitis sp	Sha=Janjanpur roo	Wild variety for	none	N.A

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English Name	Botanical name	Local name	Use	National Status	IUCN status
			Grape		
	Hydrangea anomala			none	N.A
	Herpetospermum pedunculosum	Sha=Pokpo roo	Fruit eaten as vegetable or pickle	none	

3.3.4 Ferns

Fern sp (F), Pteridium asculanta, Dz=Keam Sha=Pang Dawai (F) Asplenium sp (F), Suphagonus sp (F), Diplezium (Dz=Nakey) Drynaria sp (Sha=Benang-golapu), Cythea spinulosa (tree Fern), Adiantum sp (F),

Table 3-7: Record of Ferns

English Name	Botanical name	Local name	Use	Endangered/protected/endemic	IUCN status
Fern	Pteridium	Dz=Keam	Young shoot		
	esculentum	Sha=Pang	boiled and		
		Dawai	eaten,		N.A
			Leaf good for		
			green manure	none	
Fern	Asplenium sp		Good for		
			indoor plant	none	N.A
Fern/	Sphagnum sp	Dz=Hangpe			
lichen		Shu=Punpu		none	N.A
Fern	Diplazium sp	Dz=Nakey	Shoot delicacy		
			for Bhutanese		
			dining table	none	N.A
Fern	Drynaria sp	Sha=Benang-	Collected for		
		golapu	medicine	none	N.A
Tree Fern	Cyathea		Good indoor	Included in endangered red book	
	spinulosa		plant	list	N.A
	Adiantum sp		Good indoor		
			plant	none	N.A

3.3.5 Epiphytes

Aechementhera sp (s), Rhododendron lindlye, Coelogyene corymbosa (o), Balbophyllum sp (o), Sorbus microphylla (s), Rhododendron dalhosie (s), Agapetis serpens, Dz/Sha= Enzeeboa, Vaccinium vacciniceum (s) Selaginella sp (F), Asplenium sp (F), Suphagonus sp (F), Colocasia sp, Sha=Bozong (h) Adiantum sp (F),

Table 3-8: Record of Epiphytes

English Name	Botanical name	Local name	Use	Endangered/protect ed/endemic	
Epiphytes	Aechementhera		Indoor	none	

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English Name	Botanical name	Local name	Use	Endangered/protect ed/endemic	
	sp		decoration		
			plant		N.A
Rhododendron	Rhododendron	Dz=Eto-meto rig	-Do-		
	lindleyi			none	N.A
Rhododendron	Rhododendron	Dz=Eto-meto rig	-Do-		
	dalhousiae			none	N.A
Orchid	Coelogyene	Sha=Churchurbu	Flower		
	corymbosa	rig	petals eaten	none	N.A
orchid	Bulbophyllum sp		Ornamental		
			plant	none	N.A
	Sorbus		Berry eaten		
	microphylla		by birds	none	N.A
Epiphytes	Agapetes	Dz/Sha=			
	serpens,	Enzeeboa		none	N.A
	Vaccinium				
	vacciniaceum			none	N.A
	Selaginella sp			none	N.A
	Asplenium sp		Ornamental		
	(F),		indoor plant	none	N.A
	Sphagnum sp			none	N.A
Colocasia	Colocasia sp, (h)	Sha=Bozong	Indoor plant		N.A
	Adiantum sp (F),		Indoor plant		N.A
	Taxillus	Dz=Lamtakey			N.A
	KUempien	Sha=Khaine			

3.3.6 Orchids

Coelogyene corymbosa (o), Balbophyllum sp (o), Calanthe sp (o), Chilochista usneoides dz=Tsa Awadotizulma, Octochilus lanciliabius Md=Pusheltse, Dendrobium candidum (o), Orchid Sha=Sapin, Pintse.

Table 3-9	Record of	Orchids
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English Name	Botanical name	Local name	Use	Endangered/protected/endemic	IUCN Status
Orchid	Coelogyene		Good indoor		
	corymbosa		plant	none	N.A
Orchid	Bulbophyllum sp			none	N.A
Ground	Calanthe sp		Flowers eaten		
Orchid			as vegetable,		
			good indoor		
			plant	none	N.A
Orchid	Chiloschista	dz=Tsa			
	usneoides	Awadotizulma		none	N.A
Orchid	Octochilus sp	Md=Pusheltse	Collected for		
			Bhutanese		
			medicine	none	N.A
Orchid	Dendrobium	Sha=Sapin,	Tuber used as		
	candidum	Pintse.	glue		
				none	N.A

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3.3.7 Floral Diversity Summary

The summary of floral diversity is provided in Table 10. As can be seen from below table the species diversity is highest at Dam area with 42 species per 100 m² and lowest around midway of the Head Race Tunnel alignment and the second rich diversity around powerhouse area. It is natural diversity the higher the lesser would be tree volume. This is depicted by Table 3-10.

Transact	No of trees per sample quadrant (Q)		Av. tree density per 100 m ²	Average volume of tree per plot m3 (cft)	Species diversity per 100 m ²	Remarks
00	(Q1 – 2)=3 nos	(Q4-5)=8 nos	6	6.230m3 (219.79cft)	41 species	
01	(Q1-9)=20 nos	(Q10 – 18)=7 nos	14	23.993m ³ (846.47cft)	30 species	
02	(Q1-5)=13 nos	(Q6-17)=9 nos	16	4.933m ³ (174.04cft)	25 species	
03	(Q1-6)=2 nos	(Q7-17)=0 nos	1	4.883m ³ (172.27cft)	14 species	
04	(Q1-10)= 1nos	(Q10-20) = 0 nos	1	4.715m ³ (166.35cft)	12 species	
05((Q1-7) =8 nos	(Q8-15) =0 nos	4	0.000m ³ (0.00cft)	25 species	
06	(Q1-10)=24 nos	(Q11-15)=0 nos	12	3.239m ³ (114.27cft)	26 species	
07	(Q1-10)=2 nos	(Q11-20) =1 no	2	9.279m ³ (327.36cft)	37 species	

Table 3-9: Summary of floral diversity from cumulative of plots per transact

Note: i) Diversity of species taken into consideration are all those plants species enumerated in all quadrants. Species of grass and the lichens have not been reflected in the vegetation list.

ii) Fifty (50) centimeter girth and above are considered into tree category. Biggest tree girth enumerated within the plot was 620 centimeter oak (Quercus glauca).

iii) 35.28cft equals 1m³



The species diversity in various hydropower project components is illustrated by Figure 3-4.

Figure 3-4: Species diversity in various hydropower project component locations



Figure 3-5: Estimation of average tree volume along transact line from Dam towards Power House

3.4 Faunal Records

3.4.1 Mammals

Sambar Deer (fresh hoof marks & dungs), Barking Deer (fresh hoof marks and Dung), Horry – bellied squirrel (spotted), Stripped Squarrel (spotted), and Assamese macaque (scats seen) were recorded during survey.

Mammals generally found in this zone as per locals and Jigme Singye Wangchuk National Park staff are as follows:

Tigers, Panthera tigris, Dz=Taa, Sha=Mayme Chenzin, Phuga Mayme, Kheylu, Leopard, Dz=Zeeg Sha=Zeeg, Black panther, Sha=Khu Kheylu, Dhole/Wild dog, Dz=Phaw, Sha-Romu, Leopard cat, Prionailurus bengalensis, Dz=Jazee, Sha=Jazee/Foskong ; golden cat, Dz/Sha=goong, Samber Deer, Servus unicolor, Dz/Sha=Shaw, Shou; Barking Deer, Muntiacus muntjakDz=Kasha, Sha=Gasha, Gashu, Gash Tokpaling, Wild boar, Sus scrofa, Dz=Riphag, Sha= Borang Faakpa, Himalayan Black bear, Dz=Dom, Sha=Omsha Omshu; Serrows, Dz=Jha, Sha=Shangsha, Shangshu; Goral, Dz=Bjara, Basha, Bashu; Mongkey, Dza=Pcha, Sha=Zala, Common langur, Dz=Pcha-ka, Sha= Roksha, Rokshu, Zalu Kaptong, Golden langur (trachypithecus geei) Dz=Pcha-ka, Sha=Rokshu Serbu, (migratory); Porcupine Histerix bracyhura, Dz=Bjithu, Sha=Zumphi, Red fox, Vulpes Vulpes, Dz=Haam, Sha=Shewlee; Common Otter, Lutra lutra. Dz/Sha/=Sam; Yellow-throated Martin, Martes flavigula, Dz=Hachu Ney Ney, Sha= Gagogmu; Bos gaurus, Gaur, dz=Rilang, Sha=Yeybu, Recent camera trap in the lower Nikachu zone.

Note: Dz=Dzongkha, Sh=Schachop, Kh=Khengkha, Eng/C=English common name

English Name	Scientific name	Spotted during survey (Y/N)	Reported by locals (Y/N)	National status	Migratory	IUCN status
Sambar Deer	Servus unicolor	Y				N.A
Barking Deer, Dz=Kasha	Muntiacus mutjak	Y				N.A
Hoary –bellied squirrel	Callosciusus pygerythus	Y				N.A
Stripped Squarrel		Y				
Assamese macaque Dz=Pcha, Sh=Zala	Macaca assamensis	Y	,			Near Threatened
Common langur		Ν	Local/Park			N.A

Table 3-10: Record of Mammals (spotted and reported by locals/park staff)

English Name	Scientific name	Spotted during survey (Y/N)	Reported by locals (Y/N)	National status	Migratory	IUCN status
Golden Langur,	Trachypithecus					
Kh=Raksha	geei	N	Local/park	Endemic		Endangered
Tigers, Dz=Taa	Penthera tigris	N	Local/park	Protected	Migrate to south	N.A
Common Leopard	Penthera pardus	Ν	-Do-	protected	local	N.A
Black panther		Ν	-Do-	protected		N.A
Dhole/ Wild dog	Cuon alpines primaevus	N	-Do-			N.A
Leopard cat	Prionailurus bengalensis	N		Protected		Least Concern
Asiatic golden cat,	Catopuma temmincki	N	-Do-	Protected		N.A
Wild boar	Sus scrofa	Ν	-Do-			Least Concern
Himalayan Black bear La dom	Ursus thibetanus Laniger	Ν	-Do-	protected		N.A
Himalayan Serow, Dz= Jha, Sh=Shanhsha	Capricornis sumatraensis	Ν	-Do-	protected		Vulnerable
Porcupine	Histerix bracyhura	Ν				N.A
Red fox	Vulpes Vulpes	Ν				Least concern
Common Otter	Lutra lutra	N				Near Threatened
Yellow-throated Martin Dz=Hachu Ney Ney	Martes flavigula	Ν				Least Concern
Gaur, Dz/Sh=Rilang	Bos gaurus,.	Recent camera trap in the lower Nikachu zone (by		Protected		Vulnerable
		JSWNP staff)				

3.4.2 Avifauna

Table 3-11: Record of Avifauna

English Name	Scientific name	Spotte d during survey (Yes)	Reporte d by locals (Y/N)	National status	Migratory [1] (Y/N)	IUCN status
1) White- throated laughing thrush,	Garrulax albogularis		As per spotting record of JSWNP		Ν	Least Concern
2) Green-backed tit,	Parus monticolus		-do-		N	Least Concern

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English Name	Scientific name	Spotte d during survey (Yes)	Reporte d by locals (Y/N)	National status	Migratory [1] (Y/N)	IUCN status
3) Grey bushchat (Sha=Drin-	Saxicola ferrea	Vaa			N	Logat Canaara
4) Whiskered yuhina	Yuhina flavicollis	Vee			N	Least Concern
5) Chestnut –crowned laughing	Garrulax	res			IN	Least Concern
thrush	erythrocephalus	Yes			N	Least Concern
6) Rutous sibia,	Heteropnasia capistrata		-do-		Ν	Least Concern
7) Black drongo,	Dicrurus macrocercus	Yes			N	Least Concern
8) Streaked laughing thrush,	Garrulax lineatus	Yes			N	Least Concern
9) White-throated fantail,	Rhipidura albicollis		-do-		N	Least Concern
10) Yellow-Billed blue magpie,	Urocissa flavirostris	Yes			N	Least Concern
11) White- collared blackbird,	Turdus albocinctus	Yes			N	Least Concern
12) Oriental turtle dove,	Streptopelia orientalis	Ves			N	Least Concern
13) Blue whistling thrush,	Myophonus caeruleus	Voc			N	Least Concern
14) Spotted forktail,	Enicurus scouleri	165	do		N	Least Concern
15) Wedge-tailed green	Treron pompadora		-00-		IN	Least Concern
pigeon, 16) White-browed fullyette	Alcinne vininectus		-do		N	Least Concern
			-do-		N	Least Concern
		Yes			N	Least Concern
18) Russet sparrow,	Passer domesticus	Yes			N	Least Concern
19) Streak-breasted scimitar babbler.	Pomatorhinus ruficollis		-do-		Ν	Least Concern
20) Common hoopoe,	Upupa epops	Yes			N	Least Concern
21) Blue-capped rock thrush	Monticola					
22) Large-billed crow	cinclorhynchus Corvus	Yes			N	Least Concern
	macrorhynchos	Yes			Ν	Least Concern
23) Nepal house martin,	Delichon nipalensis	Yes			N	Least Concern
24) Red-vented bulbul,	Pycnonotus cafer	Yes			N	Least Concern
25) Long-tailed shrike,	Lanius schach	Yes			Ν	Least Concern
26) White-tailed nuthatch,	Sitta himalayensis	Yes			N	Least Concern
27) Long-tailed minevet,	Pericrocotus ethologus	Yes			N	Least Concern
28) Chestnut -tailed minla,	Minla strigula					
		Yes			N	Least Concern
29) Great barbet,	iviegalaima virens	V			N	
30) Steppe eagle.	Aguila nipalensis	Yes			N	Least Concern
,,	,	Yes			N	Least Concern
31) Broad-billed warbler,	Acrocephalus aedon					
			-do-		N	Least Concern

English Name	Scientific name	Spotte d during survey (Yes)	Reporte d by locals (Y/N)	National status	Migratory [1] (Y/N)	IUCN status
32) Erusain jay,	Garrulus glandarius					
		Yes			N	Least Concern
33) Golden-throated barbet,	Megalaima franklinii		-do-		N	Least Concern
34) Crimson sunbird,	Aethopyga siparaja					
	Lhunainataa		-do-		N	Least Concern
	leucocephalus		-do-		N	Least Concern
36) Blue rock thrush,	Monticola solitarius	N			N	
37) Bufous-vented tit	Parus rubidiventris	Yes			N	Least Concern
	Falus lubidiventilis	Yes			N	Least Concern
38) Black throated tit	Aegithalos concinnus	Vas			Ν	Least Concern
39) Rufous-winged fulvette.	Alcippe castaneceps	163				Least Ooncent
			-do-		N	Least Concern
40) Mrs. Gould's sunbird,	Aethopyga gouldiae	Yes			N	Least Concern
41) Striated laughing thrush,	Garrulax striatus					
		Yes			Ν	Least Concern
42) Hoary-throated barwing,	Actinodura nipalensis		da		N	
43)Stripe-throated vubina	Yuhina qularis		-00-		IN	Least Concern
		Yes			Ν	Least Concern
44) Grey-cheeked warbler,	Seicercus poliogenys					
45)	(15) Anthua rapactua	Yes			N	Least Concern
45)	45) Aninus Toseaius		-do-		N	Least Concern
46) White-rumped munia	Lonchura striata					
(7)	Cashwall		-do-		N	Least Concern
47)	Gadwall		-do-		N	Least Concern
48) Ward's-Trogon	Harpactes wardi		-do-	Rare/enda	N	Near threatened
		1	- uu-	ngereu	I N	near meaterieu

3.4.3 Reptile

01 and half feet long with white and black patch spotted snake seen at the vicinity of view point seen at night, and another snake almost brown with dull white patch stripes over a meter long was seen killed other side of unidentified another. Figure 3-6 is a snake found along Trongsa Highway smashed by vehicle.





Figure 3-6: Pit Viper (protobothrops) (Ptyas nigromarginata)

Figure 3-7: Green rat snake

3.4.4 Insect Butterfly and moth

Ludlo's saw tail Butterfly was spotted dead in Transect 06. Divers of butterflies specially moths been spotted in this time of the season apart from some photographs identification was not done due to non-availability of taxonomist in such field including insects. Blue Pansy and Hill Jezebe are illustrated by Figures 3-8 and 3-9.



Figure 3-8: Blue Pansy

Figure 3-9: Hill Jezebel

4 Observation & Discussion

4.1 General

On the left bank of Nikachhu where whole hydropower project components lie there are no primary forests that are ecologically intact. The forest are heavily grazed by the cattle, the right that local people enjoy to rear their livestock. From Dam, Bangla Pokto, Tangsbi, Tashicholing Tshangkha and Norbuodi all the way to the Trongsa View point composition of tree species are mainly mixed Oak Dz=Lathomp, (Quercus glauca, Q.serrata, Q.griffithii, Q. lanata) and Alder Dz=Gama Shing. Oaks are mainly used for fire wood. Alder trees although not valuable for timber due to its softness and prone to insect attacks, local people still use timber as pine species ideal for timber are far. Valuable timber tree species as Exbucklandia populnea, Acer Campbellii and Carpinus veminae (Ash) seen in this forest belt are very negligible in terms of quantity. Very rare regeneration of this top canopy vegetation been noticed.

Middle canopy plant species comprise of Persea clarkeana, Rhododendron grande, R.arboreum, Rhus chinensis, Lyonia ovalifolia etc. Of all under grown regeneration seen during the survey were mainly Alunus sp and Symplocos sp. Other small trees such as Rhus succedenia Dz/Sha=Sey shing, that yield lacquer, Litsea sp that yield insect repellent from fruit have also been noted.

Some economic shrub plants as Daphne sp, Edgeworthii gardeneria which yields good material for traditional paper from its bark and Berberis aristata root collected for traditional medicine are found but in negligible population.

climbers and woody twiners like Wild kiwi (Actina collasa) Sha=Fhangkholom Sey edible fruit found in this forest zone could be a potential for economic venture.

4.2 Assessment of impacts

4.2.1 Flora

The Western portion to Dam Site falls partly within the territory of Jigme Singye Wangchuk National Park (JSWNP). Hence a portion of it at the Dam Site would be submerged which is unavoidable since Nikachu river being the boundary to Park. In terms of percentage loss relative to the size of the Park it is less than 0.01% which is really negligible.

The survey shows vegetation coverage is maximum by very low valuable lumber species trees as oak, Alnus, Perisia, and other miscellaneous species in this zone. The survey report also shown traces of wild Herbivores. Herds of local cattle spotted grazing in this forest zone during survey. Cattle hoop prints are noted in all the sample plots which indicate there is no forest in the project area that is not grazed by the cattle.

Despite availability of sparse high value timber species the other plants present in this forest zone as Climber, Rhododendron, shrubs Herbs, orchids and rich epiphytic diversity qualifies ecologically healthy. The richness of ground flora including fodder species as grasses and other palatable plants found in the open space and at the fringe of high forest have the greater role played by the biotic factors mainly from those Herbivores both wild and domestic present in the zone.

Although it do not directly relates to the upcoming Nikachu Hydro Project it seems necessary to make a mention here about the effect of side income generation to local residents due to the death of Bamboo forest in the upper limits of forest in this zone. The natural death of bamboo in Nikachu catchment belt (*Phenomenal characteristics of bamboo species is that it dies after flower and fruiting known as "gregarious flowering". All bamboo plants from the same stock or source of seed from the same parent will flower in the same year) has deprived the local people making products for sale and to add on their livelihood.*

The Borinda grossa Dz=Baa, Sha=shee in the upper pine/conifer zone have all been dried after its gregarious flowering starting middle of 2010. The survey team noted only one family in Chendeji High Way belt (used to be several families making bamboo mate for side income) making bamboo mate for sale. On inquiry husband and wife said that they managed to select some remaining green bamboo culms from far remote areas and do not pay back worth to their many days work input. They said is now their last effort making bamboo mate. Such bamboo as Borinda grossa takes close to a decade to mature the stock after the gregarious flowering and mass natural seeding.

As regards the ecological recession in this area it will be site specific and will be of temporary nature which the mitigation measure needs to be addressed by replenishing the muck disposal ADIT sites with plantation. The whole forest belt along the vicinity of proposed project zone, (from Dam Site to Power House) are mostly of degraded forest and are used as pasture by the local households of Ngala, Drangla, Tangsibji and Trshiling villages . Local residence from

Ngala and Drangla village are seen camping in the vicinity of proposed Dam Site with the herds of cattle and horses. Similarly 03 households from Tangsibji Village are seen still camping in Bangla Pokto with their cattle herds at this time of the year. A substantial chunk of forest area between Bangla Poto to Tsheringma Drupchu has been developed into village pastures. According to reliable local information the pasture in this belt were developed during early 1990s. Over hundred hectares of forest area in this same belt, after a kilometer short of Bangla Pokto to Tsheringma Drupchu is been allotted as Community Forest very recently.

Medicinal plants identified are Berberis aristata, Artimesia vulgaris, Verbuscom thapsus, Plantago tibetica, and Rubia cordifolia. These plants are most common and found scattered in the vicinity of village and open meadows.

Golden Langur migrates in summer to this zone, reported first observed during 2006 and 2008, along High Way between Bangla Pokto to Neemto Zam chu and project sites. Golden Langur however was not spotted during the survey time (July 2012) which was otherwise generally expected to be in this area. Birds spotted during the survey are mostly local migratory type.

There is a Biological corridor (BC) connecting Jigme Wangchuk National Park (JWNP) and Wangchuk Centennial Park measuring some 4.2 km. The biological corridor falls between ADIT 01 and ADIT 03. There are no boundary pillars fixed for the BC nor for National Parks but natural borders such as rivers and mountain ridges are used. In here the BC falls between two tributaries of Nikachhu namely Nyalalum Chhu and Bangla Chupa.

In terms of forest submersion at the Dam Site it does not hold any threatened species. As regards the Biological corridor there are no deterrent threats from the proposed project.

5 References

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Second Field report and Biodiversity Survey

A second biodiversity survey was conducted in the second and third week of October, 2012 using the same quadrat sizes as previous survey $(10m^2; 5m^2; 1m^2)$ along eight transects at various locations within the project site. A total of 82 plots were surveyed wherein data on Vegetation, wildlife and birds were collected. The level of disturbance was also noted.

No	Transect	Location	Соо	Coordinates		Elevation
1	Transect 1	Dam site	90*22'11.4"	27*27'02.8"	20	2301-2342
2	Transect 2	Muck disposal 2	90*24"54.6"	27*26'52.9"	4	2316-2356
3	Transect 3	Muck disposal 3	90*26'47.7"	27*27'02.6"	11	2160-2326
4	Transect 4	Muck disposal 4	90*28'05.6"	27*27`57.4"	4	2221-2275
5	Transect 5	Muck disposal 4b	90*28'46.4"	28*27'59.1"	4	2229-2300
6	Transect 6	Muck disposal 5	90*28'21.7"	27*27'79.9"	7	2155-2247
7	Transect 7	Muck disposal 6	90*29'13.1"	27*29'36.0"	6	2177-2254
8	Transect 8	Power house area	90*28'51"	27*28'38.3"	26	1753-2215
	TOTAL				82	

Table 1: Transect locations and plot numbers

In addition to each survey, information on vegetation and wildlife was also collected during site visits to each individual site (dam site, power house site, muck disposal sites, adits) in 2012.

Dam Site Area

The Dam site area is at a place called Sibdizim. Along with the Dam, a Temporary office, Staff colony, Labour camps, stores and workshops will be constructed. An Access road of 3.5km will be built to this site. Two muck disposal sites as well as aggregate crushing plant and Batching and mixing plants are also located here.

The river bed level at the Dam Site is at an elevation of 2,262m upto 2500m. The vegetation at the dam site area is mostly evergreen oak forest mixed with higher altitude broadleaf species. The main tree species found in this area are *Quercus griffithii*, *Quercus lamellose*, *Quercus lanata*, *Persea clarkeana*,*Acer Campbellii*, *Alnus nepalensis*, *Betula alnoides*, *Erythrina arborescens*, *Lyonia ovalifolia*, *Persea bootanica*, *Juglans regia*. The second canopy comprises mostly of smaller trees like Rhododendron arboreaum, Daphne sureil, Persea clarkeana, interspersed with Pinus wallichiana, *Castanopsis hystrix* and smaller oaks.

The vegetation on both sides of the river is very similar since they are both at the same elevation. While the forest looks dense from the outside, the understorey is a not as dense as the tree cover does not give enough sunlight for the understorey to flourish.

The biodiversity survey conducted indicated that flora density was highest at the dam site with 41 species per 100 m². Some of the shrub species here are *Berberis aristata, Daphne sureil, Eurya acuminate, Ligustron confusum, Persea sp. Rubus ellipticus, Aconogonum mollee, Rhus chinensis, Sorbus species, Symplocus paniculata, Toricellia tilifolia,*. The ground cover is more

diverse and mainly dominated by comprises of *Artemesia and Arundinaria species, Elastostema platyphyllum, Eupatorium, Pilea species, Pteridium aquilinium, Elsholtzia fruticosa, Hedychium, Cautleya, Oxalis*, and many more. The following table shows the species that are expected to be submerged once the dam is constructed.

Adit 1 is about a km away from the Dam site. Access to adit will require clearance of 2.6km. Here the vegetation is similar to the dam site area and the top canopy is dominated by *Quercus griffithii, Quercus lamellose, Quercus lanata, Persea clarkeana, Alnus nepalensis, Betula alnoides, Persea species, Castanopsis hystrix* and *Rhododendron arboreaum*, The second canopy comprises mostly of smaller oak trees, *Daphne sureil, Persea clarkeana, Lyonia ovalifolia, Carpinus viminea, Viburnum, Berberis, Rubus, Hedysarum, Gaultheria, Aconogonum mollee, Eleocarpus, Ilex and Bamboo among others.* The Herb and ground cover comprises mostly of Ferns such as *Pteridium, Asplenium and Drymaria species. Eupatorium Crassocephalus crepidioides, Cynoglossum Hypericum, Gnaphalium. Potentilla, Artemesia, Desmodium, Arisaema, Leucas, Campylotropis, Galium, Anselia, Ophiopogon and Geranium are some of the more common ground cover species. Climbers such as <i>Vitis, Hemiphragma, Smilax* are also quite common.

Adit II

Adit II is located near Badela Chu, in Taktshang Nye area. The muck disposal site has been identified below the Highway, Access to adit II will require clearance of 2.6km. The forest is mostly broadleaved interspersed with Oaks. The dominant species here are At lower levels *Castanopsis hystrix and Castanopsis tribuloides, Quercus lamellose,*

Quercus. lanata, Quercus. Griffithii, Lyonia ovalifolia, Alnus nepalensis and Pinus wallichiana appear. The shrub layer comprises of Berberis aristata, Edgeworthia gardneri, Elsholtzia fruticosa, Eurya serrata, Eurya acuminate, Gaultheria fragrantissima, Viburnum cylindricum, Viburnum cylindricum Artemesia dubia Besser, Rubus ellipticus and Aconogonon molle. The ground cover comprises mostly of Anaphalis triplinervis, Ainsliaea aptera, Gentiana pedicellata, Girardiania diversifolia, Eupatorium odoratum, Fragaria nubicola, Persicaria nepalensis, Hedychium ellipticum, Hemiphragma herterophyllum and Pteridium aquilinum.

Adit III will be located north of Tangsibji village. The project proposes to widen the existing Tangsibji farmroad and extend it by 2.5km to the muck disposal site. The site is located close to human settlement (North of Tangsibji village) in an open and once grazing land of the community. There is a canal providing water for the micro-hydroelectricity project located below the National Highway, which also serves irrigation water for paddy cultivation for the major Tangsibji Geog.

The area is used as Sokshing (forest that is used for collection of leaf litter and pine needles). The dominant trees in this area are *Quercus glauca*, *Quercus griffithii*, *Quercus lanata*, *Rhododendron arboreum*, *Erythrina arborescens*, *Castanopsis hystrix*, *Lyonia ovalifolia*, *Rhus chinensis* interspersed with *Pinus wallichiana*.

The understorey and shrub layer is quite sparse and mainly dominated by smaller oak trees and Lyonia ovalifolia and Rhus chinensis. The dominant shrubs are Edgeworthia gardneri, Elsholtzia fruticosa, Eurya serrata, Gaultheria fragrantissima, Hedychium ellipticum, Hedysarum sikkimense, Saurauia napaulensis, Viburnum cylindricum, Viburnum cylindricum Artemesia dubia Besser, Rubus ellipticus, Aconogonon molle and Tetradium daniellii.

The ground cover comprises mostly of Cotoneaster microphylla, Anaphalis triplinervis, Ainsliaea aptera, Gentiana pedicellata, Girardiania diversifolia, Eupatorium odoratum, Fragaria nubicola, Persicaria nepalensis, Hedychium ellipticum, Halenia elliptica, Inula cappa, Hemiphragma herterophyllum and Pteridium aquilinum.

Adit 4 leads to muck disposal sites 4 and 5 which are just below the highway, so therefore the length of road required is only 990m. The Forest is mostly disturbed scrub forest and is also heavily used for grazing. The dominant tree species are *Alnus nepalensis, Quercus griffithii, Betula alnoides, Lyonia ovalifolia, Quercus lanata, Rhodendron* and *Benthamedia capitata.*

The shrub layer comprises of species like Rhus chinensis, smaller Quercus, Rhododendrons and Lyonia or Castanopsis trees. Other shrubs include Eurya serrata, Viburnum cylindricum, Hedysarum sikkimense, Aconogonon molle, Eupatorium odoratum and Rubus ellipticus.

The ground cover is mostly dominated by *Eupatorium adenophorum, Hedychium ellipticum, Cautleya gracilis, cirsium verutum, Bidens pilosa, Carex nubigena, Oxalis corniculata, Anaphalis triplinervis, Desmodium elegans* and *Pteridium aquilinium.*

Adit V. This is just below the national highway and therefore only 220m road will be required to be cleared. Species biodiversity here is not high as it's a highly disturbed scrub forest. The dominant trees are Alnus nepalensis, Lyonia ovalifolia, Quercus lanata, Quercus griffithii, *Erythrina arborescens,* Benthamedia capitata, Daphne sureil, Rhus chinensis, *Toricellia tiliifolia* and Rhododendron.

The shrub layer comprises of smaller trees of Alnus, Benthamedia, Rhododendrons, *Rhus chinensis, Berberis aristata, Elsholtzia fruticosa, Eurya acuminate, Eurya acuminate, Rosa brunonii, Arundinaria, Viburnum erubescens* and *Rubus ellipticus.*

The ground cover is sparse and comprises mostly of *Artemesia dubia Besser, Eupatorium* odoratum, Pteridium aquilinum, Anaphalis triplinervis, Carex nubigena, Desmodium elegans, *Fragaria nubicola, Hedychium ellipticum, Hedychium spicatum, Rubus ellipticus, Nepeta laevigata* and Ophiopogon intermedius.

The Power House complex is located approximately 300 m upstream to Mangdechhu dam, at Norbuodi. Although access road facilities constructed by Mangdechhu Hydropower Project shall be used as access, additional access to adits and powerhouse, labour camps, store and workshop, Power house colonies and Power house cavity will be constructed.

The elevation of the Power House Complex area ranges from 1810 to 2400m. Here the forest is mostly dominated by Broadleaf forest and Oaks such as *Quercus griffithii, Quercus lanata*.

Other dominant species are Alnus nepalensis, Betula alnoides, Rhododendron species, Erythrina arborescens, Juglans regia, Persea bootanica, Lyonia ovalifolia, Fraxinus, Albizia species, Magnolia, Ex-bucklandia populnea, Carpinus veminii, Macaranga species and Pinus wallichiana.

The middle-storey is dominated by small trees such as *Alnus nepalensis*, *Quercus griffithii*, *Quercus lanata*, *Rhododendrons*, *Erythrina arborescens*, *Docynia indica* and *Lyonia ovalifolia*. The shrub layer is dominated by *Arundinaria* species, *Eurya acuminata*. *Daphne sureil*, *Berberis aristata*, *Elaegnus parvifolia*, *Brassaiopsis mitis Clarke*, *Aconogonum mollee*, *Symplocus paniculata*, *Measa chisia*, *Viburnum erubescens*, *Solanum khasianum*, *Rubus ellipticus*, *Rosa brunoii*, *Girardiana diversifolia* and *Rhus chinensis*. The ground cover comprises mostly of *Desmodium elegans*, *Artemesia*, *Eupatorium odoratum*, *Hedychium ellipticum*, *Pilea anisophylla*, *Poa annua* and *Pteridium aquilinium* among others.

Data from the biodiversity surveys as well as the site visits have been compiled and summarized according to their abundance in the quadrats and during site visits.

Description	Class
0-25% of quadrats; sighted during site visit	Less Common
26-50% of quadrats	Common
51-75% of quadrats	Fairly abundant
>75% of quadrats	Abundant

Table 2. Abundance of species in each quadrat.

Table 3. Top Canopy plant species

No.	Scientific Name	Family	Habit	IUCN status
1	Acer campbellii	Aceraceae	Tree	N.A
2	Acer sikkimensis	Aceraceae	Tree	N.A
3	Alnus nepalensis	Betulaceae	Tree	N.A
4	Benthamidia capitata	Cornaceae	Tree	N.A
5	Betula alnoides	Betulaceae	Tree	N.A
6	Carpinus viminea	Betulaceae	Tree	N.A
7	Castanopsis hystrix	Fagaceae	Tree	N.A
8	Daphne sureil	Thymelaeaceae	Shrub	N.A
9	Docynia indica	Rosaceae	Tree	N.A
10	Erythrina arborescens	Fabaceae	Tree	N.A
11	Ex-bucklandia populnea	Hamamelidaceae	Tree	N.A
12	Ficus nerifolia	Moraceae	Tree	N.A
13	Fraxinus floribunda	Oleaceae	Tree	N.A
14	Juglans regia	Juglandaceae	Tree	Near Threatened
15	Lyonia ovalifolia	Ericaceae	Tree	N.A

No.	Scientific Name	Family	Habit	IUCN status
16	Macaranga pustulata	Euphorbiaceae	Tree	N.A
17	Magnolia campbellii	Magnoliaceae	Tree	N.A
18	Measa chisia	Myrinsinaceae	Shrub	N.A
19	Persea bootanica	Lauraceae	Tree	N.A
20	Persea clarkeana	Lauraceae	Tree	N.A
21	Pinus wallichiana	Pinaceae	Tree	Least Concern
22	Quercus glauca	Fagaceae	Tree	N.A
23	Quercus griffithii	Fagaceae	Tree	N.A
24	Quercus lamellosa	Fagaceae	Tree	N.A
25	Quercus lanata	Fagaceae	Tree	N.A
26	Quercus serrata	Fagaceae	Tree	N.A
27	Rhododendron arboreum	Ericaceae	Tree/Shrub	N.A
28	Rhododendron grande	Ericaceae	Tree	N.A
29	Rhodendron lindleyi	Ericaceae	Shrub	N.A
30	Rhus chinensis	Euphorbiaceae	Tree	N.A
31	Toricellia tiliifolia	Cornaceae	Tree	N.A
32	Tsuga dumosa	Pinaceae	Tree	Least Concern
33	Schima wallichii	Theaceae	Tree	N.A

Table 4. Middle canopy and shrub species

No.	Scientific Name	Family	Habit	IUCN status
1	Aconogonon molle	Polygonaceae	Shrub	N.A
2	Actinidia strigosa	Actinidiaceae	Shrub	N.A
3	Agapetes serpens	Ericaceae	Shrub	N.A
4	Aster albescens	Compositae	Shrub	N.A
5	Aralia sp.	Araliaceae	Shrub	N.A
6	Arundinaria gigantea	Pinaceae	Shrub	N.A
7	Berberis asiatica	Berberidaceae	Shrub	N.A
8	Berberis insignis	Berberidaceae	Shrub	N.A
9	Berberis praecipua	Berberidaceae	Shrub	N.A
10	Brassaiopsis mitis	Araliaceae	Shrub	N.A
11	Buddleja paniculata	Buddlejaceae	Shrub	N.A
12	Callicarpa macrophylla	Verbanaceae	Shrub	N.A
13	Campylotropis speciosa	Leguminosaceae	Shrub	N.A
14	Cassia tora	Caesalpinaceae	Shrub	N.A
15	Chirita urticifolia	Gesneriaceae	Shrub	N.A
16	Chromolaena odorata	Asteraceae	Shrub	N.A
17	Cotoneaster	Rosaceae	Shrub	N.A

No.	Scientific Name	Family	Habit	IUCN status
	microphyllus			
18	Cyathula capitata	Amaranthaceae	Shrub	N.A
19	Daphne bholua	Thymelaeaceae	Shrub	N.A
20	Daphne sureil	Thymelaeaceae	Shrub	N.A
21	Desmodium elegans	Fabaceae	Shrub	Least Concern
22	Edgeworthia gardneri	Thymelaeaceae	Shrub	N.A
23	Elatostema platyphullum	Urticaceae	Shrub	N.A
24	Eleagnus parvifolia	Elaeagnaceae	Shrub	N.A
25	Elsholtzia fruticosa	Lamiaceae	Shrub	N.A
26	Elshotlzia eriostachya	Lamiaceae	Shrub	N.A
27	Erythrina arborescens	Fabaceae	Tree	N.A
28	Eupatorium odoratum	Asteraceae	Shrub	N.A
29	Eurya acuminata	Theaceae	Shrub	N.A
30	Eurya serrata	Theaceae	Shrub	N.A
31	Gaultheria fragrantissima	Ericaceae	Shrub	N.A
32	Girardiania diversifolia	Urticacaeae	Shrub	N.A
33	Hedysarum sikkimense	Leguminosaceae	Shrub	N.A
34	Hypericum calycinum	Hyperiaceae	Shrub	N.A
35	Hypericum	Hyperiaceae	Shrub	ΝΔ
36	Indigofera dosua	Leguminosaceae	Shrub	N.A
37	Inula cappa	Compositae	Shrub	N.A
38	Inula hookeri	Compositae	Shrub	N.A
39	llex aquilinium	Aquifoliaceae	Shrub	N.A
40	Justicia adhatoda	Acanthaceae	Shrub	N.A
41	Leycesteria formosa	Caprifoliaceae	Shrub	N.A
42	Ligustrum indicum	Oleaceae	Shrub	N.A
43	Ligustrom compactum	Oleaceae	Shrub	N.A
44	Neillia rubiflora	Rosaceae	Shrub	N.A
45	Oenanthe javanica	Apiaceae	Shrub	Least Concern
46	Oxytropis williamsii	Leguminaceae	Shrub	N.A
47	Pilea pumila	Urticaceae	Shrub	N.A
48	Piper pedicellosum	Piperacea	Shrub	N.A
49	Photinia integrifolia	Rosaceae	Shrub	N.A
50	Rosa brunonii	Rosaceae	climbing Shrub	N.A
51	Rosa sericea	Rosaceae	Shrub	N.A
52	Rubus ellipticus	Rosaceae	Shrub	N.A
53	Rubus biflorus	Rosaceae	Shrub	N.A
54	Sarcocca saligna	Buxaceae	Shrub	N.A

No.	Scientific Name	Family	Habit	IUCN status
55	Saurauia napaulensis	Saurauiaceae	Tree/Shrub	N.A
56	Scutellaria discolor	Lamiaceae	Shrub	N.A
57	Smilax retusa	Smilacaceae	Climber	N.A
58	Sorbus microphylla	Rosaceae	Tree/Shrub	N.A
59	Symplocus paniculata	Symplocaceae	Shrub	N.A
60	Vaccinum nummularia	Ericaceae	Shrub	N.A
61	Viburnum cylindricum	Caprifoliaceae	Shrub	N.A
62	Viburnum erubescens	Caprifoliaceae	Shrub	N.A
63	Zanthoxylum oxyphyllum	Rutaceae	Shrub	N.A
64	llex aquilinium	Aquifoliaceae	Shrub	N.A

Table 5. Ground vegetation

No.	Scientific Name	Family	Habit	IUCN status
1	Ageratum adenophora	Asteraceae	Herb	N.A
2	Ageratum conyzoides	Asteraceae	Herb	N.A
3	Ainsliaea aptera	Asteraceae	Herb	N.A
4	Anaphalis busua	Compositae	Herb	N.A
5	Anaphalis triplinervis	Compositae	Herb	N.A
6	Arthraxon quartianus	Gramineae	Grass	N.A
7	Arabis laevigata	Cruciferae	Herb	N.A
8	Arisaema consanguineum	Araceae	Herb	N.A
9	Arisaema erubescens	Araceae	Herb	N.A
10	Artemisia indica	Asteraceae	Herb	N.A
11	Arundinaria sp.	Poaceae	Cane	N.A
12	Axonopus compressus	Gramineae	Grass	N.A
13	Bidens pilosa	Asteraceae	Herb	N.A
14	Borinda sp.	Poaceae	Grass	N.A
15	Brachiaria ramosa	Gramineae	Grass	Least Concern
16	Campanula colorata	Campanulaceae	Herb	N.A
17	Carex nubigena	Cyperaceae	Sedge	N.A
18	Cautleya gracilis	Zingiberaceae	Herb	N.A
19	Cirsium verutum	Asteraceae	Herb	N.A
20	Clinopodium umbrosum	Labiateae	Herb	N.A
21	Clintonia sp.	Liliaceae	Herb	N.A
22	Commelina benghalensis	Commelinaceae	Herb	Least Concern
23	Conyza candensis	Compositae	Herb	N.A
24	Conyza stricta	Compositae	Herb	N.A
25	Crassocephalium	Asteraceae	Herb	N.A

No.	Scientific Name	Family	Habit	IUCN status
	crepidioides			
26	Cyanotis cristata	Commelinaceae	Herb	Least Concern
27	Cyanotis vaga	Commelinaceae	Herb	N.A
28	Cynodon dactylon	Gramineae	Grass	N.A
29	Cynoglossum curcatum	Boraginaceae	Herb	N.A
30	Cyperus cyperiodes	Cyperaceae	Sedge	N.A
31	Digitaria ciliaris	Gramineae	Grass	N.A
32	Echinochloa colona	Gramineae	Grass	Least Concern
33	Eleusine indica	Gramineae	Grass	Least Concern
34	Eupatorium adepophorum	Asteraceae	Shrub	N A
35	Eagopyrum dibotrys	Polygonaceae	Herb	ΝΔ
36	Fragaria nubicola	Bosaceae	Herb	ΝΔ
37	Galium aparine	Bubiaceae	Horb	ΝΔ
38	Galium elegans	Bubiaceae	Herb	ΝΔ
39	Gentania nedicellata	Gentianaceae	Herb	ΝΔ
40	Geranium wallichianum	Geraniaceae	Herb	ΝΔ
41	Geranium procurrens	Geraniaceae	Herb	N A
42	Hedvchium ellipticum	Zingberaceae	Herb	N A
43	Hedychium spicatum	Zingiberaceae	Herb	N A
44	Halenia elliptica	Gentianaceae	Herb	N A
45	Impatiens sulcata	Balsaminaceae	Herb	N.A
46	Imperata cylindrica	Gramineae	Grass	NA
47	Juncus ochraceus	Juncaceae	Grass	N.A
48	l eucas ciliata	Lamiaceae	Herb	N.A
49	Leucas lanata	Lamiaceae	Herb	N.A
50	Lycopodium clavatum		club Moss	N.A
51	Nepeta laevigata	Lamiaceae	Herb	N.A
52	Gnaphalium hypoleucum	Asteraceae	Herb	N.A
53	Oplismenus burmannii	Poaceae	Grass	N.A
54	, Onhionogon intermedius	Liliagoago	Grass like	N A
55		Ovalidação	Horb	N A
56	Paspalum distichum	Gramineae	Grass	N A
00	Pennisetum	Grammodo	Giubb	14.7 (
57	clandestinum	Gramineae	Grass	N.A
58	Persicaria nepalensis	Polygonaceae	Herb	N.A
59	Persicaria runcinata	Polygonaceae	Horb	N.A
60	Pilea anisophylla	Urticaceae	Herb	N.A
61	Pilea umbrosa	Urticaceae	Grace	N.A
62	Poa annua	Gramineae	Glass	Least Concern

No.	Scientific Name	Family	Habit	IUCN status
63	Polypogon fugax	Gramineae	Grass	N.A
64	Potentilla indica	Rosaceae	Herb	N.A
65	Potentilla microphylla	Rosaceae	Herb	N.A
66	Primula denticulata	Primulaceae	Herb	N.A
67	Ranunculus diffusus	Ranunculaceae	Herb	N.A
68	Rubia manjith	Rubiaceae	Herb	N.A
69	Rumex nepalensis	Polygonaceae	Herb	N.A
70	Saussurea deltoidea	Asteraceae	Herb	N.A
71	Selaginella numularia	Selaginellaceae	spike Moss	N.A
72	Siegesbeckia orientalis	Compositae	Herb	N.A
73	Setaria pumila	Gramineae	Grass	N.A
74	Solanum khasianum	Solanaceae	Herb	N.A
75	Sphagnum Moss	Sphagnaceae	Moss	N.A
76	Strobilanthes wallichii	Acanthaceae	Herb	N.A
77	Taraxacum sp	Asteraceae	Herb	N.A
78	Thalictrum foliolosum	Ranunculaceae	Herb	N.A
79	Theropogon pallidus	Liliaceae	Herb	N.A
80	Thysanolena latifolia	Poaceae	Grass	N.A
81	Trifolium repens	Fabaceae	Herb	N.A
82	Urtica dioica	Urticaceae	Herb	N.A
83	Viola wallichiana	Violaceae	Herb	N.A

Table 6. Orchids

No.	Scientific Name	Family	IUCN status
1	Coelogyne corymbosa	Orchidaceae	N.A
2	Balbophyllum sp	Orchidaceae	N.A
3	Calanthe tricarinata	Orchidaceae	N.A
4	Chiloschista usneoides	Orchidaceae	N.A
5	Octochilus lanciliabius	Orchidaceae	N.A
6	Dendrobium candidum	Orchidaceae	N.A
7	Anthogonium gracile	Orchidaceae	N.A
8	Sunipia scariosa lindly	Orchidaceae	N.A
9	Satyrium nepalense	Orchidaceae	N.A
10	Plantanthera clavigera	Orchidaceae	N.A
11	Habenaria arietina	Orchidaceae	N.A
12	Spiranthes sinensis	Orchidaceae	N.A
13	Coelogyne raizadae	Orchidaceae	N.A

No.	Scientific Name	Family	IUCN status
14	Coelogyne shuttesii	Orchidaceae	N.A
15	Dendrobium porphyrochilum	Orchidaceae	N.A
16	dendrobium hookerianum	Orchidaceae	N.A
17	dendrobium longicornu	Orchidaceae	N.A
18	Otochilus fuscus	Orchidaceae	N.A
19	Otochilus lancilabius	Orchidaceae	N.A
20	Dendrobium sp.	Orchidaceae	N.A

Table 7. Ferns.

No.	Scientific Name	Family	Habit	IUCN status
1	Adiantum pedatum	Pteridaceae	Maidenhair Fern	N.A.
2	Asplenium trichomanes	Aspleniaceae	Maidenhair spleenwort	N.A.
3	Cystopteris protrusa	Dryopteridaceae	Fern	N.A.
4	Diplazium sp	Athyriaceae	Cliff Fern	N.A.
5	Drynaria sp	Polypodiaceae	basket Fern	N.A.
6	Osmunda sp.	Osmundaceae	Fern	N.A.
7	Oleandra wallichii	Oleandraceae	Fern	N.A.
8	Polystichum munitum	Dryopteridaceae	western swordFern	N.A.
9	Pteridium esculantum	Dennstaediaceae	Fern	N.A.
10	Pteridium aquilinum	Dennstaediaceae	Fern	N.A.

Table 8. Climbers

No.	Scientific Name	Family	Habit	IUCN status
1	Actinida callosa	Actinidiaceae	woody vine	N.A
2	Clematis buchananiana	Ranunculaceae	climbing stems	N.A
3	Cotoneaster microphyllus	Rosaceae	mat forming shrub	N.A
4	Dioscorea deltoides	Dioscoreaceae	climber	N.A
5	Hemiphragma herterophyllum	Scrophulariaceae	Herb/creeping plant	N.A
6	Herpetospermum pedunculosum	Curcurbitaceae	climbing plant	N.A
7	Hydrangea anomala	Hydrangeaceae	climbing shrub	N.A
8	Parthenocissus semicordata	Vitaceae	climber	N.A
9	Photinia integrifolia	Rosaceae	epiphytic shrub	N.A
10	Rosa brunonii	Rosaceae	climbing shrub	N.A
11	Rubia cordifolia	Rubiaceae	climber on shrub	N.A
12	Rubia manjit	Rubiaceae	climber	N.A

No.	Scientific Name	Family	Habit	IUCN status
13	Rubus paniculata	Rosaceae	climbing shrub	N.A
14	Senecio scandens	Compositae	climber	N.A
15	Smilax mytillus	Smilacaceae	climber	N.A
16	Smilax retusa	Smilacaceae	climber	N.A
17	Vitis sp	Vitaceae	woody climber	N.A
18	Zanthoxyllum oxyphyllum	Rutaceae	woody climber	N.A
19	Periploca calophylla	Periplocaceae	liana	N.A
20	Hemiphragma heterophyllum	Scrophulariaceae	creeping plant	N.A
21	Senecio scandens	Asteraceae	climber	N.A
22	Smilax mytillus	Smilacaceae	climber	N.A

Fungi

During the field survey, the following pictures show the fungi that were encountered were photographed for further identification.

Amanita sp.

Laetiporus sp.



Trichaptum abietnum

Lycopodon sp.



Xeromphalina campanella

Unidentified sp.





WILDLIFE

39% of the plots had some sign of wildlife in them. The most abundant sign was that of Barking deer, followed by Wild Pigs, Sambar and Monkeys. Wild pig and Macaques were also directly sighted during field visits. Barking deer, Wild pigs and monkeys are considered as pests by some farmers due to crop damage. Other significant species that were not encountered during the survey but are present in the area include the Tiger, Common leopard, Wild Dogs, Serow, Sloth bear, Macaques, Otters, Porcupines and Langurs.

Plot No.	T1a	T1b	T2	Т3	T4	Т5	Т6	T7	T8a	T8b	Total
1	D(f)	0	0	D(f)	0	0	0	0	D(f) S(f)	D(f)	4
2	0	D(f)	0	0	D(f)	0	0	0	S(f)	wp(rp)	4
3	D(f)	D(f)	0	0	0	0	0	D(f)	M(s)	wp(rp)	5
4	B(e)	0	0	wp(w)	0	0	0	D(f)	D(d)	0	4
5	wp(r)	D(d)		0			0	0	wp(rp)	wp(r)	4
6	0	0		0			0	0	0	0	0
7	D(f)	0		0			D(f)		0	0	2
8	D(d)	D(f)		D(f)					D(f)	0	4
9	0	D(f)		0					wp(r)	wp(wp)	3
10	0	0		0					D(f)	JF(d)	2
11				0						0	0
12										0	0
13										0	0
14										0	0
15										0	0
16										0	0
	6	5	0	3	1	0	1	2	8	6	32
Total Plots	10	10	4	11	4	4	7	6	10	16	82

Table 9. Plots and wildlife signs in transects

Legend:

D(f): Barking deer (footprints) B(e): Black Bear (eating signs) D(d) Barking deer (droppings) WP(w): Wild pig (wallowing signs) WP(r): Wild pig (rooting) WP (rp): Wild Pig (resting place) S(f): Sambar (footprints) S(d): Sambar (droppings) M(s): Monkey (sighting) JF(d): Jungle fowl (dropping)
Assamese macaques



Pit viper



Table	10:	Birds	in	the	pro	ject	site
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SI. No.	Common name	Scientific Name	IUCN status
1	Ashy-throated Warbler	Phylloscopus pulcher	Least Concern
2	Black drongo	Dicrurus macrocercus	Least Concern
3	Black throated tit	Aegithalos concinnus	Least Concern
4	Blue Whistling Thrush	Myophonus caeruleus	Least Concern
5	Chestnut-tailed Minla	Minla strigula	Least Concern
6	Chestnut-crowned Laughingthrush	Garrulax erythrocephalus	Least Concern
7	Eurasian Jay	Garrulus glandarius	Least Concern
8	Great Barbet	Megalaima virens	Least Concern
9	Green-backed Tit	Parus monticolus	Least Concern
10	Grey-headed canary Flycatcher	Culicicapa ceylonensis	Least Concern
11	Grey-backed Shrike	Lanius tephronotus	Least Concern
12	Hill Partridge	Arborophila torqueola	Least Concern
13	Hill Prinia	Prinia atrogularis	Least Concern
14	Large-billed Crow	Corvus macrorhynchos	Least Concern
15	Lemon-rumped warbler	Phylloscopus proregulus	Least Concern
16	Gould's Sunbird	Aethopyga gouldiae	Least Concern
17	Nepal House Martin	Delichon nipalensis	Least Concern
18	Olive-backed Pipit	Anthus hodgsoni	Least Concern
19	Oriental turtle Dove	Streptopelia orientalis	Least Concern
20	Plumbeous Water- redstart	Rhyacornis phaenicuroides	N.A
21	Red-vented Bulbul	Pycnonotus cafer	Least Concern
22	Rufous-bellied Niltava	Niltava sundara	Least Concern
23	Rufous Sibia	Heterophasia capistrata	Least Concern
24	Russet Sparrow	Passer rutilans	Least Concern
25	Short-billed Minivet	Pericrocotus brevirostris	Least Concern
26	Spotted Forktail	Enicurus maculatus	Least Concern
27	Striated Laughingthrush	Garrulax striatus	Least Concern
28	Streaked Laughingthrush	Garrulax lineatus	Least Concern
29	Verditer Flycatcher	Eumyias thalassina	Least Concern
30	White-tailed Nuthatch	Sitta himalayensis	Least Concern
31	Whiskered Yuhina	Yuhina flavicollis	Least Concern
32	Whistler's Warbler	Seicerus whistleri	N.A
33	White -throated Fantail	Rhipidura albicollis	Least Concern
34	White Wagtail	Motacilla alba	Least Concern
35	Yellow-bellied Fantail	Rhipidura hypoxantha	Least Concern
36	Yellow-billed Blue Magpie	Urocissa flavirostris	Least Concern

SI. No.	Common name	Scientific Name	IUCN status
37	Yellow-browed Tit	Sylviparus modestus	Least Concern

HUMAN INFLUENCE

There are many threats to wildlife, but human-related activities are the main threats. For each plot and transect, the human influence in the area was recorded one of four categories from 0 (no disturbance) to 4 (very High) disturbance.

- 0: None (no grazing, fire, logging)
- 1 Low Undisturbed forest but with a few signs of human presence can be found
- 2: Medium Fairly undisturbed under-story vegetation but with some signs of human presence.
- 3: High Forest is grazed, trees cut and under-story vegetation disturbed
- 4: Very High: Very disturbed and degraded wildlife habitat and highly disturbed under-story vegetation due to grazing, human signs, lopping of trees

Disturbance category	Plots	% of plots
No disturbance	17	21
Low disturbance	3	4
Medium Disturbance	0	0
High Disturbance	23	28
Very High disturbance	39	48
	82	

Table 11. Disturbance in various plots

Over 75% of the plots were in disturbed areas indicating high signs of grazing, cutting of trees, collection of firewood or leaves for fodder. One reason for the high disturbance could be due to the sites already being heavily visited by the project staff.

No.	Scientific Name	Family	Habit
1	Acer campbellii	Aceraceae	Tree
2	Acer hookeri*	Aceraceae	Tree
3	Aconogonon molle	Polygonaceae	shrub
4	Actinida callosa	Actinidiaceae	woody vine
5	Adiantum pedatum	Pteridaceae	Maidenhair Fern
6	Agapetes serpens	Ericaceae	shrub
7	Ageratum conyzoides	Asteraceae	Herb
8	Ainsliaea aptera	Compositae	Herb
9	Albizia julibrissin	Mimosaceae	Tree
10	Alnus nepalensis	Betulaceae	Tree
11	Anaphalis busua	Asteraceae	Herb
12	Anaphalis triplinervis	Asteraceae	Herb
13	Anemone rivularis	Ranunculaceae	Herb
14	Anthogonium gracile	Orchidaceae	Orchid
15	Arisaema consanguineum	Araceae	Herb
16	Arisaema erubescens	Araceae	Herb
17	Arisaema nepenthiodes*	Araceae	Herb
18	Aristolochia griffithii*	Aristolochiaceae	Herbs(climber)
19	Artemisia indica	Asteraceae	shrub
20	Arthraxon quartianus	Gramineae	Grass
21	Arundinaria sp.	Poaceae	Cane
22	Asplenium sp.	Aspleniaceae	Fern
23	Asplenium trichomanes	Aspleniaceae	Maidenhair spleenwort
24	Aster albescens	Compositae	Shrub
25	Axonopus compressus	Gramineae	Grass
26	Balbophyllum sp	Orchidaceae	Orchid
27	Begonia spp.*	Begonaceae	Herb
28	Benthamidia capitata	Cornaceae	Tree
29	Berberis aristata	Berberidaceae	Shrub
30	Berberis insignis	Berberidaceae	Shrub
31	Berberis praecipua	Berberidaceae	shrub
32	Betula alnoides	Betulaceae	Tree
33	Bidens pilosa	Asteraceae	Herb
34	Borinda sp.	Poaceae	Grass
35	Brachiaria ramosa	Gramineae	Grass
36	Calanthe tricarinata	Orchidaceae	Orchid
37	Campylotropis speciosa	Leguminosaceae	Shrub
38	Capillepedium assimile	Poaceae	Grass
39	Carex sp.	Cyperaceae	Sedge
40	Carpinus veminii	Corylaceae	Tree
41	Cassia tora	Caesalpinaceae	shrub
42	Castanopsis hystrix	Fagaceae	Tree
43	Cautleya gracilis	Zingiberaceae	Herb
44	Chiloschista usneoides	Orchidaceae	Orchid
45	Chromolaena odorata	Asteraceae	Shrub
46	Cirsium verutum	Asteraceae	Herb

Table 12: Plants that will be submerged by the dam construction

No.	Scientific Name	Family	Habit
47	Clematis buchananiana	Ranunculaceae	climbing stems
48	Coelogyene corymbosa	Orchidaceae	Orchid
49	Coelogyne raizadae	Orchidaceae	Orchid
50	Coelogyne shuttesii	Orchidaceae	Orchid
51	Cotoneaster microphyllus	Rosaceae	Shrub
52	Crassocephalium crepidioides	Asteraceae	Shrub
53	Cyanotis cristata	Commelinaceae	Herb
54	Cyanotis vaga	Commelinaceae	Herb
55	Cyathula capitata	Amaranthaceae	Shrub
56	Cynoglossum furcatum	Boraginaceae	Herb
57	Cyperus cyperiodes	Cyperaceae	Sedge
58	Cystopteris protrusa	Dryopteridaceae	Fern
59	Daphne bholua	Thymelaeaceae	Shrub
60	Daphne sureil	Thymelaeaceae	Shrub
61	Datura suaveolens	Solanaceae	Shrub
62	Dendrobium candidum	Orchidaceae	Orchid
63	Dendrobium hookerianum	Orchidaceae	Orchid
64	Dendrobium longicornu	Orchidaceae	Orchid
65	Dendrobium porphyrochilum	Orchidaceae	Orchid
66	Desmodium elegans	Fabaceae	Shrub
67	Dichrocephala integrifolia	Asteraceae	Herb
68	Dioscorea deltoides	Dioscoreaceae	climber
69	Diplazium sp.	Athyriaceae	Fern
70	Drynaria sp	Polypodiaceae	basket Fern
71	Drynaria Propinqua*	Polypodiaceae	Fern
72	Dryopteris spp.*	Dryopteridaceae	Fern
73	Elastotema platyphyllum	Urticaceae	Shrub
74	Elsholtzia fruticosa	Lamiaceae	Shrub
75	Elshotlzia eriostachya	Lamiaceae	Shrub
76	Enkianthus deflexus*	Ericaceae	shrub
77	Eria spp.*	Orchidaceae	orchids
78	Erythrina arborescens	Fabaceae	Tree
79	Eupatorium adenophorum	Asteraceae	Shrub
80	Eupatorium odoratum	Asteraceae	Herb
81	Eurya acuminata	Theaceae	shrub
82	Fagopyrum dibotrys	Polygonaceae	Herb
83	Ficus spp.*	Moraceae	climber
84	Fragaria nubicola	Rosaceae	Perennial Herb
85	Galinsoga parviflora	Asteraceae	Herb
86	Galium aparine	Rubiaceae	Herb
87	Gaultheria fragrantissima	Ericaceae	Shrub
88	Gentania pedicellata	Gentianaceae	Herb
89	Geranium nepalensis	Geraniaceae	Herb
90	Geranium procurrens	Geraniaceae	Herb
91	Geranium wallichianum	Geraniaceae	Herb
92	Girardiania diversifolia	Urticacaeae	Shrub
93	Gnaphalium hypoleucum	Asteraceae	Herb

No.	Scientific Name	Family	Habit
94	Gonanthus pumilus	Araceae	Herb
95	Habenaria arietina	Orchidaceae	Orchid
96	Halenia elliptica	Genrianaceae	Herb
97	Hedychium ellipticum	Zingiberaceae	Herb
98	Hedysarum sikkimense	Leguminosaceae	shrub
99	Hemiphragma herterophyllum	Scrophulariaceae	Herb/creeping plant
100	Herpetospermum pedunculosum	Curburbitaceae	Climber
101	Hottuynia cordata	Saururaceae	Herb
102	Hydrangea anomala	Hydrangeaceae	shrub
103	Hypericum calycinum	Hyperiaceae	shrub
104	llex aquilinium	Aquifoliaceae	shrub
105	Impatiens edgeworthii	Balsaminaceae	Herb
106	Impatiens stenantha*	Balsaminaceae	Herb
107	Isodon coetsa	Lamiaceae	Herb
108	Juglans regia	Juglandaceae	tree
109	Leucas ciliata	Lamiaceae	Herb
110	Leycesteria formosa*	Caprifoliaceae	Herb
111	Ligustrom confusum*	Oleaceae	Shrub
112	Listera(Neottia) pinetorum*	Orchidaceae	Orchids
113	Lonicera spp.*	Caprifoliaceae	Herb
114	Lycopodium clavatum*	Lycopodiaceae	Fern
115	Lycopodium serrata*	Lycopodiaceae	Fern
116	Lyonia ovalifolia	Ericaceae family.	Tree
117	Macaranga pustulata	Euphorbiaceae	Tree
118	Merrilliopanax alpinus*	Araliaceae	shrub
119	Monotropastrum humile*	Orobanchaceae	Herb
120	Neillia rubiflora	Rosaceae	Shrub
121	Nepeta laevigata	Lamiaceae	Herb
122	Nephrolepsis cordifolia*	Dryopteridaceae	Fern
123	Octochilus lanciliabius	Orchidaceae	Orchid
124	Oenanthe javanica	Apiaceae	Shrub
125	Oleandra pistillaris*	Oleandraceae	Fern
126	Oleandra wallichii	Oleandraceae	Fern
127	Onychium siliculosum*	Pteridaceae	Fern
128	Ophiopogon intermedius	Liliaceae	Grass like plant
129	Osbeckia nepalensis	Melastomataceae	Herb
130	Osmunda sp.	Osmundaceae	Fern
131	Otochilus fuscus	Orchidaceae	Orchid
132	Otochilus lancilabius	Orchidaceae	Orchid
133	Oxalis corniculata	Oxalidaceae	Herbaceous plant
134	Oxytropis williamsii	Leguminaceae	Shrub
135	Paris polyphylla*	Trilliaceae	Herb
136	Parthenocissus semicordata	Vitaceae	climber
137	Periploca calophylla	Periplocaceae	liana
138	Persea bootanica	Lauraceae	Tree
139	Persea clarkeana	Lauraceae	Tree
140	Persicaria nepalensis	Polygonaceae	Herb

No.	Scientific Name	Family	Habit
141	Persicaria runcinata	Polygonaceae	Herb
142	Philadelphus spp.*	Hydrangeaceae	shrub
143	Photinia integrifolia	Rosaceae	epiphytic shrub
144	Pilea anisophylla	Urticaceae	Herb
145	Pilea umbrosa	Urticaceae	Herb
146	Pinus wallichiana	Pinaceae	Tree
147	Piper mellesua	Piperacea	Shrub
148	Plagiogyria spp.*	Plagiogyriaceae	Fern
149	Plantanthera clavigera	Orchidaceae	Orchid
150	Poa annua	Gramineae	Grass
151	Polypogon fugax	Gramineae	Grass
152	Polystichum munitum	Dryopteridaceae	western swordFern
153	Potentilla indica	Rosaceae	Herb
154	Potentilla microphylla	Rosaceae	Perennial Herb
155	Primula denticulata	Primulaceae	Herb
156	Pteridium aquilinum	Polypodiaceae	Fern
157	Pteridium esculantum	Dennstaediaceae	Fern
158	Polystricum nepalensis*	Dryopteridaceae	Fern
159	Pyrola spp.*	Pyrolaceae	Herb
160	Pyrrosia boothii	Polypodiaceae	Fern
161	Quercus griffithii	Fagaceae	Tree
162	Quercus lamellosa	Fagaceae	Tree
163	Quercus lanata	Fagaceae	Tree
164	Rhododendron arboreum	Ericaceae	Tree/shrub
165	Rhododendron grande	Ericaceae	Tree/shrub
166	Rhododendron edgeworthii	Ericaceae	Shrub
167	Rhododendron grifithianum	Ericaceae	Shrub
168	Rhododendron dalhousiae var rhabdotum	Ericaceae	Shrub
169	Rhododendron lindleyi	Ericaceae	Shrub
170	Rhododendron camilliflorum	Ericaceae	Shrub
171	Rhus chinensis	Euphorbiaceae	shrub
172	Ribes spp.*	Grossulariaceae	Shrub
173	Rosa brunonii	Rosaceae	climbing shrub
174	Rosa sericea	Rosaceae	Herb
175	Roscoea alpina*	Rosaceae	Herb
176	Rubia cordifolia	Rubiaceae	climber on shrub
177	Rubia manjit	Rubiaceae	Herb
178	Rubus ellipticus	Rosaceae	shrub
179	Rubus paniculata	Rosaceae	shrub
180	Rumex nepalensis	Polygonaceae	Herb
181	Satyrium nepalense	Orchidaceae	Orchid
182	Schima wallichii	Theaceae	Tree
183	Schefflera impressa*	Araliaceae	Shrub
184	Schisandra neglecta*	Schisandraceae	Herb/climber
185	Scurrula elata*	Loranthaceae	Herb
186	Selaginella numularia	Selaginellaceae	spike Moss
187	Selinum wallichianum (DC)*	Umbelliferae	Herb

No.	Scientific Name	Family	Habit
188	Senecio scandens	Asteraceae	Hard climber
189	Smilacina spp.*	Liliaceae	Herb
190	Smilax mytillus	Smilacaceae	climber
191	Smilax retusa	Liliaceae	Climber
192	Solanum khasianum	Solanaceae	Herb
193	Sorbus microphylla	Rosaceae	Small tree/shrub
194	Sphagnum Moss	Sphagnaceae	Moss
195	Spiranthes sinensis	Orchidaceae	Orchid
196	Streptopus simplex	Liliaceae	Herb
197	Strobilanthes wallichii	Acanthaceae	Herb
198	Sunipia scariosa lindly	Orchidaceae	Orchid
199	Symplocus paniculata	Symplocaceae	shrub
200	Symplocus sumantia*	Symplocaceae	Shrub
201	Tetradium fraxinifolium*	Rutaceae	Tree
202	Thalictrum foliolosum	Ranunculaceae	Herb
203	Thalictrum virgatum	Ranunculaceae	Herb
204	Theropogon pallidus	Liliaceae	Herb
205	Toricellia tiliifolia	Cornaceae	Tree
206	Triflorum repens	Leguminosea	Herb
207	Tsuga dumosa	Pinaceae	Tree
208	Tupistra nigra*	Asparagaceae	Herb
209	Urtica dioica	Urticaceae	shrub
210	Vaccinum nummularia	Ericaceae	Shrub
211	Viburnum cylindricum	Caprifoliaceae	shrub
212	Viburnum erubscens	Caprifoliaceae	shrub
213	Vitis sp	Vitaceae	woody vine
214	Viola bhutanica Hara*	Violaceae	Herb
215	Vittaria spp.*	Vittariaceae	Fern
216	Vinecetoxicum hirundinaria*	Asclepiadaceae	Herb
217	Zanthoxyllum oxyphyllum	Rutaceae	woody climber

(All species are from both banks, but * are additional species recorded from right bank of river/park side)

B. Biodiversity report for Transmission Line

Background: The proposed 132kV transmission line with 18.6Km and 19.2Km respectively is aligned mostly in the Government Reserved land/forest with few numbers of towers falling under private land and community forest. The first and the preferred route with 18.6Km is diverted via Raphey top crossing the existing 66kV line at Tower No.7 & T8.

Along the alignment for the Transmission line a total of 74 plots were randomly selected at intervals of approximately 250m each. Within these plots, data was collected on vegetation, wildlife, birds as well as additional information on signs of disturbance were noted. 80% of the alignment fell under broadleaf forest, while 15% was in Scrub forest and the remaining 3% in agricultural land or community forest or crossing footpath or road.



Graph 1: Land use along transmission line

Below is a brief description of how the vegetation changes as one proceeds along the transmission line alignment (From TL 1to TL 56). The typical structure of these forests includes the following layers: a top canopy comprising of tall mature trees; a shade-tolerant middle canopy comprising smaller mature trees; shrub layer, comprising mostly woody or herbaceous plants; followed by the ground cover.

Within the Warm broadleaf forest, the dominant trees are Oaks, especially Quercus griffithii, Quercus Lamellosa and Quercus Lanata. Other species include Alnus nepalensis, Docynia indica, Juglans regia, Lyonia ovalifolia, Exbucklandia populnea, Daphne phyllum, Symplocus ramossima, Maesa chisea and Daphne bholua. The middle shrub layer comprises mostly of younger tree species of Quercus, Rhododendrons, Symplocus and other species like Ardisia macrocarpa, Berberis aristata, Brassaiopsis mitis, Dichroa fibrifuga, Toricella tiliifolia, Daphne bholua, Leucosceptrum, Viburnum cylindricum, Cinnamomum bejolghota, Samraria nepalensis and Arundinaria. The ground species include mostly common species like Artemisia vulgaris, Eupatorium adenophorum, Inula cappa, Rubus ellipticus and Urtica parviflora. There are also

climbers like Hedera nepalensis, Agapetes serpens, Orchids, and ferns like Pteridium aquilinium, Diplazium esculentum, Drynaria and Pteris wallichiana. Grass species include Poa annua, Anthraxon, Borinda, Cynodon dactylon and Cyperus cyperoides.

Moving further onwards towards TL14, the vegetation is not as dense as it passes close to the Mangdechu Dam colony area and the Taktse Community Forest. Here the oaks are not as dominant but other tree species such as *Castanopsis hystrix, Daphnephyllum, Ex-bucklandia populnea, Symplocus ramossima, Symplocus glomerta, Lyonia ovalifolia, Maesa chisia, Rhododendron arboretum, Toricellia tiliifolia, Prunus cerasoides, Alnus nepalensis and Viburnum* are found. The middle lower trees and shrubs comprise of *Viburnum cylindricum, Eurya acuminata, Dichroa fibrifuga, Daphne bholua* and *Berberis aristata*. The ground vegetation is dominated largely by *Eupatorium adenophorum, Anaphalis triplinervis, Ancelia aptera, Cirsium falconeri* and ferns like *Pteridium aquilinium, Diplazium esculentum, Pteris wallichiana* and other species like *Smilax, Solanum virginianum* and *Swertia chirata*. Orchids like *Cymbidium, Otochilus lanciliabius, Dendrobium candidium,* and *Coelogyne* are also found.

Continuing onwards towards TL25, other trees species such as *Michelia doltsopa, Prunus cerasoides, Persea bootanica, Rhus wallichii,* and Oaks (*Quercus griffithii, Quercus glauca, Quercus semicarpifolia, Quercus lanata*) are observed again with *Sympolocus, Lyonia ovalifolia, Exbucklandia populnea, Maesa chisia* and Rhododendrons. The middles storey is almost the same as before but also including species like *Nellia rubiflora, Lindera pulcherra, Viburnum cylindricum, Edgeworthia gardneri, Ilex aquilinium,* and *Cotoneaster microphyllus.* Additional ground species observed include *Tupistra chinensis, Solanum khasianum, Smilax ovalifolia, Raphidophora, Hemiphragma heterophyllum, Inula cappa, Pilea umbrosa, Potentilla fruticosa, Lycopodium clavatum, Glienchenia gigantean, Vanda cristata and Oleandra pistillaris and Otochilus species.*



Photo 1: Photo showing forest cover along TL

The density of trees is much lower moving towards TL42 as the forest is mostly scrub forest with fewer trees and scantier understory and barren land. Tree species are mostly *Quercus lanata, Quercus semicarpifolia, Quercus griffithii, Alnus nepalensis, Rhus wallichii, Maesa chisia, Lyonia ovalifolia, Castanopsis hystrix, Docynia indica, Symplocus ramossima, Exbucklandia populnea, Rhododendron and Schima wallichii. The scanty shrub layer comprises mostly of Artemisia vulgaris, Eupatorium adenophorum, Rubus ellipticus, Berberis aristata, Maesa chisia, Leucoceptrum species, Zanthoxylum and Indigofera dosua. Even the ground vegetation is scanty comprising mainly of Pteridium aquilinium, Eupatorium adenophorum, Osbeckia stellata, small Rhododendrons, Anaphalis triplinervis, Artemisia vulgaris, Rubus ellipticus and some grass species like Poa annua and Arthraxon species.*



Photo 2: Photo showing vegetation cover along TL

From TL40, the TL passes through private land, plantation forest and scrubland interspersed with forest land. The main trees species are *Castanopsis hystrix, Lyonia ovalifolia, Quercus lanata, Symplocus ramossima, Pinus roxburghii* and *Schima wallichii*. As the elevation drops and the climate is warmer, the vegetation becomes more sub-tropical, with species like *Duabanga grandiflora, Alnus nepalensis, Bischofia javanica, Rhus chinensis, Pinus roxburghii, Ficus roxburghii, Ficus semicordata*, and *Quercus lanata* in Langthel and Yurmo. Overall tree density is not very high along the TL, with a maximum of 14 trees per 100 m².

Shrubs include Berberis aristata, Ardisia macrocarpa, Edgeworthia gardneri, Dichroa fibrifuga, Viburnum erubescens, Mahonia nepalensis, Brassaiopsis mitis, Daphne bholua, Viburnum cylindricum, Maesa chisia, Eurya acuminatum, Rhododendron arboreum, Symplocos glomerata, Viburnum cylindricum, Ilex species, Cotoneaster microphylla, Elaeagnus parvifolia,

Rubus ellipticus, Eupatorium adenophorum, Zanthoxylum species,. Vaccinium myrtillus, Rhododendron vaccinoides, Indigofera dosua, Aconogonum molle, Datura suaveolens, Adhatoda vasica and Arundinaria species

Herbs include Artemisia vulgaris, Artemisia indica, Leucas ciliata, Inula cappa, Leucosceptrum species, Eupatorium adenophorum, Urtica parviflora, Anaphalis triplinervis, Cirsium falconeri, Solanum virginianum, Smilax ovalifolia, Swertia chirata, Pilea umbrosa, Ainsliaea aptera, Elatostema platyphyllum, Hedychium ellipticum, Elshotzia fruticosa, Osbeckia stellata, Oxalis corniculata, Pilea anisophylla, Colocasia esculenta and Pilea umbrosa.

Ground cover includes Polygonum runcinatum, Hydrocotlye javanica, Fragaria nubicola, lycopodium clavatum (moss), Poa annua (turf grass), Hemiphragma heterophyllum (creeping plant), Potentilla fruticosa, Potentilla microphylla, Tupistra chinensis, Osbeckia stellata, selaginella sp (spike moss),

Climbers include Raphidophora species, Hedera nepalensis and Agapetes serpens. Ferns include Diplazium esculentum, Pteris wallichiana, Oleandra pistillaris, Glienchenia gigantean, Pteridium aquilinium and Drynaria propinqua, Adiantum caudatum, Asplenium sp.

Orchids include *Calanthe* sp, *Eria coronaria*, *Phalaenopsis* sp. *Vanda cristata*, Cymbidium cyperifolium, *Gastrochilus* sp., and *Dendrobium candidum*, Coelogyne corymbosa and Bulbophyllum sp.

Mushrooms that can be found there include Amanita sp., *Lactarius piperatus, Laetiporus* sp., *Lycoperdon* sp., *Trichaptum abietinum, Boletus sp., Laccaria sp., Ramaria sp.*A list of all species recorded is provided in the Annex.

Human influence/disturbance of the forest

The main threat to forest cover and integrity is human activity. In each surveyed plot, the level of human influence in the area was recorded according to the following categories:

- 0: None (no grazing, fire, logging);
- 1: Low (undisturbed forest, but with a few signs of human presence);
- 2: Medium (fairly undisturbed under-story vegetation, but with some signs of human presence);
- 3: High (forest is grazed, trees cut and under-story vegetation disturbed); and,
- 4: Very High (very disturbed and degraded habitat; highly disturbed under-story vegetation due to grazing, human activities, lopping of trees).

The most significant finding from the field assessment was that in all plots Disturbance was rated as 'High'. This reflects the high use of the site for grazing, cutting of trees, collection of firewood or leaves for fodder. This is examined further below. Basically, the TL extends from

below and the moves above the National Highway from Trongsa to Zhemgang, and all along the Transmission line alignment, it criss crosses access roads to the Mangdechhu project Dam Axis site runs parallel to the 66KV and 400 KV lines or crosses some footpath.

Tower location	Elevation	Accessibility/Adjacent structures along TL		
Pothead	2040	Mangdechhu dam site, take off point		
OOP1	2067	below national Highway, near grazing land		
TL6	2110	Mangdechhu dam axis Road, old footpath		
TL7	2060	opposite mangdechu dam colony		
TL8	2047	parallel to existing 66KV, T60, T61		
TL9	2035	above Highway, Crossing 66KV		
TL10	2054	Access road to Mangdechu Dam colony area		
TL12	2126	Mangdechu Dam colony top and Taktse Road, old footpath		
TL13	2247	Road to cremation ground, Approach road to Taktse College, old footpath		
TL21	2104	Parallel to 66KV		
TL24	2091	Above 66KV line		
TL27- TL42	2060	Access road to Samcholing MSS school and Kuengarabten Nunnery Centre		
TL40	2156	under Taktse community forest		
TL43- TL50		Old footpath, Approach road to Mangdechu Surge shaft		
TL52	1488	Parallel to 400KV/D/C line, private land		
TL53	1426	Crossing 400KV D/C line		
TL54	1296	Parallel to 400KV/D/C line, private land		
TL55	1295	Parallel to 400 KV, D/C line		
TL56	1238	Parallel to 400 KV, D/C line		

Table 1: Proximity to access roads and other structures along TL

The field assessment concluded that the project area does not contain any pristine forest as the entire area has been heavily grazed by the cattle, or used for collection of leaf litter, or revegetated recently as community forests.

Photo 3: Photos along transmission line



The picture shows the alignment of the existing 66kV line. The proposed 132kV line is aligned parallel to this line just above it. The picture below shows the same 66kV line and the access road to the Mangdechhu colony below it.



Photo 4: The village and the Highway just below the TL



Photo 5 and 6: The vegetation and forest cover along the proposed alignment



No.	Scientific Name	Family	Habit
1	Aconogonon molle	Polygonaceae	Shrub
2	Adhatoda vasica	Acanthaceae	Shrub
3	Agapetes serpens	Ericaceae	semiclimbing shrub
4	Ainsliaea aptera	Compositae	Herb
5	Alnus nepalensis	Betulaceae	Tree
6	Anaphalis busua	Compositae	Herb
7	Anaphalis triplinervis	Compositae	Herb
8	Ardisia macrocarpa	Myrisinaceae	Shrub
9	Artemesia vulgaris	Asteraceae	herb
10	Artemisia indica	Asteraceae	Herb
11	Arundinaria sp.	Poaceae	Cane
12	Asplenium sp.	Aspleniaceae	fern
13	Berberis aristata	Berberidaceae	Shrub
14	Berberis praecipua	Berberidaceae	Shrub
15	Bischofia javanica	Bischofiaceae	Tree
16	Brassaiopsis mitis	Araliaceae	Shrub
17	Bulbophyllum affine	Orchidaceae	Orchid
18	Calanthe sp.	Orchidaceae	Orchid
19	Castanopsis hystrix	Fagaceae	Tree
20	Cautleya gracilis	Zingiberaceae	Herb
21	Cinnamomumm bejolghota	Lauraceae	Tree
22	Cirsium falconeri	Asteraceae	Herb
23	Cirsium verutum	Asteraceae	Herb
24	Coelogyene corymbosa	Orchidaceae	Orchid
25	Cotoneaster microphyllus	Rosaceae	Shrub
26	Cymbidium cyperifolium	Orchidaceae	Orchid
27	Cyperus Cyperoides	Cyperaceae	Grass
28	Daphne bholua	Thymelaeaceae	Shrub
29	Daphniphylluim calycinum	Daphniphyllaceae	Shrub
30	Daphniphyllum sp.	Daphniphyllaceae	Tree
31	Datura suaveolens	Solanaceae	Shrub
32	Dendrobium candidum	Orchidaceae	Orchid
33	Dichroa febrifuga	Hydrangeacea	shrub
34	Diplazium esculentum	Athyriacea	fern
35	Docynia indica	Rosaceae	Tree
36	Duabanga grandiflora	Sonneratiaceae	Tree
37	Edgeworthia gardneri	Thymelaeaceae	Shrub
38	Eleagnus parvifolia	Elaeagnaceae	Shrub

Table 2: List of Plant species recorded from Project site

No.	Scientific Name	Family	Habit
39	Eria coronaria	Orchidaceae	Orchid
40	Erythrina arborescens	Leguminaceae	Tree
41	Eupatorium adenophorum	Asteraceae	Herb
42	Eupatorium odoratum	Asteraceae	Shrub
43	Eurya acuminata	Theaceae	T/S
44	Eurya acuminata	Theaceae	Shrub
45	Exbucklandia populnea	Hamamelidaceae	Tree
46	Ficus roxburghii	Moraceae	Tree
47	Ficus semicordata	Moraceae	Tree
48	Fragaria nubicola	Rosaceae	Herb
49	Gastrochilus	Orchidaceae	Orchid
50	Gleichenia gigantea	Glienchianaceae	Fern
51	Hedera nepalensis	Araliaceae	Climber
52	Hemiphragma heterophyllum	Scrophulariaceae	creeping plant
53	Hydrocotlye javanica	Apiaceae	Herb
54	llex aquifolium	Aquifoliaceae	Shrub
55	Indigofera dosua	Leguminosaceae	Shrub
56	Inula cappa	Asteraceae	Herb
57	Juglans regia	Juglandaceae	Tree
58	Leucas ciliata	Lamiaceae	Herb
59	Lindera pulcherrima	Lauraceae	Tree/Shrub
60	Lindera pulcherrima	Lauraceae	Tree/Shrub
61	Lycopodium clavatum	Lycopodiaceae	club Moss
62	Lycopodium clavatum	Lycopodiaceae	Moss
63	Lyonia ovalifolia	Ericaceae	Tree
64	Measa chisia	Myrinsinaceae	Shrub
65	Michelia doltsopa	Magnoliaceae	Tree
66	Mikania micrantha	Asteraceae	vine
67	Neillia rubiflora	Rosaceae	Shrub
68	Oleandra pistillaris	Oleandraceae	Fern
69	Ophiopogon wallichianus	Convallariaceae	herb
70	Osbeckia stellata	Melastomataceae	Herb
71	Persea bootanica	Lauraceae	Tree
72	Persea clarkeana	Lauraceae	Tree
73	Phalaenopsis sp.	Orchidaceae	Orchid
74	Pilea umbrosa	Urticaceae	Herb
75	Pinus roxburghii	Pinaceae	Tree
76	Poa annua	Poaceae	grass
77	Polygonum runcinatum	Polygonaceae	Herb
78	Potentilla indica	Rosaceae	weedy plant

No.	Scientific Name	Family	Habit
79	Potentilla microphylla	Rosaceae	Herb
80	Prunus cerasoides	Rosaceae	Tree
81	Pteridium aquilinum	Dennstaedtiaceae	Fern
82	Pteris wallichiana	Pteridaceae	Fern
83	Quercus glauca	Fagaceae	Tree
84	Quercus griffithii	Fagaceae	Tree
85	Quercus lamellosa	Fagaceae	Tree
86	Quercus lanata	Fagaceae	Tree
87	Quercus semicarpifolia	Fagaceae	Tree
88	Rhododendron arboreum	Ericaceae	tree
89	Rhus chinensis	Anacardiaceae	Tree
90	Rhus wallichii	Anacardiaceae	Tree
91	Rubus ellipticus	Rosaceae	Shrub
92	Sauraria nepalensis	Saurariceae	Tree
93	Schima wallichii	Theaceae	Tree
94	Selginella	Selaginellaceae	Spikemoss
95	Senecio scandens	Asteraceae	Climber
96	Smilax myrtilus	Smilacaceae	Climber
97	Solanum khasianum	Solanaceae	Herb
98	Sorbus microphylla	Rosaceae	Shrub
99	Swertia chirata	Gentianaceae	Herb
100	Symplocos glomerata	Symplocaceae	Tree/Shrub
101	Symplocos paniculata	Symplocaceae	Shrub
102	Symplocos ramosissima	Symplocaceae	tree/shrub
103	Toricellia tiliifolia	Torricelliaceae	Tree
104	Tupistra sp.	Convallariaceae	Herb
105	Urtica dioica	Urticaceae	Herb
106	Urtica parviflora	Urticaceae	Heb
107	Vaccinium myrtillus	Ericaceae	Shrub
108	Vanda cristata	Orchidaceae	Orchid
109	Viburnum cylindricum	Axodaceae	Shrub
110	Viburnum erubescens	Axodaceae	Shrub
111	Yushinia microphylla	Poaceae	Bamboo
112	Zanthoxylum armatum	Rubiaceae	Tree
113	Zanthoxylum oxyphyllum	Rutaceae	Shrub

Wildlife

A wide variety of fauna inhabits the forested areas in Trongsa due to its high forest cover and diversity in elevation and forest types.

During the Biodiversity survey, the study of faunal distribution and its occurrence was conducted by looking at specific plots of 10x10m, every 250m along a transect running parallel to the Transmission line. Within each plot, observations on Visual observation of wildlife signs (rooting, feeding, resting, fecal droppings, foot prints, or wildlife sounds were recorded. Also, during public consultation meetings, additional information on wildlife presence was also discussed.

From a total of 74 plots, wildlife signs were found in 23 plots. Species signs that were observed during mammalsurveys include those of Sambar Deer (footprints), Barking Deer (sighted, as well as foot prints and dung), Wild Pigs (resting/wallowing place, footprints) and Assamese Macaque (sighted). All of these four species are considered as pest species and responsible for crop damage and endless sleep for farmers who spend hours protecting their crops from these species.





Plot No.	Wildlife species	Sign type	No. of signs
1	Wild pig	resting pl.	1
2	Barking deer	dung	1 clump
7	Barking deer	dung	1 clump
7	Wild pig	rooting	1
8	Wild pig	rooting	1
9	Barking deer	footprint	3
12	Barking deer	dung	1
19	Barking deer	footprint	3
25	Wild pig	rooting	1
30	Wild pig	rooting	1
32	Jungle fowl	scratching	many
33	Sambar	footprint	4
34	Barking deer	spotted	1
37	Wild pig	resting place	1
38	Wild pig	rooting	1
39	Barking deer	footprint	1
44	Wild pig	Rooting	1
45	Wild pig	wallowing	1
46	Wild pig	rooting	1
49	Wild pig	wallowing	1
52	Wild pig	nesting	1
55	Wild pig	rooting	1
60	Wild pig	footprint	1
65	Wild pig	rooting	1
	TOTAL plots		23

Table 3: Types of wildlife signs found during biodiversity survey

Much of the lower slopes in the Project area comprises of Agricultural Land. In the warmer Broad-leaved Forest that occurs along the Trongsa – Zhemgang Road there are signs of high anthropogenic disturbances including heavy grazing and lopping so signs of wildlife are much lower.

Based on the forest type and lower level of disturbance higher up on the slopes, the rarer and more elusive species like Leopards, Bears, Capped Langur, Goral, Gray Langur, Himalayan Black Bear, Indian Porcupine, Little Himalayan Rat, Jungle Cat, Leopard Cat and Otter are expected.

No.	Common Name	Scientific Name	Expected in project area	Status in Bhutan	IUCN status
1	Leopard	Panthera pardus	Yes	Sch-I	Near threatened
2	Clouded Leopard	Neofelis nebulosa	Yes	Sch-I	Least Concern
3	Leopard Cat	Prionailurus bengalensis	Yes	Sch-I	Least Concern
4	Asiatic Black Bear	Ursus thibetanus	Yes	Sch-I	Vulnerable
5	Wild pig	Sus scrofa	Yes		Least Concern
6	Wild dog	Cuon alpinus	Yes		Least Concern
7	Barking deer	Muntiacus muntjak	Yes		Least Concern
8	Sambar	Cervus unicolor	Yes		Least Concern
9	Indian crested porcupine	Hysterix indica	Yes		Least Concern
10	Grey langur	Semnopithecus entellus	Yes		Least Concern
11	Tiger	Panthera tigris tigris	Yes	Sch-I	Endangered
12	Goral	Naemorhedus goral	Yes		Near threatened
13	Indian gray mongoose	Herpestes edwardsii	Yes		Least Concern
14	Bengal fox	Vulpes bengalensis	Yes		Least concern
15	Assamese macaque	Macaca assamensis	Yes		Near threatened
16	Capped Langur	Trachypithecus pileatus	Yes		Vulnerable
17	Himalayan Serow	Capricornis thar	Yes		Near threatened
18	Jungle cat	Felis chaus	Yes		Least concern
19	Yellow-throated Marten	Martes flavigula	Yes		Least concern
20	Gaur	Bos gaurus	Yes	Sch-I	Vulnerable
21	Little Himalayan Rat	Niviventer eha	Yes		Least concern

Table 4:	Status of Wildlife	present in the	project area.
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Schedule I* means that the species is included in the Schedule I of the Species and Nature Conservation Act of Bhutan.

** The project area is taken to mean within about 5 km of the specific project component footprints.

Given the presence of the National Highway, the extent of degraded forests and the cleared RoW, and level of human disturbance, it is expected that this area is much less important to the rarer wildlife compared to the undisturbed great expanse of suitable habitat on the higher more remote altitudes away from the villages and the highway

Birds

At total of 123 species of birds were recorded in and around the Project site. These are presented in the table. From these the Rufous-necked Hornbill (Aceros nipalensis) is listed as Vulnerable in IUCN and a totally protected species listed in Schedule-I of the Forest and Nature Conservation Act, 1995. The Satyr Tragopan and the Yellow-rumped Honeyguide are both listed as 'Near threatened' in the IUCN Red List. All of these three species were recorded once during the field survey, the Stayr Tragopan near the Taktse Community Forest area, and the Yellow-rumped Honeyguide and the Rufous-necked Hornbill (2 Male and 1 Female) near the top of Kuengrabten.



Graph 3: Frequency of bird occurrence along transects

Many of the species that are found in the project site fall in the "Least Concern" category. These include Thrushes, Bulbuls, Laughing thrushes, Robins, Tree pies, Eagles, Mynas, Minlas, Fulvetta, Honeyguides, Leafbird, Magpie, Fantails, Warblers, Babblers, Pigeon, Wallcreeper, Prinia, Fork tail, Sparrow, Crows, Redstarts, Pheasants and many more.

S/No	Common Name	Scientific Name	Status in Bhutan	IUCN status
1	Aberrant Bush Warbler	Cettia flavolivacea		LC
2	Ashy Wood Pigeon	Columba pulchricollis		LC
3	Ashy-throated Warbler	Phylloscopus maculipennis		LC
4	Asian Brown Flycatcher	Muscicapa dauurica		LC
5	Barred Cuckoo-dove	Macropygia unchall		LC
6	Black Bulbul	Hypsipetes leucocephalus		LC
7	Black Redstart	Phoenicurus ochruros		LC
8	Black-faced Laughingthrush	Garrulax affinis		LC
9	Black-tailed Crake	Amaurorius bicolor		LC
10	Black-throated Tit	Aegithalos concinnus		LC
11	Blue Whistling Thrush	Myophonus caeruleus		LC
12	Blue-fronted Redstart	Phoenicurus frontalis		LC
13	Blue-throated Barbet	Magalaima asiatica		LC
14	Blyth's Leaf Warbler	Phylloscopus reguloides		LC
15	Brownish-flanked Bush Warbler	Cettia fortipes		LC
16	Chestnut-bellied Rock-thrush	Monticola rufiventris		LC
17	Chestnut-crowned laughingthrush	Garrulax erythrocephalus		LC
18	Chestnut-crowned Warbler	Seicercus castaniceps		LC
19	Chestnut-tailed Minla	Minla strigula		LC
20	Chestnut-tailed Starling	Strunus malabaricus		LC
21	Collared Owlet	Glaucidium brodiei		LC
22	Oriental Scops Owlet	Otus sunia		LC
23	Common Buzzard	Buteo buteo		LC
24	Common Hoopoe	Upupa epops		LC
25	Common Kestrel	Falco tinnunculus		LC
26	Common Myna	Acridotheres tristis		LC
27	Common Quail	Conturnix conturnix		LC
28	Common Tailorbird	Orthotomus sutorius		LC
29	Coral-billed Scimitar-babbler	Pomatorhinus ferruginosus		LC
30	Himalayan cutia	Cutia nipalensis		LC
31	Darjeeling Woodpecker	Dendrocopos darjellensis		LC
32	Dark-throated Thrush	Turdus ruficollis		LC
33	Eurasian Jay	Garrulus glandarius		LC
34	Eurasian Tree Sparrow	Passer montanus		LC
35	Eurasian Treecreeper	Certhia familiaris		LC
36	Eurasian Woodcock	Scolopax rusticola		LC
37	Golden-throated Barbet	Magalaima franklinii		LC
38	Great Barbet	Magalaima virens		LC

Table 5: List of birds recorded in project site

39	Greater Necklaced Laughingthrush	Garrulax pectoralis	LC
40	Green-backed Tit	Parus monticolus	LC
41	Green-tailed Sunbird	Aethopyga nipalensis	LC
42	Grey Bushchat	Saxicola ferreus	LC
43	Grey Treepie	Dendrocitta formosae	LC
44	Grey Wagtail	Motacilla cinerea	LC
45	Grey-backed Shrike	Lanius tephronotus	LC
46	Grey-headed Canary Flycatcher	Culicicapa ceylonensis	LC
47	Grey-hooded Warbler	Phylloscopus xanthoschistos	LC
48	Grey-winged Blackbird	Turdus boulboul	LC
49	Hill Partridge	Arborophila torqueola	LC
50	Hill Prinia	Prinia atrogularis	LC
51	Hoary-throated Barwing	Actinodura nipalensis	LC
52	Hodgson's Redstart	Phoenicurus hodgsoni	LC
53	Kalij Pheasant	Lophura luecomelanos	LC
54	Large Niltava	Niltava grandis	LC
55	Large-billed Crow	Corvus macrorhynchos	LC
56	Lemon-rumped Warbler	Phylloscopus proregulus	LC
57	Lesser necklaced Laughingthrush	Garrulax monileger	LC
58	Little Bunting	Emberiza pusilla	LC
59	Little Forktail	Enicurus scouleri	LC
60	Little-pied Flycatcher	Ficedula westermanni	LC
61	Long-tailed Minivet	Pericrocotus ethologus	LC
62	Long-tailed Shrike	Lanius schach	LC
63	Long-tailed Thrush	Zoothera dixoni	LC
64	Maroon-backed Accentor	Prunella immaculata	LC
65	Mountain Bulbul	Hypsipetes mcclellandii	LC
66	Mountain Hawk-eagle	Nisaetus nipalensis	LC
67	Olive-backed Pipit	Anthus hodgsoni	LC
68	Orange-flanked Bush Robin	Tarsiger cyanurus	LC
69	Oriental Magpie-robin	Copsychus saularis	LC
70	Oriental Turtle Dove	Streptopelia orientalis	LC
71	Plain-backed Thrush	Zoothera mollissima	LC
72	Plumbeous Water Redstart	Rhyacornis fuliginosa	LC
73	Pygmy Wren Babbler	Pnoepyga pusilla	LC
74	Red-billed Chough	Pyrrhocorax pyrrhocorax	LC
75	Red-headed Bullfinch	Pyrrhula erythrocephala	LC
76	Red-vented Bulbul	Pycnonotus cafer	LC
77	Rock Pigeon	Columbia livia	LC
78	Rufous-bellied Niltava	Niltava sundara	LC
79	Rufous-breasted Accentor	Prunella strophiata	LC

80	Rufous-capped Babbler	Stachyris ruficeps		LC
81	Rufous-gorgeted Flycatcher	Ficedula strophiata		LC
82	Rufous-necked Hornbill	Aceros nipalensis	Sch-I	V
83	Rufous sibia	Heterophasia capistrata		LC
84	Rufous-vented Yuhina	Yuhina occipitalis		LC
85	Rufous-winged Fulvetta	Alcippe castaneceps		LC
86	Russet Sparrow	Passer rutilans		LC
87	Rusty-cheeked Scimitar -babbler	Pomatorhinus erythrogenys		LC
88	Rusty-flanked Treecreeper	Certhia nipalensis		LC
89	Satyr Tragopan	Tragopan satyra		near Threatened
90	Scaly Thrush	Zoothera dauma		LC
91	Scaly-breasted Munia	Lonchura punctulata		LC
92	Scarlet Minivet	Pericrocotus flammeus		LC
93	Slaty-backed Forktail	Enicurus schistaceus		LC
94	Slender-billed Scimitar Babbler	Xiphirhynchus superciliaris		LC
95	Small Niltava	Nitava macgrigoriae		LC
96	Solitary Snipe	Gallinago solitaria		Lc
97	Speckled Wood Pigeon	Columba hodgsonii		Lc
98	Spotted Forktail	Enicurus maculatus		LC
99	Streak-breasted Scimitar Babbler	Pomatorhinus ruficollis		LC
100	Striated Bulbul	Pycnonotus striatus		LC
101	Striated Laughingthrush	Garrulax striatus		LC
102	Striated Prinia	Prinia crinigera		LC
103	Stripe-throated Yuhina	Yuhina gularis		LC
104	Ultramarine Flycatcher	Ficedula superciliaris		LC
105	Verdicter Flycatcher	Eumyias thalassinus		LC
106	Wallcreeper	Tichodroma muraria		LC
107	Wedge-tailed Green Pigeon	Treron sphenurus		LC
108	Whiskered Yuhina	Yuhina flavicollis		LC
109	Whistler's Warbler	Scicercus whistleri		LC
110	White Wagtail	Motacilla alba		LC
111	White-browed Bush Robin	Tarsiger indicus		LC
112	white-browed fulvetta	Alcippe vinipectus		LC
113	White-capped Water Redstart	Chaimarrornis leucocephalus		LC
114	White-collared Blackbird	Turdus albocinctus		LC
115	White-throated Fantail	Rhipidura albicollis		LC
116	White-throated Laughingthrush	Garrulax albogularis		LC
117	Yellow-bellied Fantail	Rhipidura hypoxantha		LC
118	Yellow-billed Blue Magpie	Urocissa flavirostris		LC
119	Yellow-rumped Honeyguide	Indicator xanthonotus		near threatened

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120	Orange bellied leafbird	Chloropsis hardwickii	LC
121	Nepal Fulvetta	Alcippee nipalensis	LC
122	Orange bellied leafbird	Chloropsis hardwickii	LC
123	Nepal Fulvetta	Alcippee nipalensis	LC

Other orders

Till date no specific surveys have been specifically conducted on Amphibians and Reptiles in Trongsa dzongkhag. Thus there is no baseline information on species that thrive there. During the field surveys, snakes such as Pit viper (*protobothrops*) and Green rat snake (*Ptyas nigromarginata*) were recorded from the Nikachhu project area. Amphibians are usually found in moist places and near water bodies. Flat tailed Gecko (*Hemidactylus platyurus*) and the common Garden lizard (*Calotes versicolor*) can also be found there. Lizards found in Mangdechu include Eastern green calotes (*Calotes jerdoni*), Draco (*Draco dussumieri*), Green Keelback (*Macropisthodon plumbicolor*), Banded Krait (*Bungarus fasciatus*), Python (*Python molurus*) and Common skink (*Mabuya carinata*). (MHPA, no date).

The tadpole could belong to an *Amolops* sp. since this group of frogs inhabits mountain rapids. Other species of frogs spotted in the Mangdechu area include East Asian Tree Frog (*Polypedates leucomystax*), Giant tree frog (*Rhacophorus maximus*), Himalayan torrent frog (*Amolops marmoratus*), Himalayan bull frog (*Pea leibigii*), Tree frog (*Polypedates spp.*) and Leaping frog (*Rama erythraea*) (MHPA, no date).

There is a good diversity of Macro invertebrates at the project site. These include Flies (Diptera), Beetles such as the Rhinoceros beetle, dung beetle, Ladybird, Stag beetle, (Coleoptera), Grasshoppers and Crickets (Orthopterans), Aphids (Hemiptera), Stoneflies (Plecoptera), Mayflies (Ephemeroptera), Caddis flies (Trichoptera), Dragonflies and damselfly (Megaloptera), Moths and Butterflies (Lepidoptera), Bees and Wasps and Ants (Hymenoptera), Spiders (Araneae), Leeches (Clitellata), Ticks (Acarina) and Worms (Oligochaeta).

49 species of butterflies were reported from the Mangdechhu area. These are mainly from the families Papilionidae, Nymphalidae, Pieridae, Hesperidea and Lyeaenidae.

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Photos from the survey

Photo 1: Aureoboletus thibetanus

Photo 2: Calocera viscosa



Photo 3: Gomphus floccossus

Photo 4: Ramaria botrytis





Photo 5: damsite vegetation

Photo 6: Rosa sericea



Photo 9: Snake among vegetation



Photo 11: Cymbidium sp.

Photo 12: Butterfly on Dulhadea cappa



Annex I: Aquatic Report

A Report on the Aquatic Biodiversity Survey of Nikachu and Mangdechu Hydropower Project Areas

1. INTRODUCTION

Assessment of pre-project biodiversity status and environmental integrity of any area is critical to understand the impact of developmental project. While the BHUCORE had conducted the environmental assessment for Nikachu and Mangdechu hydropower project areas as part of ESIA for Nikachu Hydropower Project, there was a need to supplement the BHUCORE assessment, Aquatic biodiversity of the recommended sites was conducted in the first week of December 2012 by staff from the College of Natural Resources. The focus of the survey was to assess the ichthyo-fauna, macroinvertebrates, and zooplankton diversity. Attempt was also made to assess the quality of water using macroinvertebrates along with other physical parameters of water. Besides, other habitat parameters at sampling sites were also studied. For the assessment of the fish fauna however, the survey timing was not the best, but this survey provided opportunity to assess the aquatic biodiversity of the waters in the project areas during the cold season.

2. METHODOLOGY AND BASELINE DATA

2.1 Study areas and sampling sites

The survey was carried out in the proposed Nikachu Hydropower Project area and ongoing Mangdechu Hydropower project (MHPP) area as these two projects are cascade projects whereby the water from Nikachu tailrace is to be released above the Mangdechu dam . The area was divided into four sections, viz., section above Nikachu dam site, section between Nikachu dam site and Mangdechu-Nikachu confluence, section between Mangdechu dam site and Mangdechu-Nikachu confluence, and section between Mangdechu-Nikachu confluence and M HPP tailrace tunnel. Eight sampling sites were chosen within the four sections so as to be able to monitor the impact of project on the aquatic ecology during project implementation and also after commissioning of the project. Besides these eight sites, three additional sites were also

sampled to help make the sampling more comprehensive. Figure 1 gives the location of sampling sites and table 1 gives the distribution and coordinates of sampling sites within different sections.



Figure 1. Distribution of sampling sites.

Table 1. Sampling sites along with coordinates.

Sections	Sampling Site No.	Coordinates	Remarks
1. Above Nikachu	Site 1	N27°26′54.04″	
Dam Site		E090°22'23.96"	
2. Between Nikachu	Site 2	N27º26'55.54"	
Dam Site & Mangdechu-		E090°22'26.26"	
Nikachu Confluence	Site 3	N27º26'00.57"	
		E090°27'47.40"	
3. Between	Site 4	N27º28'58.07"	150 m below Mangdechu
Mangdechu Dam site &		E090°29'28.03"	ADIT2
Mangdechu-Nikachu	Site 5	N27º26'02.11"	
Confluence		E090°27'99.04"	
4. Between	Site 6	N27º22'00.78"	
Mangdechu-Nikachhu		E090°32'04.06"	
Confluence & Mangdechu	Site 7	N27º21'43.14"	At Mangdechu tailrace
Tailrace		E090°32′52.79″	tunnel.
	Site 8	N27º21'18.88"	
		E090°33'40.08"	
5. Additional sites	Site 9	N27º22'00.14"	Yurmong stream
		E090°32'07.85"	
	Site 10	N27°29'23.95"	Above Mangdechu
		E090°29'47.20"	diversion channel
	Site 11	N27°28'32.73"	Chendebji stream
		E090°21'01.04"	

2.2 Water and habitat parameters in and around sampling sites

Water and habitat parameters which are important to aquatic biodiversity were assessed at all the sampling sites. The physical parameters of water and habitat parameters are dealt separately below.

2.2.1 Physical parameters of water: The tests were conducted in the field using HANNA pH/EC/TDS/Temperature meter, HI 991300 for conductivity, TDS and water temperature. The water temperature was also measured using thermometer. The relative humidity and air temperature was measured using HANNA HI9564-HI9565 portable water resistant thermo hygrometer. The pH and chemical parameters could not be measured due to lack of chemicals and equipments. Still than the parameters were not felt so necessary to be measured as BHUCORE's initial report found the parameters much below the upper acceptable limits of national standards laid by NEC.

The conductivity varied between $82-110\mu$ S/cm, water temperature between $5-12^{\circ}$ C, TDS between 41-56ppm, air temperature from $9.2-24.4^{\circ}$ C and relative humidity between 42.6-66.1%. There were no any unusual values of these parameters, and the values spread between expected values corresponding to the time of the day these parameters were measured and the altitude of the sites (Table 2).

Parameters						Sites					
	1	2	3	4	5	6	7	8	9	10	11
Conductivity (µm/s)	82	82	117	*	90	*	105	110	*	*	*
TDS (ppm)	41	41	57	*	44	*	52	56	*	*	*
Water Temp.(°C)	7	7	9	7.5	9	5	10.5	12	9.5	7.9	5.5
Air Temp. (°C)	9.2	9	18.3	13.4	21.2	17.7	18.7	24.4	17.5	16.9	9.3
Humidity (%)	60.5	60.3	42.6	66.1	44.4	52.8	52.7	45.1	55.7	48.4	70.3
Altitude (m)	2251	2177	1466	1818	1390	1014	990	977	1080	1782	2433
Sampling time	2.40	3.50	11.30	10.50	12.30	3.30	1.45	10.45	3.00	12.10	4.05
	pm	pm	am	pm	pm	pm	pm	am	pm	pm	pm
Sampling date	1/12/	1/12/	2/12/1	4/12/	2/12/	3/12/	3/12/	3/12/	3/12/	4/12/	4/12/
	12	12	2	12	12	12	12	12	12	12	12

Table 2. Physical parameters of water at different sites with altitude, date and time of sampling.

*Parameters were not measured.

2.2.2 Habitat parameters: In-river habitat parameters like river microhabitats (pools, riffles, runs and cascades), nature of river bottom particles, presence of logs or large woody debris and naturally-occurring organic materials(leaves and twigs) in the rivers, and water appearance were visually assessed and recorded into field record sheets at each site. Likewise, the river bank and channel characteristics like river bank and the channel shape, river width, depth and velocity, along with riverside cover and presence of any human land-use within estimated distance of 50 meters from the river bank for about a distance of 100 meters along the river bank at each site were also recorded in the field data sheet.

The microhabitats along both rivers at sampling sites were mainly riffle with side pools, while site 2 below Nikachu dam had mixed of riffle, pool, run and cascade, site 3 (above Nikachu-Mangdechu confluence) had characteristically cascade stretching almost about 200 meters, and the site 10 (above Mangdechu diversion tunnel) had cascade and short waterfalls. When it comes to the nature of bottom particles the sites had mixed of silt, sand, gravel, cobbles and boulders with maximum components being gravels, cobbles and boulders. The sites 1, 2,4,5,6 and 10 had also bedrock as the stream bottom component. Almost all the sites also had logs or large woody debris and naturally-occurring organic materials. The water appearance was clear in all the sites, except at site 5 between Mangdechu dam and Mangdechu-Nikachu confluence, where the water appearance changed from clear to very turbid within 10 to 15 minutes from the time of sampling probably due to release of muck at the worksites above the sampling site.

The river bank and the channel shape were mainly steeply sloping (> 30°) at all the sites. It was measured using clinostat. Also, all the sites, except sites 9 and 11 had certain portions of the bank on both the sides or on one side of the river with vertical/undercut banks. The estimated average river width of Nikachu at different sites ranged between 14-30 meters, while that of Mangdechu ranged between 20-30 meters. The estimated depths ranged from 1.5-3 meters at Nikachu sites and 1.5-3.5 meters in Mangdechu. The velocity of the rivers at their thalweg ranged from 1m/s to 2.5m/s. There was minimal land-use by human along both the rivers at all the sites. But the sites 3 and 5 were being used by people of Tshangkha village for grazing and site 8 had terrace on the right bank and suspension bridge across the Mangdechu. The other sites (4, 6, 7 and 9) had ongoing works of MHPP. Besides, the site 9 (Yurmong stream) was being dammed and channelized for the construction of new bridge, and site 11 (Chendebji stream) has
national highway crossing across it. The streamside cover along almost all the sites was mainly of trees along with tall grasses and ferns. Boulders and rocks were also prominent features along the banks. The vegetation types and major trees found along the sites are discussed below under section 2.2.3.

2.2.3 Vegetation structures found beside the sampling sites: Around sites 1 & 2 the vegetation were predominantly of Quercus lamellosa, Q. glauca, Rhododendron spp., Symplocus sp., Tetradium sp., and bamboo. These species were mostly of the members of the cool broadleaved forest species. In the sites 3 and 5 around the confluence area of Mangdechu and Nikachu, the vegetation was mostly of the warm broadleaved forest consisting of Schima wallichii, Rhus chinensis, Rhododendron arboreum, Symplocus sp., Quesrcus griffithii, Talauma hodgsonii, Indigofera dosua and bamboo. In the Langthel and Yurmong areas where sites 6, 7 and 8 were located, the vegetation primarily consisted of the subtropical species like the Duabanga grandiflora, Alnus nepalensis, Bischofia javanica, Rhus chinensis, Datura suaveolens, Adhatoda vasica, Opuntia vulgaris, Pinus roxburghii, Ficus roxburghii, F. semicordata, and Quercus lanata.

2.3 Aquatic Diversity

The major focus of the aquatic diversity was on fish, macroinvertebrates and zooplanktons. The following subsections discuss materials and method used for the study along with taxonomic diversity of the three principal groups of organisms under this study along with other organisms sighted during the survey or whose signs of presence were sighted at the sampling sites.

2.3.1 Materials and method: A combination of convenience and purposive survey methods was used for the assessment of aquatic diversity in the study areas. For fish sampling, cast net and seine net were used for generic species collection but for the benthic species single hook was used. In case of macroinvertebrates we used D-frame net to sample and for planktons the sampled water was filtered through 30-µm mesh net and the net was flushed with 4% formalin into the sample collection bottles. The identification of fishes and macroinvertebrates were done using appropriate guide books and literatures available in the field itself, and identification of macroinvertebrates were aided by use of field microscopes. But for the zooplanktons we fixed and preserved samples in 4% formalin and were identified in laboratory

using high power microscopes. Besides, samples of macroinvertebrates were fixed in 10% formalin and preserved in 70% alcohol for further identification and confirmation in the laboratory.

2.3.2 Fish diversity: The water was cold, ranging from 7°C to 12°C, in the sampling sites during the survey (Table 3). Post monsoon seasonal migration of fishes from high water to warm water region was over. Yet the following species of fishes were sampled from different sampling sites during the survey:

Schizothorax richardsonii, the local Snow trout or the Asala (Figure 2), was the most abundant fish species found during the biodiversity survey. This species was collected from many sampling sites of Mangdechu (site 5, 6, 7 & 8). However, in the sampling sites 4 and 9, the sites



Figure 2: Schizothorax richardsonii

below and above Mangdechu dam site respectively, the presence of fish was not detected which could be attributed to high disturbances, especially due to muck getting into the river or due to use of explosives. While this species is not known to be a migratory species, it does exhibit seasonal movement – entering smaller tributaries during monsoon and returning back to deep water in post monsoon.

In the Nikachu sites 1 and 2, except the site near the confluence of Mangdechu and Nikachu (site 3 & 5), Brown trout (Salmo truta)-figure 3, was found but not the Asala. The Yurmong stream site (site 9) had several juveniles of S. richardsonii, measuring 7–21 cm in length. This indicates that small tributaries of Mangdechu are breeding grounds for this fish species. However,

fingerlings of S. richardsonii were found in the stagnated or shallow pools of water beside the main stretch of Mangdechu (site 8). The specimen collected from the Mangdechu had ovaries with mature eggs. This indicates that the Asala continues to



Figure 3: Salmo truta

breed over the winter season as well, perhaps taking

advantage of low water volume in the rivers.

Two juvenile specimens of Schistura sp. and Psilorhynchus homaloptera (figure 4) were

collected from a pool near the sampling site 8. These benthic species are subtropical species and are mostly found in warm waters, primarily inhabiting small rivers and streams. However, other associate species of the warm water were missing in the pool. The pool was at about a km below the Mangdechu HPP tailrace tunnel.



Figure 4: Psilorhynchus homaloptera

3.2.2 Macroinvertebrates Diversity: All the sampling sites were rich in macroinvertebrates (Figure 5 & Table 3). The most common and abundant macroinvertebrates were of orders Plecoptera (stoneflies), Ephemeroptera (mayflies) and Trichoptera (Caddisflies).

The next common orders were Odonata (Dragonfly & damselfly), Megaloptera and Diptera (True flies). Besides these orders, aquatic worms and flatworms (planarians) were there in different sites.

3.2.2.1 Stonefly (**Plecoptera**): Stoneflies belong to the order Plecoptera and are sensitive to water pollution. They are found in relatively clean waters. All the sites had stoneflies belonging to one family, viz., Perlidae, the so called common stonefly.



Figure 7. Macroinvertebrates in site 1.



Figure 8. Common stonefly at Chendebji.

3.2.2.2 Mayflies (Ephemeroptera): Mayflies belong to the order Ephemeroptera and are very common members of freshwater macroinvertebrates. The members of Ephemeroptera range in their tolerance to pollution from tolerant to sensitive. The order was the most abundant among all the orders in the sampled sites and was represented by family Baetidae, Heptageniidae (Flathead mayfly) and Oligoneuriidae (Brush-legged mayfly).



Figure 9. Members of Heptageniidae (Flathead mayfly), Oligoneuriidae (Brush-legged mayfly) & Baetidae at site 3.

3.2.2.3 Caddisflies (Trichoptera): Caddisflies belong to the order Trichoptera and are fairly tolerant to water pollution. The order is very common in the rivers and streams in Bhutan and it was well represented in all the sites in the survey area. The major families were Hydrosychidae, Polycentropodidae and Rhyacophilidae. The most abundant family was Hydrosychidae of these three families at the sampled sites, while the Rhyacophilidae was represented by Himalopsyche sp.



Figure 10. Members of Hydrosychidae (site 1), Polycentropodidae (site 8) & Rhyacophilidae (site 1).

3.2.2.4 Dragonflies (Odonata): The dragonflies belong to order Odonata and include true dragonflies and damselflies. The nymphs of dragonfly were present in sites 1, 2, 3, 7 and 8. The adult dragonflies belonging to three different families, viz., Cordulegastridae, Libellulidae and Aeshnidae, were observed at a side channel forming a pool at site 8. The sites 1, 2 and 7 had larva of Epiophlebia laidlawi, a relict species belonging to family Epiophlebiidae that has only three known extant species in the world.



Figure 11. Epiophlebia laidlawi at site 1 & 3.



Figure 12. Nymphs of Libellulidae at sites 3 & 7, and adult mountain hawk (Cordulegaster sp.) at site 8.

3.2.2.5 Other orders of Macroinvertebrates: The other common orders of macroinvertebrates present in the sampling sites were order Diptera (true flies) with three families Tipulidae (cranefly larvae), Chironomidae (midge fly larvae) and Athericidae (watersnipe larvae), and order Megaloptera with one family Corydalidae consisting of dobsonfly larvae. The site 8 also had adult water strider in the pool inhabited by Balitorid and Psilorhynchoid juveniles.



Figure 13. Dobsonfly(site 1), watersnipe fly(site 1), midge fly (site 3), cranefly (site 8) larvae & water beetle (site **3.2.3 Zooplanktons:** Zooplanktons a range of macro and microscopic animals and have representatives of almost all major taxa particularly the invertebrates. Zooplanktons are important components of any aquatic ecosystem where they function as link in the transformation of energy from producers (phytoplanktons) to consumers. In the rivers they are mainly found in the storage zones where volumes of water are essentially stationary in the river

channels. In the sampling sites the zooplanktons were represented by ciliates (Paramecium and choanoflagellates), rotifers and chrysomonads.



Figure 14. Rotifer (site 2), Choanoflagellate (site 1), Chrysomonad (site 6) & Paramecium (site 6).

Table 3. Distribution of aquatic fauna within sites.

Taxonomic group						Sites					
	1	2	3	4	5	6	7	8	9	10	11
Schizothorax richardsonii	-	-	+	-	+	-	+	+	-	-	-
Schizothorax richardsonii	-	-	-	-	+	+	+	+	-	-	-
Salmo truta	+	+	-	-	-	-	-	-	-	-	-
Psilorhynchus homaloptera	-	-	-	-	-	-	-	+	-	-	-
Perlidae	+	+	+	+	+	+	+	+	+	+	+
Baetidae	+	+	+	+	+	+	+	+	+	+	+
Heptageniidae	-	-	+	+	-	+	+	+	-	+	+
Oligoneuriidae	+	+	-	-	+	+	+	+	-	+	+
Hydrosychidae	+	+	+	+	+	+	+	+	-	+	+
Polycentropodidae	+	+	+	-	+	+	-	+	-	+	+
Rhyacophilidae	-	-	+	+	-	-	-	+	-	-	-
Epiophlebia laidlawi	+	+	+	-	-	-	+	-	-	-	-

Tipulidae larvae)	-	+	+	-	+	-	-	-	-	-	-
Chironomidae	-	+	+	+	-	-	-	+	-	-	-
Athericidae	+	+	+	-	-	+	+	-	-	-	-
Corydalidae	+	+	+	-	+	-	+	-	-	+	+
Paramecium sp.	+	+	+	-	-	-	+	-	-	-	-
Chrysomonad	+	+	+	-	+	-	-	+	-	-	-

*The symbols – (absence), + (presence)

3.2.4 Other Aquatic Fauna: Few other important aquatic fauna observed during sampling are discussed below:

3.2.4.1 Water shrew: A water shrew was observed getting over a stone by the river bank below the Mangdechu dam construction site (site 4). A worker from the dam site said that the river has many such shrews in the water beside the Mangdechu dam construction site. It is unclear if the abundance of water shrew in the water around the dam site is due to less competition for food which is attributed to the absence of fishes which otherwise could hunt for the same macroinvertebrates.

3.2.4.2 Otter: Scats or droppings of otter were observed in the sampling sites of Mangdechu below the confluence. No such signs of the presence of otter were observed around the dam sites of Mangdechu and the sampling sites at Nikachu. It was not clear how far the otter would migrate up stream along the Mangdechu.

3.2.4.3 Tadpoles: Tadpoles of frogs were observed at the sampling sites of Mangdechu and Nikachu confluence (site 3). However, it was not possible to determine its taxonomic identity. The tadpole could belong to an Amolops sp. since this group of frogs inhabits mountain rapids.

4. IMPACTS

Any human activities along the river will definitely have impact on the aquatic biodiversity. The possible impacts due to Nikachu HPP on the fishes, macroinvertebrates, zooplanktons and other organisms is change of natural flow regime and landuse changes along the rivers. Current assessment of land use along sampling sites show minimal human disturbance and the quality of water as can be deduced by looking at macroinvertebrates diversity is good. Once both the projects are commissioned, a major impact could be due to totally dewatered region between Nikachu dam and Mangdechu dam to the Mangdechu tailrace tunnel especially during lean seasons when other tributaries to both the rivers within the dewatered area become themselves very less or dry up.

For the fishes local distribution will be impacted because of dams as well due to change in water discharge regime. It could be also impacted change in macroinvertebrate diversity as the macroinvertebrates provide food for the fishes. For the macroinvertebrates the change in instream or in-river condition like presence or absence of naturally-occurring organic materials and bigger logs (snags), and change in river bed materials could have impact. For zooplanktons the change in river flow regime may change the amount of storage zones along the rivers and could either lead to increase or decrease in number. However, at the dams the number could go high due to more water residence time as zooplanktons require longer time for development.

5. MITIGATION AND MANAGEMENT PLAN

5.1 Fish Diversity: Brown trout is an exotic species introduced widely in Bhutan. It is less adapted to mountain rapids and its population density seems to depend on the severity of seasonal floods. It is a cold water species and can survive low water temperature, but moves to deeper water during winter. Construction of dam is not likely to have much effect on the species. However, this is a game fish and therefore needs restocking if its population declines below certain level.

Conservation of Snow trout requires protection of its natural habitats, streams and rivulets in particular which help fingerlings to grow. This benthic feeder has suctorial disc and are adapted to mountain rapids. However, like for any other fish species, high-head dams are obstacle even to

the short distance upstream or downstream seasonal migration. Since the fish ladders or automated bucket lifts do not facilitate fish migration in rivers with high-head dams, genetic drift can be avoided by catching fish from any side of the dam and releasing them to the other side on a regular basis.

Monitoring fish population on either side of the dam needs to be done regularly with established scientific protocols. For reasons, particularly to give scientific rigour and avoid vested interests, independent researchers from established organization with research capacity should be encouraged to monitor such programmes.

7.2 Macroinvertebrates and zooplanktons: For the macroinvertebrates and zooplankton diversity the microhabitats along the rivers need to be maintained with minimal disturbance. Therefore, proper muck disposal during construction phase and maintaining the natural regime of other tributaries is essential. Other important factor is to minimize the water pollution by human use and for this project activities should follow set standards set by concerned agencies.

For dragonfly the maintenance of natural vegetation structure along the rivers is important as it acts as visual cue for habitat selection by the parent generation for laying eggs for next generation. Though there is a relict species, Epiophlebia laidlawi in the project area, the nymph of the species was recorded elsewhere in the country and also at the head waters of Nikachu, and therefore if those places are taken care of there is minimal impact on the species.

The monitoring of the macroinvertebrates along the project area and the tributaries using accepted protocols and application of adaptive management of the river sections within project area is recommended for maintenance of ecological integrity to the maximum extent possible, so as to have minimum impact on its current composition.

Though it is economically not viable to maintain the current status of the instream fauna, but it could be done to optimal level possible. For this, the project could also specify an environmental flow regime that could include minimum flows, flood sequences with specified magnitudes, return intervals and frequencies for maintenance of channel characteristics and triggering key biological events, a seasonal pattern of flows, and rates of rise and fall of flow which are similar to natural responses to rain events.

Annex J: Socio-economic Report

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Abbreviations/Acronyms & Glossary

BHU	Basic Health Unit
CGI	Corrugated Galvanized Iron
DGCPL	Druk Green Power Corporation Limited
GNHC	Gross National Happiness Commission
GT	Geog Tshogde
Hh	Household
KW	Kilowatt
M&E	Monitoring & Evaluation
MS	Micro Soft
MW	Mega watt
NHPP	Nikachhu Hydro Power Project
ORC	Outreach Clinic
PHCB	Population & Household Census
RNR	Renewable natural Resources
RP	Resettlement Plan
SIA	Social Impact Assessment

Executive Summary

With the mandate to manage existing power generating facilities as well as to accelerate hydro-power development in the country, the DGPCL will develop the 115 MW Nikachhu Hydro-power Project in Trongsa dzongkhag. This document, the Social Impact Assessment is part of the feasibility studies carried out for the NHPP to describe the social impacts of the project. The objective of the SIA is aimed at taking stock of the current socio-economic situation of the population living in the area and to identify impacts and vulnerability.

The SIA was carried out using the sample survey method with structured questionnaires administered on 127 households sampled in the villages amounting to 73% of the total households in the project villages under Tangsibji village and indirectly benefiting villages under Drakten geog. Among those interviewed, 71% were women and also 67% women headed households. The data shows that an extended family form of residence prevalent with a household size of 4.3 persons and sex ratio of 1.22 females for each male. Populations are mostly young with 36% in the youth category and with 58% of the economically active population supporting a 48% of the dependent population. The population also shows a low level of divorcees (28%) and widows (8%).

The majority of the population is engaged in farming for their livelihoods with low levels of participation in business. The level of skills in construction trades is also low. However, off-farm work opportunities are available with the project area providing substantial opportunities to use such skills. Morbidity is low in the villages. Education levels among the population are also low with 60% who have never been to school.

Land is the main productive asset owned but up to 72% of the dry land is used and up to 75% of the wetland is similarly utilization showing in-optimal land utilization due to wild life predation, water insufficiency and farm labour shortages. Yields of paddy are low though the maize yields are comparable to national averages. Few horticultural crops are sold. Use of farm inputs and credit is low implying low investments in agriculture. Livestock rearing especially of improved cattle breeds seems to be on the rise as an important means for supplementing incomes of the people through sale of dairy produce.

The farmers are relatively affluent owning big houses and with good access to basic services such as electricity, water and sanitation. Access to services such as health, education, RNR and economic and political institutions is also noted to be good for the population. Though there were not many that lived below the poverty line, incomes were still moderate with most of the income earned from agriculture. Farmers were noted to own many of the household assets indicating presence of disposable income to purchase such assets. Expenditure on non-consumption heads such as education, religious ceremonies as such exceeded the consumption expenditure indicating a diversified expenditure base of farmers. There are as yet few shops and businesses in operation in the project area.

The main types of vulnerability faced are crop failure and loss of livestock and illness and injury although these were not so serious as to incapacitate farmers. Levels of disability are low in the area. Only 7 households faced income poverty in that they earned less than the stipulated Nu. 1,097 a month

designated as the poverty line in Bhutan. Widowhood and divorce is also low. In total 13 farmers had land holding below 1 acre. From this we can deduce that though vulnerability is low, it is present in some form or the other. However, compounding of vulnerabilities and what this means in terms of being affected by project impacts has been taken up in the RP.

In the planning phase of the project, people have been consulted and they have participated in discussions, the household survey and in leading the teams to their land and resources during the feasibility study. They have high expectations in terms of benefiting from the project mostly in enhancing their livelihoods and their access to social and economic infrastructure and institutions. They are eager to receive the project and to participate. Other agencies such as the GNHC, Ministry of Finance, DGPCL will operate through the procedures to ensure implementation of the project with the assistance of the private sector and assistance of donors as relevant. No form of opposition from any individual or pressure group has been discerned till date implying that people are buying-in to the project and through good implementation and adequate consultation a post-completion win-win situation for all is expected.

Chapter 1: The Project

1.1 Background

The Druk Green Power Corporation Limited (DGPCL), established in 2008, is mandated to manage existing power generating facilities and to accelerate hydropower development in the country. The company currently operates five power plants with an installed capacity of 1,480 MW. It is responsible for the operation and maintenance of the power plants after construction. On Royal Government of Bhutan (RGoB) approval to develop the 208 MW Nikachhu Hydro Power Project (NHPP), DGPCL recently commissioned the Feasibility Studies of which among others constituted the Social Impact Assessment (SIA) detailed in this report.

From an estimated total hydropower potential of 30,000 MW, about 5% has been harnessed amounting to an installed capacity of 1,480 MW till date from the 5 hydro-power plants across the country. Further, a total of 10 projects (10,000 MW capacity) have been selected jointly by the Governments of Bhutan and India for development of by 2020. These 10 projects have different implementation modalities such as bi-lateral development by the two governments, joint ventures between government corporations of the two countries and sole implementation by Druk Green Power Corporation. DGPCL will implement 4 projects on its own of which the Government approved Nikachhu Hydro Power Project (NHPP) is among them that the DGPCL will implement on this mode.¹

1.2 Description of the Project

Nikachhu Hydropower Project is located about 5 hours' drive from Thimphu towards East, on the river Nikachhu (a tributary of Mangdechhu with the catchment north and south of the road running from Pele La to Tangsibji), between 3 km (approximately) downstream of the Chhunabchhu confluence and the Nikachhu/Mangdechhu confluence in Trongsa District, Bhutan. The environmental and social assessment was once concluded in 2011 with dam locations at Lorim (27'26'55.41"N and 90'22'22.21"E) and Power House location at Tangsibji Village (27'26'29.46" N and 90'27'17.90"E). Although the locations seemed feasible the costs of the project was assessed to be substantial. Moreover continued geological investigations revealed Power House location options in more stable locations. As such, the changed locations and scope of the project necessitated additional social and environmental assessments.

1.3 Project Components

The Project components which will be spread over the project area are described in this section. The location of the project components from the onset had the broad objective of ensuring, that as far as possible, the facilities would be constructed on government land so that there is minimal impact on land and livelihoods of villagers.

(a) Adits

¹ Sourced from <u>http://www.drukgreen.bt/Content2.aspx?c=114</u>. See link for complete list of projects to be developed by 2020.

Adits are potentially the least damaging to private land and property since adits are all constructed underground. The table below shows five adits to be constructed which will cut across most of the villages in the project area namely Serpochen which is the main dam and intake area, Tashiling and lastly Norbuodi which will host the surge shaft and power house. In total 13.74 km of adits are planned.

ADIT	Length (m)			
ADIT-1	509.81			
ADIT-2	830.74			
ADIT-3	523.35			
ADIT-4	693.95			
ADIT-5	791.31			
ADIT to surge shaft top	463.00			
ADIT to BVC	369.00			
Total (m)	4,181.16			

Table 1: Details of	of adits to be	constructed
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(b) Muck disposal sites, batching plants, colonies and camps

A number of other structures to be constructed on the land surface are muck disposal sites, batching plants, colonies and temporary worker camps. The table below shows the amount of land that each of these structures will occupy. As mentioned before, to the extent possible, during the design phase, these have been located on government land but where unavoidable; some private land will be affected. As noted an area extent of 273.14 acres will be required to locate these facilities. The area and type of private land impacted will is detailed out in the Resettlement Plan document.

Muck Disposal Area	Locations	Area m ²
Disposal site- I	Upstream of dam	44,605.00
Disposal site- II	Downstream of dam	23,373.00
Disposal site- III	Near Silt Flushing Tunnel	46,990.00
Disposal site-IV	Adit -1	55,958.00
Disposal site- V	Adit -2	72,996.00
Disposal site- VI	Adit – 3	83,055.00
Disposal site- VII	Aidt – 4	29,303.00
Disposal site- VIII	Common disposal site at Tsangkha	73,116.00

	Table 2: Details o	f muck dis	posal to be	constructed
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Muck Disposal Area	Locations	Area m ²
Disposal site- IX	Adit- 5	51,631.00
Disposal site- X	Surge Shaft area	41,198.00
Disposal site- XI	Pressure Shaft area	16,593.00
Disposal site- XII	Power House area	71,000.00
	Total	609,818.00

(c) Approach road

Most approach roads to muck disposal sites, adits, surge shaft, power house and colonies have their off take from the national highway and existing farm roads. The table below shows that in total 13.37 km of approach roads will be constructed leading to the different structures.

No.	Access Road (s) to:	Approximate Length (km)	Place
1	Surge Shaft	3.467	Norbuodi
2	Adit I	2.584	Serpochen
3	Adit II	2.572	Badela/Tsemla
4	Adit III (Option 1: Tsheringma Drupchhu)	2.491	Tsheringma Drupchu
5	Adit III (Option 2: Tashiling)	1.326	Tashiling
6	Adit IV	0.474	Tashiling
7	Adit V	0.155	Norbuodi
8	To Main Access Tunnel (MAT): PH (From MHPA Dam)	0.305	MHPA Dam
	Total	13.374	

Table 3: Details of access roads to be constructed	Table 3: Details	of access	roads to b	e constructed
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(d) Transmission line

The transmission line is also a component which will evacuate power from the NHPP power house the to join the grid at Yurmu. Some 18.92 km of transmission lines entailing 64 towers will be required. The towers will be located mostly in government reserved forest land but some amount of land where the towers will be located in private land and will acquire 10 acres of land.

1.4 Objectives of the Social Impact Assessment

The overall purpose of the SIA is to assess and analyze the social impacts of the proposed project.

The objective of the SIA is to produce an independent and robust Social Impact Assessment Report that will satisfy best practice and applicable national and international requirements. The social impact assessment process should be built on the following three elements:-

- a detailed assessment of the socio-economic conditions of the people who may be negatively/positively affected;
- a detailed study of the impacts in terms of the extent of land acquisition, crop and tree loss, displacement, livelihoods and employment impacts, aesthetic impacts, cultural impacts (both tangible and non-tangible), community impacts, demographic impacts, development impacts, economic impacts, gender impacts, health impacts, impacts on vulnerable groups and indigenous peoples, infrastructural impacts, institutional impacts, leisure and tourism impacts, political impacts (good governance, human rights, democratization etc.), poverty impacts, psychological impacts, resource impacts (access and ownership of resources), and impacts on social and human capital;
- a detailed plan to mitigate the identified impacts and an assessment of the costs of such measures. It is essential to generate key indicators based on the social impact assessment in order to facilitate monitoring. Most essential of all is that the impact assessments should be transparent, participatory, and verifiable. This section of the work will be contained in the Resettlement Plan (RP) document.

1.5 Methodology

1.5.1 Sampling criteria, survey and data collection

The approach and methodology proposed here are best practices of international application advocated and mainstreamed into loan portfolio projects by the World Bank and the Asian Development Bank. These procedures have been applied in Bhutan with a notable measure of success. Described below are a summary of the approach and methods. The approach and methods are organized below by broad activities carried out in the assessment.

Stakeholder analysis

A stakeholder is any person, group or institution that has an interest in a development activity, project or programme. This definition includes intended beneficiaries and intermediaries, winners and losers, and those involved or excluded from decision-making processes. The stakeholders were met and information collected in focus groups or in key informant interviews. The table below summarizes the stakeholders and nature of engagement during the study: -

No.	Stakeholder	Type of stakeholder	Activity planned for engagement during study
1.	DGPCL	Primary	Discussions on project and secondary data collection.
2.	Local government (Tangsibji, Drakten)	Secondary	Views on project and its development prospects. Participation in the project,
3.	Community members impacted by project	Primary	Perceptions on benefits and adverse impacts. Views on compensation packages. A survey planned in the catchment villages taking roughly 30% sample households of both impacted and non-impacted households to establish the socio-economic baseline. A Census of all impacted persons, their property and

Table 4: Stakeholder by type and expected engagement

			discussions to gather their views, hopes and fears about losses.
4.	Businesses	Secondary	Perceptions on benefits and adverse impacts on their livelihoods. Purposively sampled business by category (hotels, shop keepers, contractors, taxis)

The output of this exercise is a matrix listing the stakeholders describing their interests, potential project impact on them (positive, negative or neutral) and relative priority of their interest. From this the 'influence' and 'importance' of stakeholders can be assessed. Influence refers to how powerful a stakeholder is. Importance refers to those stakeholders whose problems, needs and interests are the priority of DGPCL's intervention - if these 'important'; stakeholders are not assisted effectively then the project cannot be deemed a 'success'. By combining influence and importance, stakeholders can be classified into different groups, which will help identify assumptions and the risks, which need to be managed through project design. Stakeholder analysis can contribute to the process of deciding how the key stakeholders are to be included in the project. Note that 'key' refers to high importance, high influence, or both. The second output of this exercise will be Stakeholder participation Plan - a matrix describing the type of participation (inform, consult, partnership, control) required of stakeholders by stage (identification, planning, implementation, implementation and monitoring) in the project.

Consultations

Consultations are an important component of social (impact) assessments. These events are crucial to test acceptance or opposition of the project by beneficiaries. Since this assignment attempts to cover the extended joint project area, the previous SIA and concurrent consultations carried out for the reduced scope already will contain much information on consultations. These will be referred to as a point of reference to design and carry out additional consultations for people living within the extended area.

In the appraisal stage project affected persons need to be consulted on their perceptions of the project, opinions on losses and discussion on the compensation package, sharing information on procedures and rates of compensation, as well as understanding their needs for better implementation of the RP. Once the RAP is prepared it needs to be disclosed to the project affected people in a meeting. The land and property impacted, the rates of compensation calculated, procedures for land acquisition and compensation as well as provision of a grievance redressal mechanism has to be explained. The output of the consultations describes discussions and agreement/recommendation on each point with a list of signatures of all persons attending the consultations.

Socio-economic Survey

It is necessary to understand the socio-economic profile of people living in the area where the project will be implemented for several reasons. Firstly, from the socioeconomic profile, the core social issues can be accentuated such as the economic status and socio-economic differentiation of people to categorize and to focus on the truly vulnerable populations based on variables such as age, marital status, income, employability, food security, land holdings, disability and income. Secondly, from the survey, information on perceptions of people on the project can be aggregated to ascertain the level of buy-in to the project. Thirdly, impacts on people and their property or livelihoods can also be identified through the survey.

The socio-economic study will be carried out through a survey among a selected sample of households from each village within the primary influence area of the project using a structured questionnaire. It

may be noted here that the sample selected in the earlier study was small and therefore was not representative. Those not covered in the sample earlier will be covered. So it would be useful to have the database of interviews and data collected by Kyingkhor Consultancy Services.

This will be supplemented by a few interviews with key informants such as the Dzongda, Gup and tshogpa. The purpose of carrying out a key informant interview with the tshogpa is to solicit support for effective implementation of the surveys and consultation, understand local social dynamics, triangulate information on vulnerable populations and also to get their views and perceptions about the project. The interview with the Dasho Dzongda and Gup will provide the views of the local administration and the level of buy-in to the project besides providing the historical and developmental context the project is in. The key informant interview will be conducted using a semi-structured questionnaire.

Resettlement Plan (RP)

The proposed Nikachhu HP will acquire land for construction of project infrastructure such as: access roads, powerhouse, dam, surge shaft, offices, residential colonies, muck disposal sites and stone quarries. However, it is expected that most land acquired would fall in government-owned territory averting need to acquire private land. Acquisition of land may induce involuntary resettlement and impact on cultural properties of significance. The survey team visited all the sites identified for the facilities and coordinates have been taken and the areas mapped. These were verified during the Socio-economic Survey by the Social Assessment Team, owners identified and consultations conducted besides coming up with tentative quantities of land or properties affected and costs worked out as compensation.

It may be noted here that a RP has been prepared for all the facilities to be established in 2010-2011. However, besides the dam located at Lorim, all other facilities have been relocated. The RP for these will be taken up and the earlier RP updated. Besides, in this study, the earlier affected persons and properties of the Dam, if any, will be re-validated. The earlier study identified 19 households who were affected.

The RP will contain several important components namely an entitlement framework that spells out who is eligible for what and on what basis. The RP will also contain a section on the valuation of land and affected properties. The RP will also describe the procedures for compensation and resettlement assistance. A work plan will be drawn up indicating the milestones for achieving RP objectives besides a detailed budget for carrying out the RP and the compensation package. An M&E framework and institutional arrangements for carrying out the RP will be described. Disclosure of the RP through a community meeting with affected persons as well as making available a translated version of the RP in the local government office and with village tshogpas of villages having Project Affected Persons populations will be done.

1.5.2 Survey Instruments and training

A number of methods and tools have been used to gather information for the SIA and the RP. These are described below:-

(a) SIA

• The primary method used for the SIA was the household sample survey method wherein the sample of respondents to be interviewed was pre-calculated to determine the number of respondents to interview. The respondents were selected randomly from the frame which

consisted of the villages that benefit or would be impacted directly by the project (e.g. villages under Tangsibji geog) and villages that would indirectly benefit or be impacted by the project (e.g. villages under Drakten geog). The survey team used a structured socio-economic survey questionnaire as the primary tool to collect quantitative data.

• Other tools used were semi-structured checklists to gather qualitative information to assess impacts as well as perceptions of benefits from key informants such as the Geog Tshogde personnel and village tshogpas.

(b) Resettlement Plan

- As opposed to selecting a sample for the socio-economic survey, the RP exercise was carried
 out as a census wherein all affected people were interviewed and consulted. While the affected
 people also responded to the generic socio-economic questionnaire, in addition, a structured
 questionnaire containing questions to build up their asset inventory and to assess the extent of
 impacts on property (land, structures) as well as livelihoods formed the key tool used to gather
 both quantitative and qualitative information from affected persons.
- Additionally, the focus group discussion method was used to carry out consultations with affected persons. This method was chosen particularly because there are only 11 affected persons. This method seemed suitable for a group of such a size. A checklist of open-ended questions was prepared and used with affected persons.

1.5.3 Data analysis and reporting

Preceding the survey, enumerators were trained on survey methods and techniques. The tools for the survey were discussed in detail in the language to be used in interviews at village level. Data was collected by a survey team comprising of 6 enumerators, 1 Supervisor and the Consultant over a period of one week. The data was cleaned by the Supervisor at the end of each day during the survey. One more round of cleaning was done once all the data was entered in MS Excel. The data was then transferred to SPSS for data summary and preliminary analysis. The Consultant also carried out an intensive web search to assimilate secondary information and statistics on Trongsa district and Tangsibji geog. Data in tables or represented by graphs as well as photos were judiciously placed in MS Word processor used for preparing the Report.

1.5.4 Outline of the Report

Chapter 1 opens the Report providing a brief background on DGPCL, its mandate and work and the genesis of the SIA. The NHPP location and project components are also discussed in this section as well. The objectives of the SIA and the methodology and tools employed in the study to achieve the objectives have been elaborated by the areas of inquiry namely the socio-economic survey, stakeholder analysis, resettlement plan, the consultations.

Next, in Chapter 2, Trongsa District and Tangsibji geog are briefly described providing basic statistics on development facilities available.

Chapter 3 is the largest in volume of content as it contains the findings of the socio-economic survey and discusses demography, occupations, health and education status, land ownership and utilization, agricultural and livestock production, housing and access to basic services, access to credit and savings, income, asset ownership and consumption (used interchangeably with expenditure), enterprises and vulnerability.

Chapter 4 very briefly outlines the stakeholder consultations commencing with a stakeholder analysis as well as explicating information dissemination.

In Chapter 5, perceptions of benefits and adverse impacts of the Project of people are explained. Note that a large part of the narrative in section 4.3 entitled Stakeholder Exchange and Outcomes is relevant here but has not been reproduced.

Chapter 6 provides some conclusions on some of the key findings.

Chapter 2: Project Area

2.1 Trongsa District

Trongsa (meaning new village in the local dialect) is a district located in the central region of Bhutan. It is historically important as the seat of Kings of Bhutan who administered the country from this Dzongkhag. The origin of the place is attributed to Yongzin Ngagi Wangchuk, a historical personality in Bhutan who established a meditation centre in 1543 attracting disciples which steadily grew into a settlement. The Trongsa Dzong and the Ta Dzong (watch tower now converted to a museum) are important cultural landmarks in Bhutan. The dzongkhag is located in the heart of the country. It covers an area of about 1807 km², with elevation ranging from 800 meters to 4,800 meters above sea level with a total population of about 14,977(estimated) in 2011 with a growth rate of 1.4%. As per the PHCB 2005, Trongsa has 2,739. It shares boundaries with Bumthang dzongkhag to the northeast, Wangdiphodrang dzongkhag to the west and Zhemgang dzongkhag to the south.

Despite formidable rugged terrain in most part of the dzongkhag, the blacked topped East-West highway and the Trongsa-Gelephu highway passes through the dzongkhag connecting almost all geogs serving as the main economic artery. Though the East-West and Trongsa-Gelephu highway passes through the dzongkhag, settlements are still remote due to lack of feeder roads. Remoteness and rugged terrain makes delivery of services difficult and costly. Still, every Geog in the dzongkhag has a BHU, RNR center and a School each providing basic services. Trongsa dzongkhag consists of five geogs namely, Drakteng, Korphu, Nubi, Langthil and Tangsibji. The dzongkhag is further divided in two Constituencies - Nubi Tangsibji and Drakteng Langthil for electoral purposes.

Some important data on developmental facilities is provided below.

No.	Development facility	Quantity Trongsa	Quantity Bhutan	Remarks
1.	Schools	24 nos.	606	Statistical Yearbook of Bhutan (2011)
2.	Hospitals	1 nos.	31	Statistical Yearbook of Bhutan (2011)
3.	BHUs	7 nos.	181	Statistical Yearbook of Bhutan (2011)
	ORCs	21 nos.	518	Statistical Yearbook of Bhutan (2011)
4.	RNR Centers	5 nos.	139	Statistical Yearbook of Bhutan (2011)
5.	Irrigation canals	85 nos.		Not available (will be updated for Final Report)
6.	Farm roads	94.92 km	8,366	
7.	Feeder roads	24.20 km		Statistical Yearbook of Bhutan (2011)
7.	Telephone connections	631 nos.	27,490	Annual InfoCom & Transport Statistical Bulletin (2012)
8.	Internet connections	151 nos.	139,896	Annual InfoCom & Transport Statistical Bulletin (2012)
9.	Temples	93 nos.		Not available (will be updated for Final Report)

 Table 5: Statistics on development facilities for Trongsa and Bhutan

2.2 Tangsibji geog

Tangsibji is one of the geogs (county) of Trongsa located about an hour's drive away before reaching Trongsa from Thimphu. It is inhabited by people known as Man dips who speak Mangdechhu, a dialect spoken in Tangsibji geog and a few villages under Drakten geog such as Taktse, Yuesa and Tashidingkha. Both these terms are derived from the river Mangduechhu which drains the area.

The Geog consists of seven villages, 232 households and a population of 1,848 persons according to the PHCB-2005. It covers an area of 372 km² with Wangdiphodrang Dzongkhag to the west, Langthil Geog to the south and Drakteng Geog to the east.

The east-west highway runs through the Geog acting as a main artery for economic development. Most villages are remote yet 4 farm roads have been constructed. Paddy, rice, maize and vegetables are the major crops grown.

There are two micro hydels in the Geog at Chendebji and Tangsibji respectively. The micro hydel at Tangsibji village was established in 1987 with a generating capacity of 0.03 MW benefits 53 households. The micro hydel at Chendebji was established very recently in 2005 with a generating capacity of 70 KW benefiting 31 households. All villages now have electricity supply. Besides the Trongsa Dzong, the most popular and sacred monument, Chendebji chorten is located within this Geog. There are 14 lhakhangs (temples) in the geog.

Chapter 3: Findings - Socio-economic situation

3.1 Demography

An adult member of each sampled household was invited for the interview. The household was selected on the criteria that it was to be from one of the benefiting villages. As the data in table 6 shows, a total of 127 respondents were interviewed. From the frame provided in a previous Report² of 174 households was a calculated sample of 120 households. However, in the survey, a total of 127 households were enumerated. This takes the survey coverage to 73% of the total households in the villages under Tangsibji and Drakten villages respectively. As also noted in the table, 3 villages of Tangsibji, Tsangkha and Drangla were covered with 61 households covered from these villages under Tangsibji which will be directly benefiting from the Nikachhu HPP. Under Drakten geog, the villages of Changrey, Kingarapten, Taktse, Yuesa and Tashidingkha which will be indirectly benefiting from the NHPP were covered as well. It is important to note that 71% of the respondents were women as compared to just 29% of men indicating that women are more available for village-based interviews than their men counterparts.

		S	Sex of res	sponder	nt	
Village	Fem	ale	М	ale	То	tal
	No.	%	No.	%	No.	%
Tangsibji geog						
Tangsibji	23	26	7	19	30	24
Tsangkha	20	22	4	11	24	19
Drangla	2	2	5	14	7	5
Drakten geog						
Changrey	4	4	1	3	5	4
Kingarapten	14	16	9	24	23	18
Taktse	4	4	5	13	9	7
Yuesa	13	14	1	3	14	11
Tashidingkha	5	6	2	5	7	5
Total	90	71	37	29	127	100

Table 6: No. and percentage of respondents by sex and village

The data in table 7 below also shows an overwhelming majority of women respondents in the position as heads of households (67%) as opposed to men who also head households (33%). It is important to clarify here that the 'head of household' concept was explained to the respondent to mean 'the person in the household who took major decisions and was responsible for the welfare of other members of the family.' With this working definition, respondents could identify the household head. Also, being women-headed in Bhutan does not necessarily imply that the person and household as such is vulnerable. Women who head

² Social Impact Assessment, Kyingkhor Consultancy Services, December 2010

households in many cases are not widows or divorced but enjoy this status in the homes by virtue of them not only owning the land but also participating in decisions about farming, use of family budget and reproductive (continuity of household activities) tasks as well. It can be seen too, that from both affected and non-affected households' women predominate as household heads. Therefore, from this we can conclude that in Bhutan as compared to other countries in the region – such as Nepal or India, the status of being a woman heading a household, by itself is not to be construed as the women being vulnerable. There are other social variables such as marital status, age, disability, landholding, economic situation in the household and productive capacity of the household (labour) which can be examined together with household status to ascertain vulnerability.

	Table 7: No.	and percentage of	respondents if HH	head by sex ar	nd affected project	affected
stat	u <u>s</u>			-		

				lf F	Respondent head of household									
		N	0			Y	es		Total					
Type of	S	ex of re	sponden	t	S	ex of re	spono	dent	Sex of respondent					
Respondent	Ма	le	Fem	ale	Ма	ale	F	emale	Ма	ale	Female			
	-						No							
	No.	%	No.	%	No.	%	•	%	No.	%	No.	%		
Not affected	3	15	17	85	30	31	67	69	33	28	84	72		
Affected	0 0 4 100			4	67	2	33	4	40	6	60			
Total	3	12	21	87	34 33		69	67	37	29	90	71		

Data on the relationship of family members to the household head shows that largely besides the household heads and their spouses (husbands or wives), sons and daughters and brothers and sisters live together. This indicates that the form of residence people reside in which appear as nuclear are actually extended with sons and daughters living in with their parents. This is common in both affected and non-affected households. This is not necessarily bad as older parents often take care of the younger children and cattle while the adults can work in the fields. The elder are also guaranteed care in proximity to relatives in their old age indicting that family links are still strong.

Table 8(a): No. an	d percentage of HH memb	ers' relation to H	Ih head by sex a	nd affected project a	affected
status					

		Relation to Hh Head														
Type of Respondent	Wife husband		Son daughter		Grar	Grandchild		iece phew	Fat Mot	her ther	Sister Brother		Son daughter- in-law		Brother sister- in-law	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Not affected	92	18	143	28	9	2	21	4	47	9	27	5	16	3	6	1

Type of Respondent		Relation to Hh Head														
	Wife husband		Son daughter		Grandchild		Niece nephew		Fat Mot	Father Mother		ster ther	Son daughter- in-law		Brother sister- in-law	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Affected	7	15	11	23	0	0	0	0	4	8	1	2	12	25	0	0
Total	99	18	154	28	9	2	21	4	51	9	28	5	28	5	6	1

Table 8(b): No. and percentage of Hh members	' relation to Hh head	by sex and affected pro	ject affected
status			

						Relatio	n to I	Hh Hea	d					
Type of Respondent	Grandfather Grand mother-in- law		Father Mother- in-law		O rel	Other relative		rvant	Other		Head		Total	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Not affected	19	4	9	2	5	1	2	0	0	0	112	22	508	100
Affected	1	2	1	2	0	0	0	0	0	0	10	21	47	100
Total	20	4	10	2	5	1	2	0	0	0	122	22	555	100

In the table below, the total number of persons living in the surveyed households is 555 persons of which 45% are males and 55% are females. Data on the age of household members in categories shows that 58% of the total population is economically active (between the ages of 16 and 60 years) and support 42% of the total of dependent population (less and equal to 15 years and 61 years and above). The household size is 4.3 persons, slightly lower than the national average of 5 members a household. The ratio works out at 1.22 females for each male which is fairly uniform. The median age present in the population is 34 years. Youth (aged 25 years and below) comprise of 36% of the population implying a relatively young population present in the project area.

Table 9: No. and percentage of Hh members' age in categories by sex and affected project affected status

						Age	e in c	atego	ries				
Respondent type	Sex	1 yea ar bel	5 ars nd low	16 te yea	16 to 25 years		o 35 ars	36 t yea	o 60 ars	61 years and above		Total	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Not affected	Male	57	25	26	11	35	15	65	29	44	19	227	100
	Female	63	22	34	12	48	17	92	33	44	16	281	100
Affected	Male	8	35	4	17	1	4	7	30	3	13	23	100
	Female	6	25	4	17	5	21	7	29	2	8	24	100
Total	Male	65	26	30	12	36	14	72	29	47	19	250	100
	Female	69	22	38	12	53	14	99	32	46	15	305	100

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The data shows that 28% were unmarried while 53% were married. Also, 11% had been married at one time but were currently widowed or divorced.



Figure 1: Percentage of Hh members' marital status by sex and affected project affected status

3.2 Occupation, employment and livelihoods

In terms of the types of occupation people presently follow, it can be seen that 66% are in farming while 12% are engaged in other vocations such as business, civil servants and in private sector. Also, 22% are currently students. The data shows that currently occupations are not diversified which also mirrors the low development of the market economy wherein a large part of the populations work in subsistence agriculture while entrepreneurial activities and rural industrialization remain low.



Figure 2: Percentage respondents in occupations by type and affected status

People are not highly skilled with nearly half the respondents among both affected and non-affected households possessing no skills. There are a few that are into carpentry and masonry and women practice weaving. Skills development is one area that the Project could consider for development especially for the economically active population who could work on the project to supplement their income.



Figure 3: Percentage of household members' types of skills possessed by project affected status

Off-farm work opportunities seem to be more available in the directly benefiting/impacting villages of Tangsibji geog than Drakten geog owing to its proximity to the district head office as well as possibly more developmental works in this area creating job opportunities with contractors as semi-skilled or unskilled labour. The daily wage rate averages Nu. 300/day for men but women is reportedly paid lower wages of Nu. 200 to 250 a day owing to the perception that that they cannot perform strenuous tasks and are therefore less effective in such work as compared to men.

3.3 Health and Education

Health

Morbidity data collected during the interviews showed that 16 people fell sick in the last year. All patients were from the non-affected group who suffered from illnesses like cough and cold – which was the most common, followed by diseases like stomach pain, headaches, ulcer body pain, diabetes, high blood pressure, heart disease, body pain. The data shows that people do not easily fall.

Education attainment

Data on education attainment shows that 60% of the populations have not had education. From the non-literate population, 57% are females. Only 23% have studies till primary school and a further 7% studies till high school. From among those that have studied, females exceed males in both primary school and high school levels indicating a higher rate of drop-out of

females as compared to males owing to the fact that more female drop-outs are living in the villages. Overall, the data shows a low level of educational attainment among the population.

								Educa	ationa	l attai	nment	t					
Responde nt type	Sex	Prii) (Cla VI les	mar / ass or ss)	Hig sch (Cla VII Cla X	gh ool ass to ass ()	Hig seco y (C XI Class	her ndar lass to s XII)	Grac	duat 9	Mona educ r	astic catio 1	Nc fori	on- nal	N educ r	o atio	То	tal
		No	%	No	0/	No	%	No	%	No	%	No	%	No	%	No	%
Not affected	Male	48	21	16	7	8	3	2	1	18	8	5	2	130	57	22 7	10 0
	Femal e	66	23	18	6	5	2	3	1	0	0	6	2	183	65	28 1	10 0
Affected	Male	6	26	1	4	1	4	0	0	2	9	0	0	13	56	23	10 0
	Femal e	7	29	4	17	2	8	1	4	0	0	0	0	10	42	24	10 0
Total	Male	54	22	17	7	9	4	2	1	20	8	5	2	143	57	25 0	10 0
	Femal e	73	23	22	7	7	2	4	1	0	0	6	2	193	63	30 5	10 0

Table 10: No. and percentage of Hh members' educational attainment by sex and affected project affected status

3.4 Land ownership and Utilization

The land data shows that dry land holdings are similar between affected and non-affected households although affected households on an average seem to own smaller parcels of wetland. The data also shows that sharecropping is not commonly practiced. The data indicates that the area of land utilized for farming is not optimum. The proportion of land cultivated to land owned in terms of dry land ranges from 69% to 72%. Similarly, between 70% and 75% of the wet land is cultivated by both affected and non-affected households. Land utilization is not optimized. Though leaving land fallow for some years could be good for regeneration of fertility, however, it would have consequences for food security. Inadequate household labour, hilly terrain hindering effective farm mechanization and wild life predation on crops are some reasons that farmers may be leaving more land fallow over time.

3.5 Agricultural Production

The production data of crops shows that in affected households the production of crops as compared to non-affected households is higher many because of the higher number of non-affected households to affected (12 non-affected households to each affected household). Overall, the paddy yield shows a median yield of 883 kg/acre whereas the median yield of maize is 1,120 kgs/acre. The Tangsibji geog average yield per acre for rice is 1,053 kg/acre while the maize yield is 798 kg/acre. The national average for paddy yields is 1,122 kg/acre while for maize it is 866 kg/acre. The data reflects the fact that while paddy yields are not up to the geog and national averages, the study area farmers have yields of maize higher that the geog and national average yields.

Further, only small quantities of mainly a few types of vegetables such as potato, chili, cabbage, greens, beans etc. are sold although most seems to be consumed at the household level. While

affected households 1% of their paddy, 14% of their maize, 70% of their potato and 67% of their chili while non-affected households sold 15% of their paddy, 10% of their maize, 70% of their potato and 46% of their chili. This goes on to show that local cereals like paddy and maize are consumed at the household whereas vegetables are a source of income which farmers sell small quantities to supplement their income. Similarly, the non-affected household shows less than an acre devoted to the cultivation of vegetables implying that commercial vegetable production is not practiced at the moment suggesting a subsistence form of agriculture where most is consumed in the household and smaller production surpluses are sold in the market.

Besides irrigation and credit discussed in another section, farmers also use a few other inputs which are discussed here. Farmers in the project area are noted to use very low quantities of inorganic fertilizers (average of 18 kg used) and chemical pesticides (average of less than half a kg) suggesting almost an organic form of farming in practice. Other inputs such as improved seeds and seedlings are used. Mechanization is also low with very few owning power tillers, rice hullers, threshers, winnowers and oil expellers.

The data shows that overall; from the 92 respondents who used irrigation channels to irrigate their paddy from both affected and non-affected households, 71 farmers (77%) mentioned that water was not enough for irrigation. From those that mentioned limited water received for their crops, the majority claimed that water was not sufficient during transplantation owing mainly to limited water received from the source which is determined by the intensity of rainfall in any given year. Other minor reasons mentioned are seepage, ineffective maintenance regime of the canals. Reliable availability of irrigation would an important parameter to enhance crop production for villagers in the project area to diversify into horticulture (vegetables and fruits). There seem to be opportunities for people to re-invest savings from dairy income to drip and sprinkler irrigation for vegetable production to meet the substantial demand for vegetables by both the Nikkachhu and Mangdechhu hydropower workers.

One of the pressing issues confronted in farming across the country is wildlife predation on crops which has remained an unresolved problem till date. It is believed by villagers that the health of the forests as well as the extent of forest coverage in the district (which currently stands at 84%) besides the strong conservation policies and thereby ban on poaching of animals has led to an increase in wild animals. The data below shows the types of animals damaging crops. Rats, monkeys, boars and porcupines seem to be the common predators on crops.

Type of wild animal damaging crop	No.
Deer	2
Monkey	63
Boar	54
Rats	106
Others (porcupine)	34
Others (Sambhar deer)	17
Others (birds)	19

Table 11: No. of respondents' experience of wild life damage to crops by animal

3.6 Livestock Production

In terms of livestock owned the data shows that people keep only a few types of livestock such as cows and poultry. Since the villages are proximate to the road, rearing of horses is rare. It is pertinent to note

that the affected persons group averaged a cattle holding of 2 improved breed cows whereas the nonaffected group had an average of at least 1 improved breed cow. This indicates that villagers are into small-scale backyard dairy farming. People consume small numbers of animals (cattle) but mainly maintain them for drought and farm yard manure. Animal husbandry as such forms a part of an integrated farming system. Few poultry is also consumed. Since meat is widely available in the market, farmers purchase meat available in butcher shops in Trongsa.

Wildlife predation on animals is increasingly on the rise. The data in the table below shows that predation by wolves, tiger, leopard and wild dogs seem to be common in the villages visited. Many farmers reported not having received compensation out of the insurance scheme paid out to protect the tiger suggesting that the system for verification of kills, processing of documents and compensation could be more made for efficient to ensure quick compensation for farmers who lose their domestic animals.

Type of wild animal killing livestock	No.
Tiger	21
Leopard	18
Wild Dog	18
Wolves	27
Others	7

Table 12: No. and percentage of respondents' experienceof wild life predation on livestock by animal

3.7 Housing and access to basic services

Irrespective of being affected and non-affected, the table below shows that majority of the households were constructed in the last decade, on the period between 1992 and 2002 and all the houses built during this period have CGI roofs, stone walls and stone and wood floors. This seems to be the most typical type of house in the villages visited. Houses built in the earlier decade ending 1991 also were of the same type. The data shows that the non-affected respondents being larger in number also had a few respondents that report other types of houses as well such as wood and cement based walls and floors. On an average the villagers had 8 rooms for dwelling purposes excluding the kitchen and toilet which by Bhutanese standards is fairly well endowed in terms of space and size of houses. The type and size of houses can be considered as an economic indicator so it can be said that the communities visited especially in Tangsibji geog, owning well-built large houses are well-off.

Fable 13: No. and percentage of respondent	s' house type by year built and affected status
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Type of house owned	Type of Respondent													
	Affected					Not affected								
	Year House Constructed category					Year House Constructed category								
	1992 to 1972 to 2012 1991			2 to 91	Тс	otal	199 20)2 to)12	197 19	2 to 91	197 bef	1 or ore	То	tal
	No	%	No	%	No	%	No	%	No	%	No	%	No	%

						Туре	of Re	spond	ent					
		4	Affect	ted					١	lot af	fecte	d		
Type of house owned	Yea	Year House Constructed category				Year House Constructed category								
	1992 2012	to 2	197 19	2 to 91	Тс	otal	199 20	1992 to1972 to20121991			1971 or before		Total	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%
CGI roof, stone walls and stone/wood floors	8	80	2	20	10	100	76	70	22	20	10	9	108	100
CGI roof, wood walls and wood floors	0	0	0	0	0	0	2	100	0	0	0	0	2	100
CGI roof, cement walls and floors	0	0	0	0	0	0	7	100	0	0	0	0	7	100
Total	8	80	2	20	10	100	85	73	22	19	10	9	117	100

In terms of access to other basic services such as safe drinking water, sanitation and electricity, the data reveals that all households covered in the survey had access to electricity and sanitation. There were, however, 5 non-affected households and 1 affected household without access to drinking water. It is evident that households in the project area have access to the most basic services which the government is able to provide for villagers.

In terms of the developmental facilities provided by the government at the geog and villages level, the data shows that by far the most visited governmental facilities provided in the project areas in Bhutan are the road used to travel to other facilities, markets, schools and health facilities such as the BHU and hospital. Other less frequented facilities are the RNR office as well as the Forest Range Office which also provide extension services to farmers by visiting the villages. The data is suggestive of good usage of basic services by villagers.

The data in table 17 summarizes the locations of the facility by village. The facilities present in the geog are relatively proximate and accessed in one hour of walk from the villages. The district head office is one hour's drive from Tangsibji and about 2 hours drive away from Kingarapten. The information shows that developmental facilities are provided and located at accessible distances from the villages. In descending order of frequency of visits per year to facilities the most visited facilities are the road (average of 102 times); Market (10 times); Community school (4 times); Primary school (3 times); Forest Range Office (2 times); RNR Center, ORC, Hospital, Dzongkag (once).

Village	BHU	School	RNR Center	Gup's Office	Market	District HQ	Nearest motorable road
Tangsibji	Tashiling	Namgaycholin	Tashiling	Tashiling	Tashiling	Trongsa	Tangsibji
		g					Farm Road
Tsangkha	Tashiling	Tashiling	Tashiling	Tashiling	Tashiling	Trongsa	Highway
Drangla	Tashiling	Chendebji	Tashiling	Tashiling	Tashiling	Trongsa	Highway
Changrey	Kingarapten	Kingarapten	Kingarapte n	Kingarapte n	Kingarapte n	Trongsa	Highway

Table 14: Location of development facilities by village

Kingarapten	Kingarapten	Kingarapten	Kingarapte	Kingarapte	Kingarapte	Trongsa	Highway
			n	n	n		
Takteo	Kingarapten	Kingarapten	Kingarapte	Kingarapte	Kingarapte	Trongsa	Highway
Tanise			n	n	n		
Vuosa	Kingarapten	Kingarapten	Kingarapte	Kingarapte	Kingarapte	Trongsa	Highway
Tuesa			n	n	n		
Techidinglybe	Kingarapten	Kingarapten	Kingarapte	Kingarapte	Kingarapte	Trongsa	Highway
Tashidingkha	5 ···· ···	3	n	n	n	- 9	3 - 7

3.8 Access to credit and savings

Access to economic institutions and instruments such as credit and loans are necessary for local economic development. However, data collected reveals generally that while 4 affected households on an average availed loans of around Nu. 27,778 and 33 non-affected households took loans averaging Nu. 57,223. While non-affected persons availed loans ranging from Nu. 20,000 to Nu. 3,000,000, affected persons took loans ranging from Nu. 1,000 to Nu. 600,000. The data shows that the incidence of people taking loans is quite low indicating a risk-averse behavior of villagers. Most took loans for reasons such as house renovations, buy improved breed dairy cattle, business investments and a few borrowed money for education of their children. All availed loans from the banks.

Farmers saved a median amount of Nu. 10,000 used mainly for education of children, consumption, conduct of religious ceremonies, medical treatment, purchase of agricultural inputs and house renovation. It is evident that most savings are spent on household expenses such as consumption, education of children and medical treatment implying that tertiary education and tertiary medical care are not always available for which people have to spend leaving less funds for capital investments.

3.9 Income, Asset ownership and Expenditure

The table below shows data on income among affected and non-affected households segregated by income earned from agriculture sources (sale of agriculture and livestock produce and animals) and non-agriculture sources such as remittances, off-farm labour, business, skilled labour, pottering and weaving). The data shows that the median income earned from agricultural sources is substantially more and roughly double than that earned from non-agricultural sources. This suggests that there is huge scope for further enhancing income from agricultural activities such as horticulture and dairy farming since a ready market will be created once there is an influx of workers for the NHPP. However, farmers also need to make investments in such enterprises and therefore the question of assets, savings and loans come into play to take advantage of the market created by the NHPP for their produce.

Statistics		Tota agricult	l Income ure sources	Total Inco agricultura	me non- I sources	Total Income			
		Affected	Non-affected	Affected	Non- affected	Affected	Non- affected		
Меал		72,100	37,981	42,960	30,604	115,060	68,568		
Median		52,500	17,000	17,800	15,000	80,500	40,500		
Minimum		12,000	α	Ø	σ	21,600	0		
Maximum		215,000	642,105	140,000	600,000	305,000	692,105		
Percentiles	25	23,500	5,000	2,750	Û	53,750	17,000		
	50	52,500	17.000	17,800	15,000	80,500	40,500		
	75	1,0,5000	45,000	91,250	38,000	166,750	83,000		

Table 15: Statistics on annual income of respondents' by agriculture & non-agriculture sources and affected status

The graphs below show that while affected households derive 56% of their income from agriculture sources, the affected households earn 63% of their income from agriculture. This shows that farmers already have a comparative advantage in activities at farm level as they are proficient with the techniques of farming, have productive assets such as land, labour and basic machines and therefore are in a favourable position to enhance production with technical advice from the extension service in improved agricultural technologies.



Figure 4: Percentage income of non-allected HH by source



Figure 5: Percentage income of affected HH by source

Often incomes are under-reported so a household assets inventory can be useful to assess consumptive behavior and holdings of people. The data in the tables below show that farmers in both affected and non-affected households seem to be relatively well endowed with most of the household necessities but also have invested in luxury goods such as TVs, cars, refrigerators and archery bows indicating that farmers do hold dispensable income after costs of living which they can spend on such items.

Asset type		No	%	Asset type		No	%
Asset owned - radio	Yes	6	60	Asset owned - bukhari	Yes	8	80
	No	4	40		No	2	20
Asset owned - TV	Yes	7	70	Asset owned - electric	Yes	3	30
	No	3	30	iron	No	7	70
Asset owned -	Yes	7	70	Asset owned - electric fan	Yes	1	10
retrigerator	No	3	30		No	9	90
Asset owned – bicycle	Yes	1	70	Asset owned - rice mill	Yes	2	20
	No	9	30		No	8	80
Asset owned -	Yes	1	10	Asset owned - sewing	Yes	1	10
motorbike	No	9	90	machine	No	9	90
Asset owned - car	Yes	4	40	Asset owned - tractor	Yes	4	40
	No	6	60		No	6	60
Asset owned - mobile	Yes	10	100	Asset owned - machine	Yes	1	10
pnone	No	0		plow	No	9	90
Asset owned - rice	Yes	10	10	Asset owned - thresher	Yes	0	
cooker	No	0			No	10	100
Asset owned - water	Yes	10	10	Asset owned - winnower	Yes	3	30
Doller	No	0			No	7	70
Asset owned - foreign	Yes	4	40	Asset owned - insect	Yes	1	10
DOW	No	6	60	pump	No	9	90
Asset owned - alter	Yes	9	90	Asset owned - jewelry	Yes	2	20
	No	1	10		No	8	80

Table	16:	No.	and	percentage	of	affected	househo	d	respondents'	affirmation	on	pos	session	by	asset
type															

Table 17: No. and percentage of non-affected household respondents' affirmation on possession by asset type

Asset type		No	%
Asset owned - radio	Yes	74	63
	No	43	37
Asset owned - TV	Yes	79	67
	No	38	32
Asset owned -	Yes	54	46
refrigerator	No	63	54
Asset owned - bicycle	Yes	4	3
	No	113	97
Asset owned -	Yes	3	3
motorbike	No	114	97
Asset owned - car	Yes	17	14
	No	100	85
Asset owned - mobile	Yes	111	95

		OVI	%
Asset owned - electric	Yes	8	7
Iron	No	109	93
Asset owned - electric fan	Yes	6	5
	No	111	95
Asset owned - rice mill	Yes	22	19
	No	95	81
Asset owned - sewing	Yes	12	10
machine	No	105	90
Asset owned - tractor	Yes	23	20
	No	94	80
Asset owned - machine	Yes	8	7
piow	No	109	93
Asset owned - thresher	Yes	3	3
phone	No	6	5
-------------------------------	-----	-----	----
Asset owned - rice	Yes	116	99
cooker	No	1	1
Asset owned - water boiler	Yes	102	87
	No	15	13
Asset owned - foreign	Yes	19	16
DOW	No	98	84
Asset owned - alter	Yes	97	83
	No	20	17
Asset owned - bukhari	Yes	73	37
	No	44	73

	No	114	97
Asset owned - winnower	Yes	16	14
	No	101	86
Asset owned - insect	Yes	1	1
pump	No	116	99
Asset owned - jewelry	Yes	34	30
	No	82	70

Data on expenditures shows that overall farmers expenditures on consumption (food, clothing and children education) is much less than non-consumption expenditure (health, service bills, transportation, religious ceremonies, taxes, fuels, house maintenance, labour hire, production inputs). The farmers in the affected category seem to spending slightly higher on an average than the non-affected households. As a percentage share of the total expenditure, non-affected households spend 79% on non-consumption expenditure while affected households spend 73% as opposed to 21% spent on consumption by non-affected households where as affected households spend 27%. The data reveals that the needs of rural households are becoming diversified and there are many expenses to meet besides fulfilling the dietary needs of the household. In such a situation there will be an increasing requirement to meet these needs through augmented income for the households.

Table 18: Statistics on affected respondents' expenditureby type

Table 19: Statistics on affected respondentsexpenditure by type

		Expenditure on consumption	Total non- consumption	Total expenditure		Expenditu on	re c	Total non- onsumption	exp	Total penditur
			expenditure			concampt		xponantaro		•
Mean		21,144	81,800	102,944	Mean	27,2	260	75,026		102,286
Median		13,500	45,500	60,721	Median	24,	500	55,142		71,632
Minimum		-	1,550	5,600	Minimum	4,8	300	26,935		33,535
Maximum		296,500	1,157,200	1,173,200	Maximum	65,0	000	164,100		196,500
Sum		2,473,840	9,570,630	12,044,470	Sum	272,0	600	750,265	1,	022,865
Percentiles	25	8,900	20,850	35,585	Percentiles	25	7,65	0 38,	410	56,411
	50	13,500	45,500	60,721		50	24,50	0 55,	142	71,632
	75	21,900	90,750	122,340		75	42,85	0 113,	140	168,41
										0



Figure 6: Percentage share of expenditure by type of non affected Hh by type



Figure 7: Percentage share of expenditure of affected Hh by type

3.10 Enterprises

A rapid assessment of the type of enterprises operating in the project area reveals that there are in total 8 shops in total in Tashiling and Tsangkha. There are also 2 shops and 1 tourist resort between Chendebji and Tashiling. There are 3 RNR products sales outlets which are basic sheds constructed with government assistance from which farmers at the moment sell dairy produce.

In the periphery of the project area, in Bjizam there is one shop and between Bjizam and Trongsa there is one tourist resort and 1 general shop. Between Tsangkha and Bjizam also there is 1 resort and 1 hotel. Trongsa Dzongkhag, according to data received from the Ministry of Economic Affairs in Trongsa has 465 service category of enterprises. 262 contract businesses. 22 production and manufacturing enterprises, 293 small retail traders and 46 micro-trade enterprises. The commencement of the NHPP, as experienced with the Mangdechhu HPP, is expected to increase the volume of business transactions of businesses in Trongsa. The business communities, with their present experience with servicing clientele from the Mangdechhu HPP anticipate similar opportunities from this project as well.

3.11 Vulnerability

Discussion on vulnerability is important from a social development perspective. Often development projects can aggravate the socio-economy of vulnerable populations through differential impacts of the development. Here, several types of vulnerabilities that could be possibly triggered by shocks, income poverty, land ownership, widowhood, disability, productive capacity are briefly discussed. In this report, the types of vulnerabilities will be quantified among the population but the main analysis of vulnerability and compounding of vulnerabilities will be discussed in the Resettlement Plan document.

Shocks

Villagers' household socio-economy can be adversely affected by shocks triggered by events both natural and anthropogenic. The table below describes the number of respondents who experienced such shocks. The table shows the common shocks experienced to be crop failure, death of livestock and severe illness and injury. The other shocks seem not to be widely prevalent.

						Тур	e of s	hock	exper	ience	d					
Type of responden t	Livestoc k death		Crop failure		Loss of regular employmen t		Fire, theft, loss or property		Severe illness, injury		Death of Hh member		Victim of violence , crime		Food shortage s	
	No	Yes	Ye s	No	Yes	No	Ye s	No	Ye s	No	Ye s	No	Yes	No	Yes	No
	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Not affected	87	30	53	64	1	116	2	11 5	11	10 6	6	11 1	0	117	1	116
Affected	7	3	5	5	0	10	1	9	2	8	0	10	0	10	0	10
Total	94	33	58	69	1	126	3	12 4	13	11 4	6	12 1	0	127	1	126

Table 20: No. & perc	centage of respondents'	experience of shock by	by type and affected status
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With regard to whether or not people were adversely affected by the shocks, the table below shows that 19% of those affected by crop failure and 12% of those affected by livestock death reported to have faced difficulty since their living conditions was affected by the event. In general, the data shows that households seem to possess good resilience and have coping strategies to abide by the adverse situations instigated by the shocks. Food shortages, crime, fire or theft, violence seems to be quite rare occurrences.

Table 21: No. & percentage of respondents' experience hardship on experiencing shock

of shock by type and affected status	
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If living		Type of Respondent								
conditions	Response	Not affected		Affe	cted	Total				
anected by		No.	%	No.	%	No.	%			
Livestock	No	106	91	10	9	116	100			
death	Yes	11	100	0	0	11	100			
Crop failure	Yes	21	91	2	9	23	100			
	No	96	92	8	8	104	100			
Loss of	Yes	2	100	0	0	2	100			
regular employment	No	115	92	10	8	125	100			
Fire, theft,	Yes	0	0	0	0	0	100			
loss or property	No	117	92	10	8	127	100			
Severe	Yes	7	87	1	12	8	100			
illness, injury	No	110	92	9	8	119	100			
Death of Hh	Yes	5	100	0	0	5	100			
member	No	112	92	10	8	122	100			
Victim of	Yes	1	100	0	0	1	100			
violence,	No	116	92	10	8	126	100			

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If the size of		Type of Respondent									
conditions	Response	Not affected		Affe	cted	Total					
anected by		No.	%	No.	%	No.	%				
crime											
Food	Yes	2	100	0	0	2	100				
shortages	No	107	92	9	8	116	100				

Disability

The data about disability shows a total of 13 persons that reported disability during the household survey. It is notable that 9 out of the total disabled are women. Some of the disabilities prevalent are blindness, deafness, dumbness, lameness and body malformation.



Figure 8: No. persons with disability by type and affected status

Income poverty

The data on income poverty from the survey shows that 7 households from among the non-affected households have incomes that are below the national poverty line of Nu. 1,097 a month or Nu. 13,164 a year. Most of these households are under Drakten geog which is indirectly benefited by the NHPP.

		Type of Respondent									
If live below poverty	Not af	fected	Affected		Total						
	No.	%	No.	%	No.	%					
No	109	92	10	8	119	100					
Yes	7	100	0	0	7	100					

Widowhood or divorce can enhance the vulnerability of women. The data shows that there were in total 33 women who were widowed of which only 1 is from the affected households. Similarly only 1 woman among the 20 divorcees is from affected households. The non-affected households hold larger populations of these categories as can be noted from the table below.

	Respondent type						
Marital status of members	Not affected	Affected	Total				
	No.	No.	No.				
Widow	32	1	33				
Widower	11	0	11				
Divorcee	19	1	20				

Table 23: No.	& percentad	ae of respo	ondents facing	widowhood

As a productive asset in villages in Bhutan, the acreage of land owned and cultivated has implications not only for food security but also for income especially if livelihoods are land-based. It was found out that among the affected households only 1 household reported owning land less than 1 acre. Whereas, 12 non-affected households hold less than 1 acre of land.



Figure 9: No. of respondents with marginal landholdings (< 1 acre)

Chapter 4: Stakeholder Consultations, Participation and Information Dissemination

4.1 Stakeholder Analysis

A stakeholder analysis matrix below maps the stakeholders, the reasons for being involved in the Project, nature of involvement in the preparation and implementation phases of the project, level of influence exerted by each stakeholder vis-à-vis the project and the benefits that each stakeholder expects to achieve.

It is evident that DGPCL, the donor and the GNHC have high influence on how the project will be planned and implemented since most crucial decisions would be taken by these agencies on the project. The dzongkhag and geog administrations at the local level are important in that they would play an important role in facilitating land acquisition before the project can commence. These local government entities also will, owing to their local presence, assist the project authorities in any matters requiring engagement with villagers. The villagers in whose area the project will be implemented are important and they need to be consulted throughout project preparation and implementation as they can oppose the project if they are unhappy with impacts and if they do not get a fair deal for losses of any kind. The business community within Trongsa and beyond will be able to benefit from the many opportunities for supply of goods and services required for the project.

Stakeh	Reason for	Role/Nature of	of involvement	e	gh w	
older/ benefi ciary	involvemen t	Project preparation	Project implementation	Influen	H – Hi M - Med L – Lo	Benefits to stakeholders
DGPC L	Coordinate studies, identify & recruit construction companies, supervise implementat ion	Lead agency	Lead executing agency Management and coordination M&E Reporting Develop policy and regulation Technical adviser Implementation		Н	Contribute to fulfilling DGPCL mandate
Donor	Funds for the Project	Monitoring	Implementing agency Funds disbursements M&E		Н	Contribute to development goals of the country
GNHC	National Aid Coordinatio n GEF OFP	Coordination and monitoring	Facilitate co- financing Approve fund release M&E		Н	Contribute to GNH (poverty alleviation)
Dzongk hag	Falls within administrati	Coordination	Coordination of issues impinging		М	Local presence and necessary role for early verification of land and

Table 24: Stakeholder matrix for NHPP

DGPC-BHUCORE

Admini stration	ve area of jurisdiction. Facilitation of land survey and compensati ons		on villages and geog matters		compensation. Assist in resolving problems as they arise
Geog Admini stration	Falls within administrati ve area of jurisdiction. Facilitation of land survey and compensati ons	Coordination	Coordination of issues impinging on villages and geog matters	М	
Villager s of benefiti ng and impact ed villager s	Project located in the area and land & properties could be affected	Provision of information and facilitation of studies	Derive benefits	Н	
Busine sses within and outside Trongs a	Business opportunitie s – goods and services required by the Project.	Supplier of goods and services	Supplier of goods and services	L	

4.2 Consultation Strategy

The approach to be used for consultations has been outlined in the methodology section. The team carried out consultations with various groups of persons. The Geog Tshogde or local administrative functionaries were consulted for their views on the impending NHPP development and their suggestions on how best they could participate in the various stages of development of the NHPP. Similarly, the local village heads were also consulted for similar views. The outcomes of consultations with these groups have been summarized in the next section.

Once the impacted land had been determined, the affected persons, 10 out of 11 who are affected, participated in the consultative meeting. They were informed about land acquisition, the procedures and their views were also received on smooth transition when land is taken over and compensation paid. The minutes of the consultations is appended with the Resettlement Plan document. It is inevitable that the Resettlement Plan will have to be disclosed once complete for which all affected people will be invited to participate in the event and to forward grievances if any within a stipulated date.

4.3 Stakeholder Exchange and Outcomes

The meeting held with the Geog Tshogde was attended by the Mangmi (Deputy Gup/Chairperson) and the Geog Administration. A summary of the discussions with them are bulleted hereunder:-

With regard to the *development potentials* of the geog, some of the developmental activities and infrastructure that the geog still requires are farm roads and irrigation channels. Activities such as prevention of crop predation of crops and animals by wild animals, crop and livestock development, conversion of dry land to wetland and small and medium enterprise development such as food processing units were considered essential.

The tshogpas mention that electricity and soling of the farm road and the need of a meeting hall in centrally located Lorim as well as pasture and potato development seem to be the main needs of the Nyala-Drangla tshogpa. Whereas, for the Tangsibji tshogpa feels that wetland expansion, farm road improvement and renovation of irrigation channels are required in terms of developmental activities.

Their *perceptions* on the NHPP are that the project is beneficial although negative impacts mainly on the environment are foreseen. With the NHPP in place, it is expected that the overall infrastructure in the project area and the geog such as roads, colonies will be enhanced. The school and BHU could also be upgraded as there will be large populations that these facilities will have to service over and above the presently served villagers. They also expect that the area will receive stable electricity.

The *tshogpas* feel that the area will progress a lot and they will be able to derive benefits from the project. They also expect to benefit as they can sell agriculture and livestock products since they will have an assured demand by the customer base created by the project. They also feel that they would be assured a stable and reliable supply of electricity once the project is complete allowing them to use many electrical appliances and small machinery.

Some of the *negative impacts* of the NHPP seen are those on the environment and eco-systems. There also may be damage to community properties such as existing farm roads, drinking water systems and irrigation temporarily. Substantial dust pollution is expected to impact on crop yields and on the health of the locals. Traffic congestion, inadequate water from the current water source for the increased population is expected. There would also be possibilities of an increase in disease transmitted by the foreign worker populations.

Some of the negative impacts as foreseen by *tshogpas* are impacts on land but feel that it is acceptable if they are compensated adequately in land or cash, as desired by the owners. They also noted that those who have small parcels of land could be differentially impacted since they depend on these more that those with large landowners who may not be as adversely affected since they have larger landholdings to fall back on incase of loss. Also, since access to fuel wood resources could be competitive but these issues could be sorted out through proper discussions with the contractors. They also feel that the project will create access of wild animals from across the river to land near their village so crop predation will increase so request adequate measures in the form of fencing to control access.

The Geog Tshogde expects to *participate* in the NHPP by assisting with information provision and with surveys during the planning phase. During the construction, they can mobilize local people and youth for employment. The Tshogde also can assist in the identification of vacant government land for replacement.

They expect that these negative impacts can be well mitigated especially the environmental ones by proper management by the government. The impacts on health can be averted and reduced with good awareness among both resident and foreign worker populations.

With regard to the GT's views on *land affected by the Project*, they feel that most affected land is not prime productive land but a few whose land is affected depend entirely on the affected land and therefore could face hardship. They feel that the procedure allowing people whose land is affected to opt for exchange land or cash is up to people's choice. They feel that where possible the project should try and avoid impacting land of people who depend solely on that land where possible. Also, they request if the productivity of land lost is assessed for compensation since currently compensation does not cover the state of the land taken over.

The *tshogpas* are of the opinion that if people are adequately compensated or can get the desired replacement land for land lost, this should be acceptable. They also advocate the grant of development cost of the land which people will take over as replacement land which are mostly forested land and would require immense cost for making the land cultivable. They also feel that people should receive their registration for the replacement land soon and without hindrance.

In stating their *expectations*, the Geog Tshogde representatives expect to work closely with the project and the people. They also feel that the Project could invest in some facilities such as drinking water source protection (fencing and plantation), construction of market sheds in different areas accessible to both farmers and workers it would be beneficial. They also request for emergency budget that the Project could consider funding the re-construction works of irrigation channels and farm roads which are by *force majeure* washed away especially during summer. They also want to collaborate closely with the NHPP in solving where relevant problems jointly as they emerge.

The *tshogpas* too expect that some development funds are made available by the project so that those activities which the government is not able to fund or for emerging needs are taken up by the Project. They also feel that they should be provided electricity as the present supplies from the micro-hydels are unreliable and unstable. They also feed that blacktopping of the present farm roads and employment opportunities for local people in the project would be useful.

Some *concerns* the Geog Tshogde have are delay in land replacement. They also share the experience that people have expectations on high rates of compensation but the government has standardized rates and this leads to further delay in the acquisition process. They also request caution especially during blasting in certain areas in which local deities reside. Another concern is about health impacts brought on by incoming workers and immigration impacts if there is interaction between locals and workers leading to marriages.

The concerns that *tshogpas* have are that the work may not be implemented as per plan by the contractors and therefore may impact adversely on the environment and farmers' land for which they may not receive the required compensation. A *tshogpa* was also worried about head-hunting of children on commencement of the project as sacrifice.

The minutes of the consultations held with affected people can be found with the Resettlement Plan document. However, in summary, the discourse dealt with impacts on land and other local infrastructure such as roads and the mini-hydel, compensation or land replacement and people's views and concerns on the mode of compensations and rates offered by the government. Grievance redressal was also discussed and the means which affected people had at their disposal was explained.

4.4 Information Dissemination

Information dissemination refers to making available information with regard to the Resettlement Plan in the public domain. Some of the strategies that will be used to ensure that information is disseminated as widely as possible are described below:-

- The executive summary of the Resettlement Plan document to be posted on DGPCL's website and be made available in whatever form is desired by any authority or person sharing an interest in the RP;
- The RP Document to be made available in the DGPCL Office as well as with public libraries for access to the general public or issued on request;
- The RP is to be summarized into a booklet. Entitlements and details of compensation are to be translated into Dzongkha and made available to the Geog Tshogde, Dzongkhag Administration and last but not the least with each affected person.

Chapter 5: Perceptions on Project Benefits and Adverse Impacts

Respondents were asked on their perceptions of benefits from the project. The table below in which some of the benefits expected show that most felt that they would acquire economic gains through the sale of agriculture and livestock products. The worker base would be substantial and fresh local vegetables and dairy products would be demanded. People also expect benefits in employment opportunities as there would be substantial number of jobs created for which locals could take up like transportation and other support services. People also foresee opportunities for business such as groceries, taxis and hotels to cater to the worker population. Access to shops and markets will be enhanced through improved road networks and availability of vehicles. Upgrading of school and health facilities to cater to a larger population also seems inevitable.

Table 25: No. of respondents' mentioning benefit from NHPP by type

			Type of b	penefit expec	ted from Nik	kachhu HPP		
Respondents answering	Access to electricity	Market for agricultural produce	Improved health services	Improved education facilities	Easy access to shops and markets	Employment opportunities	Access to business opportunities	No benefits expected
No. of respondents	10	47	17	15	29	31	21	1

In terms of adverse impacts, the main concern as also found out in the consultations was with land. This concerned differential and more severe impacts on those with smaller landholdings and the need to ensure that they got fair compensation if impacts could not be avoided altogether. The possibility of avoidance was reinforced to save the land of such people. Other impacts mentioned were those affecting the environment and impacts arising out of the migrant population in terms of health, immigration and competition for local resources.

Chapter 6: Conclusions

The NHPP project components namely adits, access roads, muck disposal sites, power house and surge shaft as well as residential colonies will leave an indelible mark in the physical and social landscape of Serpochen, Tangsibji, Tsangkha and Norbuodi settlements under Tangsibji geog. The area will see substantial construction activity which will transform the rural area into a hydropower project town as observed in other areas in Bhutan in the past such as Chukha, Gedu, Rangjung and the Punatsangchu Basin settlements of Hesothangkha, Basochhu and Baychu.

There are a number of stakeholders involved in the Project but the most important besides the project proponent (in this case, DGPCLL) are the communities living in the area who will have to approve the project by according a "social clearance" to the Project. In the wake of any opposition to the Project, there will be undue delays, unwarranted media attention and a blemish on DGCPL if a robust SIA and adequate consultations are not carried out. Other key stakeholders are the local government agencies in the dzongkhag and geogs respectively who need be brought on board for their inputs, though periodic and minor, are necessary for the smooth execution of the project. They will therefore have to be consulted always and sufficient relevant information shared for their cooperation and facilitation.

It is possible that the majority of land owners are women, takes active part in family affairs and in decisions and therefore assigned by family members as household heads. This is a matter of pride and not vulnerability in Bhutan and therefore should be mistaken for a vulnerable group without the addition of other social and economic variables which could then provide better explanations of vulnerability.

People reside in semi-extended families which are a source of household labour and internal social safety net for care of the very young and the old. The population characterized by a young population and almost equal proportions of males to females has potential for better economic improvement of the household.

Though farming is the mainstay of the people in the project area, there is scope for diversification of occupations with the huge opportunities presented by the NHPP whether for household production of marketable surpluses or off-farm work in which youth and men can engage in, many of which will require prior training to perform in project-related tasks.

Health and education services and facilities are widely available to the population keeping morbidity rates low and school-going aged children in school. Influx of more people in the project, both national and non-national will necessitate an up gradation of these facilities to cater to a burgeoning population.

Land is not optimally used and factors like household labour availability, damage of wildlife to crops, limited irrigation for paddy transplantation and limited incentive to commercialize agriculture for want of absorbent markets seem responsible. This is however set to change with a huge expatriate population expected which will provide the required market. The mixture of labour, farming skills, investments and effective extension by the RNR sector for better yields can ensure broad-based development of the commercial agriculture sector in the geog.

The present benchmarks of annual income earned seem reasonably good. There are reasons, such as the quality of housing and the presence of most household assets in the houses, to believe that people of the benefiting villages are well-off. With the project, they could only prosper more if the opportunities are prudently taken advantage of to meet the diverse needs of the household as shown by the consumption patterns in the households.

The communities living in the project area though prosperous are not immune to factors that would enhance their vulnerability. Shocks arising out of natural causes (climate, death) or man-made (illness, accidents, crime, food shortages) can make people vulnerable. When these are further aggravated with the socio-economic factors such as marginal land holdings, low income, disability, senility and widowhood could compound vulnerability. Such people could become worse off as a result of the project as they would not be able to cope with and capitalize on the benefits as the more resource-rich households do.

The consultations with stakeholders has ensured buy in to the project because people are expectant that the project should start soon. Land acquisition issues have been discussed and government policies, procedures and practices disseminated and their concerns discussed. However, the process should continue so that people have a smooth transition to receipt of land exchange or cash compensation as desired by them and adequate, relevant and timely dissemination of information is necessary. Peoples' representatives namely the Geog Tshogde and the Tshogpas were allowed to share their views and concerns on imminent NHPP development and these will be carried forward in the design and implementation of the Resettlement Plan.

Projects almost always create expectations from projects of this scale. However, the needs expressed are modest and will only benefit the collective since what they ask for are development needs that the government, with its limited resource to be shared across the country, cannot immediately support. People see huge promise in their collective economic advancement through creation of a market for their goods and services. They can internalize benefits by mobilizing their own resources supported by government sectors and working of the market.

Annex K: List of Officials Consulted

Date and Year	Name	Agency
November 2-24, 2010	Public Consultation	Drakteng geog
November 25-26, 2010	Public Consultation	Tangsibji geog
29 June 2012	Dr. Durga Neopaney	Environment Officer, Mangdechu Hydropower Project
24 July 2012	Mr. Cheku Dorji	Deputy Park Manager Jigme Singye Wangchuck National Park
26 July 2012	Dasho Dawala	Dzongda, Trongsa Dzongkhag Administration
26 July 2012	Ms. Tshering Yangzom	Environment Officer, Trongsa Dzongkhag
27 July, 2012	Mr. Kunzang Chedrup	Asstt. Engineer for Dam, Mangdechu Hydropower Project
30 July 2012	Mr. Tenzing Khorlo	Chief, Environment Assessment Division, National Environment Commission
30 July 2012	Mr. Karma C Nyedrup	Advisor, National Environment Commission
25 July, 2012	Mr.Pasang Dorji	Nyala Tsogpa, Trongsa Dzongkhag
25 July 2012	Mr. Tshering Tashi	Geog Administrative Officer, Trongsa Dzongkhag
25 July, 2012	Mr. Sar Wangchuk	Tsogpa, Tangsibji geog, Trongsa Dzongkhag

List of People consulted by Project team during survey work and preparation of the EIA

List of People consulted by Project team during due diligence

Date and Year	Name	Agency
17 Sep, 2012	Dr. Durga Neopaney*	Environment Officer, Mangdechu
		Hydropower Project
May 10, 2013	Mr. Bijay Moktan	World Wildife Fund, Bhutan
May 10, 2013	Mr. Wangda	Head, Watershed Department, DOFPS
	Mr. Kesang	Park Manager
September, 2012	Wangchuk	Jigme Singye Wangchuck National Park
24 July 2013		
25 July 2013	Mr. Tshering Tashi	Geog Administrative Officer, Trongsa
29 October, 2013		Dzongkhag Administration
September 17, 2013	Ms. Rebecca Pradhan	Royal Society for the Protection of Nature
December 2013		
30 October, 2013	Mr. Sar Wangchuk	Tsogpa, Tangsibji geog, Trongsa
		Dzongkhag
September 2013-	Mr. Tenzing Khorlo	Chief, Environment Assessment Division,

June 2014 (more than	Mr. Tshering Dorji	National Environment Commission
twice a month)		
April 29, 2014	Mr. Sonam Wangchuk	Head, Wildlife Conservation Division,
		Department of Forest and Parks
April 29, 2014	Mr. Namgay Tshering	Head, Land Section, Forest Protection and
		Utilization Division, Department of Forest
		and Parks
Email communication	with stakeholders	
Email discussions with	Dzongkhag Forest Office	er, Trongsa Dzongkhag
Email discussions with	Environment Officer, Tro	ngsa Dzongkhag
Email discussions with	Park Manager, JSWNP	

Timeline of the Project

Date and Year	Project Activity
June 3, 2010	Social Impact Assessment and Environmental Impact Assessment awarded to 2 Local Consultancy firms by DGPC
July 7, 2010	Formal letter sent to Trongsa Dzongkhag, Nature Conservation Division, Department of Forest, informing them of EIA studies being conducted for Project
July 16, 2010	Meetings to discuss EIA process with 11 AM: Forest Resources and Management Division 2PM: Nature Conservation Division 3PM: National Environmental Commission
September 28,2010 November 17, 2010	Letter sent by DGPC informing Trongsa Dzongkhag informing about Project and seeking approval to conduct SIA and EIA
November 23-26, 2010	Public consultations and surveys from November 23-25 by local consultants in Drakteng and Tangsijbi gewogs
November 15, 2010	ToR for EIA endorsed by NEC
November 30, 2010	Social Impact Assessment completed
January 28, 2011	Meeting to discuss Project with stakeholders at Conference room, Project Office in Changzamto
March 3, 2011	EIA consultancy awarded for Stand Alone Project
October 25, 2011	Site visit by National Environment Commission
November 21,2011	DGPC Board decision to change project as Stand Alone Project- decision communicated to NEC to defer environmental clearance process
March 26, 2012	EIA TOR approved by NEC
July, 2012	EIA completed
June, 2012	Additional social and environmental studies initiated and due diligence initiated under ADB Technical Assistance
June, 2012	Application for various clearances (Forest, Dzongkhag, Land etc.) initiated
July 25, 2012	Public Consultation with Local Communities in Geog Tsogdue Hall, Tangsibji
September 18, 2012	EIA presentation to all stakeholders NEC, Department of Forest and Parks, NGOs, Local Representatives
October 1, 2012	EIA report finalized and submitted to DGPC after editing and

Date and Year	Project Activity
	incorporation of comments from EIA presentation
October 10, 2012	Consultant with Project Affected Women in Trashiling
October 29, 2012	EIA revised after due diligence and additional field studies and submitted by DGPC to NEC for approval
October 30, 2012	Discussion of EIA and EMP with local communities in Tsangkha and Tangsibji villages. Distribution of the EMP in dzongkhag to participants and to the geog administrative officer for further distribution
December 4, 2012	Public consultation with affected persons in Tangsibji geog office
12 December, 2013	ESIA presentation to the Dzongkhag and community leaders (Minutes of meeting in Dzongkha)
December 27, 2013	EIA presentation by DGPC to NEC and all Stakeholders/Representatives of various organizations
January 27, 2014	EIA presentation to local communities and public at Tsangkha Middle Secondary School
March 10-15, 2104	Joint field visit by NEC and stakeholdersto project site
April 3, 2014	Formal comments from NEC based on Presentation and Field visit
April 7, 2014	Public consultation with displaced household representative in Tangsibji geog office
April 9, 2014	Public consultation with displaced household representatives in Drakten geog office
May 8, 2014	Revision of EIA based on Comments from NEC after meetings and field visit
July 1, 2014	Environmental clearance awarded by NEC (based on all other clearances received from various stakeholders)

Annex L: Public consultation proceedings with the project affected households

MINUTES OF THE CONSULTATIONS WITH THE PROJECT AFFECTED HOUSEHOLDS

Venue:	Geog Tshogde Hall, Tangsibji
Date of Consultation:	25 July, 2012
Participants:	Affected households of Serpochen, Tangsibji, Tsangkha villages, Geog Tshogde Officials, DGPC officials, Facilitators from BHUCORE-Gonefel Consulting Team.

Karma Jimba, Consultant welcomed all participants (affected participants) to the meeting and emphasized the importance of cooperation to achieve good results. He then introduced all persons who came to the meeting from outside the community such as Consultants, DGPC and ADB. He introduced the purpose of the meeting, which is to discuss jointly participants' perception about the project and concerns with regard to land affected by the project. The participants were made oriented through reference to the maps, locations of project components such as Dam, access roads, adits, muck disposal sites, staff colonies, quarries, temporary camps, and power house using the map where all project components were marked on it. They were asked if they understood the entire project footprint. Questions raised regarding the components were clarified.

With regard to impact on land by project components, Mr. Karma Jimba, explained that although the type of land impacted and the owner of the land had been identified, the exact acreage of land affected is yet to be determined. The participants who expressed their concerns are described below:-

- The Mr. Sar Wangchuk Tshogpa of Tangsibji mentioned that damage to the mini hydel's canal will affect irrigation supply to all the wet land owned by Tangsibji farmers.
- He also mentioned that as far as possible minimizing impact on land should be attempted.

Wild Life Conflict

The villagers informed the meeting that the main animals which damage crops are boar and sambar deer which damage crops. They also explained that the degree of damage was similar to other geogs in the Dzongkhag and that the wild animals damage almost 40 - 50 % of the crops. They attributed the cause of wild life damage to the increase in forest areas and good health of the forest, which led to increase in wild life population. They also mentioned that they are carrying out protective fencing. They were informed of wild life predation on livestock and the compensation scheme of the government. Participants informed of a few owners of cattle killed by wolves and owners who reported the incidents to forestry officials. Participants requested Nikachhu Project to help to ease wildlife damages.

Perception of the Project and Compensation

The participants where asked their perceptions about the project. Mr. Tshering Tashi, Geog Administrator Officer (GAO) mentioned that 2 years ago the project was already being discussed and that impact on the land were assessed but issues about land loss, compensation in cash or land replacement had not been discussed. So this meeting is very timely.

Mr. Pelzang, an affected person mentioned that though impact on the land of a few households is inevitable, the benefit to participants exceeded negative impacts. He explained that most affected Page 1 of 3

participants would lose about 5 % of land but they have kept in mind that figures on the amount of land lost may change. They also informed that they are aware of people affected by Mangdechhu Project not receiving land replacement or cash compensation. The lesson learned was that it is important to sort out all compensation in advance to avert future problems. On the question raised about availability of land for compensation within the geog it was informed that there is adequate land available for replacement within the geog. Mr. Tsewang Norbu another affected person informed that most affected prefer land replacement over any other compensation. It was raised that affected people should be personally asked their preference either for land replacement, cash or any other compensation and it was not right for one person to decide on this for others.

Mr. Karma Jimba explained of other ancillary benefits such as free electricity for 10 years as in Punatsangchhu Project would have to be explored. The GAO mentioned that it is often the case that more land has been taken by the project during construction than originally assessed. This He said is very problematic for villagers. This was increasingly noticed in the Mangdechhu Project. He suggested that all land replacement and cash compensation replacement is to be done before implementation of the project and to clarify all players' responsibilities.

Another affected person Mr. Tashi Phuntsho emphasized the need for the project to consider employment for school dropout of project influenced Households (HH) to which the Karma Jimba mentioned that the household situation of potential employees among the local youth has to be examined to ascertain needs of the household.

Another affected person Mr. Tenzin Duba mentioned that the scheme applied for the Punatsangchu hydro power project should be replicated for Nikachhu wherein affected participants receive free electricity for 10 years. He also mentioned that this meeting has been useful as all participants were explained and understood the procedure for compensation.

An affected person Mr. Tenzin Duba asked what would happen if during construction land of owners other than those affected would be impacted. To this the Mr. Karma Jimba replied that that this is not likely to happen although there would be some changes to the land of affected persons identified already during the planning phase of the project.

Mr. Tenzin Wangchuk another affected person mentioned that the access road would affect land in strips above and below the road. So land affected by the road may be small and therefore not eligible for land replacement or compensation. He also enquired about the impact on houses. Mr. Karma Jimba explained that if more land is affected and only the house is saved it may be more viable for participants to relocate to places where they would have both land and homesteads. Therefore, the option would be to valuate the house for acquisition and resettle the person in the replaced land. He also mentioned that the team will look at practices followed in other power projects in Bhutan with regard to free electricity for consumption sale by the affected person.

Another affected person Mr. Norbu Wangdi informed that the Drangla people could get 1 to 2 acres along the road (Sherphuchen) and shifted therefore for income generation opportunity through sale at the road site (not clear please rephrase). He went on to request that they are given land replacement in the colony area for establishing small businesses to enhance their livelihoods.

Another affected person Mr. Tenzin Duba also mentioned that there is scope for up-gradation of school for which hostel facilities are required which the project may consider supporting.

On the enquiry about the cultural properties by Mr. Karma Jimba the participants informed about the Tsheringma Drupchu, Babji Dzong (hillock in the shape of dzong) and rock above Tsheringma Drupchu.

Page 2 of 3

They also mentioned that the Zalam chu which receives water draining from the Tseringma Drupchu is important and precious as it provide drinking water to 75% households under Tangsibji. However, none of the Project components would be affecting any of these. Furthermore they explained that area is just called Babji Dzong which has no connection to historical Dzong.

Mr. Sar Wangchuk, Tshogpa of Tangsibji mentioned that if there is an opportunity of expanding the road alignment and muck disposal site to government land; this should be done to lessen the impacts on land. He also emphasized to register replaced land before construction.

Mr. Pasang Dorji, Nyala Tshogpa indicated that the community forest at Nyalateng may be affected by the project. It was clarified that since the community forest is located above the road it will be not be impacted since the access road to the muck disposal site and colonies will have it's off take from the highway but will be aligned below the road towards the planned components.

Conclusion

The Consultant, Mr. Karma Jimba mentioned that the Consultants and the Project would as far as possible take into consideration issues that were discussed in the meeting to ensure that there are less problems with land acquisition.

Since they were no other issues raise the GAO thanked all for their participation in the discussions and for exchanging their views. He mentioned that the meeting has been very useful and informative.

The meeting ended with the signing of the attendance and invitation by Mr. Karma Jimba to all for lunch.

Annex M: Proceeding minutes of the draft ESIA presentation to the stakeholders

Record Note of Discussion of the Draft ESIA Presentation on Nikachhu Hydropower Plant (NHPP) from 0930 hours to 1330 on September 18, 2012 in Hotel Migmar Conference Room, Thimphu

The lists of participants are attached as Annexure I.

Registration of all the participants from various agencies started by 0900 hours and shortly after the arrival of the Chairperson Dasho Chhewang Rinzin, Managing Director of Druk Green Power Corporation, the presentation commenced.

Dasho in his opening remarks welcomed all the participants from various agencies of Royal Government of Bhutan and Non Governmental Organizations and also other relevant stakeholders. Dasho expressed his gratitude for the presence of diverse stakeholders that was gathered for the ESIA presentation of Nikachhu HPP. Dasho informed the forum that despite being burdened by already ambitious target to acheive 10,000 MW by 2020, Druk Green was still taking up the medium sized projects like NHPP mainly because besides operating and maintaining the existing hydropower plants, its other mandate is to develop and promote new hydropower plants. Therefore in terms of moving forward with capacity building, NHPP serves as a very important project for Druk Green.

Dasho stated that this was a revised ESIA for Nikachhu after the identification of the new scheme whereby the tail water of Nikachhu shall be discharged into the dam of Mangdechhu HPP. He stated that NHPP is fortunate enough to have been able to secure in principle Asian Development Banks (ADB) funding. M/s Price water Coopers (PWC) recruited by ADB has also been associated with the Consultant: M/s Bhutan Consultants and Research (BHUCORE) in carrying out the studies so as to enable for ADB to move forward with the funding.

Dasho reminded the forum that Nikachhu HPP is not a Druk Green's Project but an important National Project and, therefore, everyone present should work together and help each other in enabling the success of Nikachhu HPP.

He also mentioned that the project shall be developed under Clean Development Mechanism (CDM) under UNFCCC like Dagachhu HPP and therefore level of Environmental and Social Safeguards responsibilities and scrutiny is even greater for this project.

As Environmental Clearance (EC) is pre-requisite for any project implementation, the draft ESIA report discussion is very crucial to get feed backs and suggestions for the stakeholders so that the final report can be comprehensive which shall expedite the EC process.

He closed the opening remarks by hoping for an interactive and fruitful discussion.

The Consultant then presented the report and the following discussions and comments were observed:

- 1. Mr. S.k Jain of PWC, ABD noted that the environment policy of ADB which has been reflected as Environment Policy, 2002 has been revised to 2009 and therefore to be accordingly corrected in the document.
- 2. Mr. Sangay Dorji, Wildlife Conservation Division, Department of Forest and Park Services expressed the need to take into consideration the time frame that was allotted for the survey that was carried for the baseline data of the endangered animals in the project area and also the need to take into account the seriousness of the information that was provided by the park officials and locals of the presence of the endangered animals. He also suggested to incorporate the studies done by the park and records of presence of endangered species by the locals in the report.
- 3. Mr. Kesang Wangchuk, Park manager, Jigme Singye Wangchuck National Park (JSWNP) thanked Druk Green for including JSWNP in the consultation meeting. He informed the forum that JSWNP is a fairly new park and as yet no extensive research has been done. Despite that, based on the camera evidence it is established that JSWNP is a known tiger habitat and therefore proper care has to be taken while the project is still in the planning stage.

Dasho on this acknowledged the comment and also re-iterated that NHPP is not individual's project and is of National Interest so information and concerns be shared for incorporation.

- 4. Mr. Chimmi Dorji, Department of Hydro met Services, raised the concern on sample size that was considered for the socio economic survey as to whether people below the age of 15 and elders above the age of 60 were also consulted. Mr. Karma Jimba, Consultant, BHUCORE, clarified that 127 household which was the total size and that the specific details are reflected in the report.
- 5. Ms. Rebecca Pradhan from Royal Society of Protection of Nature (RSPN) expressed concerns regarding the influx of huge manpower that will be imported for the project. She stated the need for employing the local contractors and workers for the project rather than importing. She also informed that besides the tree sizes of 10 cm and above that was considered for the sampling size, trees below the 10 cm girth also has to be considered for the sample size as these trees shall grow into future forests.

Dasho assured the forum that if the local contractors had the required expertise and know how, they would definitely be taken in and that special contract works like drilling for geotechnical investigation, ESIA, survey and all had been restricted to only Bhutanese Contractors keeping in mind the need to develop competencies amongst private sector.

6. Mr. Sangay Dorji, Wildlife Conservation Division, Department of Forest and Park Services raised the question of whether the project is being accepted by the people and community within the project area. Mr. Saroj Nepal, Social Consultant with BHUCORE said that it was well included in the survey questionnaire and the people in general welcomed the project. He also mentioned that people welcomed the project wholeheartedly and were looking forward to it.

In addition to this, the Gup of Tangsibji Gewog, Mr. Jigme Chogyel expressed that this project is of national interest and would certainly be beneficial to them. He also mentioned that there were no issues from the people of his Gewog. However, the Gewog were not able to explain technically on why NHPP had to be revised technically and had to tunnel to MHPA. Generally, he expressed his people's support for the project.

Dasho on this also highlighted the development brought and associated with hydroprojects in the region with the experiences from the commissioned Kurichhu, Chukha and Tala Hydropower Plants.

- 7. Director (Projects), Druk Green raised some concerns on the following issues:
 - a. The need to revisit the figures presented on submergence area and total land acquisition;
 - b. The use of hydraulic breakers for Dam excavation was not technically viable option due to Scope of Work;
 - c. Issues related to logs being carried out and damages done to Dam. He opined that given the relatively smaller catchment of NHPP, this should not be of much concern to us and directed to re-examine in the report;
 - d. The need to discuss further on the proposed allocation of funds for the community so as not to duplicate what the Royal Government is doing and that; while the intentions are good, no undesirable precedence must be created.

Director (Finance), Druk Green further stated that allocation of separate funds could create conflict of interest over the ownership of the fund.

- e. He pointed out that nature can be more resilient than we expect: for instance, he mentioned that hornbills which are very sensitive to disturbance have been seen to habitat in the construction sites of Dagachhu Project.
- 8. Mr. Chimmi Dorji from Department of Hydro met services expressed the need for detailed study on aquatic ecology and for the environmental release.
- 9. Mr. Sangay Dorji from Wildlife Conservation Division, Department of Forest and Park Services suggested the need for diversification in plantation and to avoid monoculture.
- 10. Miss Rebecca Pradhan, Royal Society for Protection of Nature, pointed out that the budget allocated for plantation was less and hence needs to be properly assessed.
- 11. Dasho Thrompon, Thimphu Thromde pointed out the need to have a sanitary landfill instead of common landfill which could serve both Nikachhu as well as the Trongsa town.
- 12. Mr. Kezang Wangchuk, Park Manager of JSWNP mentioned that the disturbance to wildlife could be huge due to huge influx of construction workers during construction period and therefore needs to be properly mitigated. He also stated the need for support by the project, in addition to resources provided by RGoB, to the Park Management to monitor the increased activities created by the project.

Dasho in conclusion stressed the importance of this project to nation building so that the revenues from the hydropower sector contribute to support the socio-economic development if the kingdom and therefore such cross-sectoral views must be taken, noted and properly addressed. Dasho also mentioned that Consultant (BHUCORE) to take note of all the comments and incorporate them before finalizing the reports.

Dasho thanked all the representatives for their participation in the presentation meeting and the meeting concluded at 1330 hours.

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Annex N: Terrestrial survey form

APPENDIX IV: TERRESTRIAL SURVEY FORM

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Transect	Location Name	Coordinate (transect)	Coordinates Plot	Bearing	transect length (m)	Plot size	> 20	o cm	Betwe and 2	en 100 00 cm	between c	100 and 50 m	Girth <	< 50 cm	of Specie	Names of trees	Orchids	Ground vegetation	Avifauna (name)	Mammalia ns (name)	Reptiles (name)
01						radius (m)	# trees	Ht (m)	# trees	Ht (m)	# trees	Ht (m)	# trees	Ht (m)							

Annex O: List of Maps

Map 1: Project Location


Map 2: Project Layout



Map 3: Project Components and Protected Areas



Map 4: Land Use







Map 7: Project Area Hydrology





Map 8: Watershed Upstream Dam



Map 10: Dam burst scenario lacies method





Nikachhu HPP Layout showing Adits Contour Interval 10m,Scale 1:40,000



Nikachhu HPP Layout of Potential Flooded Area Scale 1:3000





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Nikachhu HPP Layout showing Access Rods



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Annex P: Terms of Reference



मुलाय्येन्द्रा अञ्चल लोकर जात्र अन्य सुन रा सुन केंगाया प्रधायम्बन्द्रगगत्न। National Environment Commission Royal Government of Bhutan NEC/ESD/DGPC/1837/2012/ 3480



March 26, 2012

Τo The Director(Projects) Projects Department Druk Green Power Corporation Ltd Thimphu

Subject: Endorsed Terms of Reference (TOR)

*This has reference to your letter no. DGPC/PD/37 (a)/2012/1626 dated March 01, 2012 regarding the Terms of Reference (TOR) for conducting the Environmental Social Impact Assessment (ESIA) study for Nikachhu Hydropower Project for the extended areas under

In this regard, find attached the endorsed terms of reference. Please ensure that the ESIA study is conducted as per the endorsed ToR and the reports are submitted accordingly.

Thanking you,

Sir,

compto m(c), frag

Pena Daril,

Copy to:

Sincerely,

(Thinley Dorji) Head

Environment Services Division



1. The Dzongkhag Environment Officer, Dzongkhag Administration, Tongsa for 2. OC

Updated Terms of Reference – Environmental and Social Impact Assessment (ESIA)

Terms of Reference (ToR) for conducting - Environmental and Social Impact Assessment (ESIA) of Nikachhu Hydropower Project (NHPP)



1. Background

Nestled in the Himalayas, Bhutan is endowed with an enormous wealth of hydropower potential. The hydropower potential is estimated to be over 30,000 MW and so far only about 5% of that potential has been harnessed.

Druk Green Power Corporation Limited (Druk Green) was formed on January 1, 2008 with the amalgamation of the erstwhile hydropower corporations and it is mandated to look after existing power generating facilities and to accelerate the hydropower development in the country. The company currently operates five power plants with an installed capacity of 1,480 MW and will be taking over power plants for operation and maintenance as and when those being constructed under Special Purpose Vehicles of the Royal Government are commissioned. The company will also be taking up new hydropower projects on its own or under joint ventures.

2. Nikachbu Hydropower Project

As per the updated Power System Master Plan (PSMP) of Bhutan (2004), the installed capacity of Nikachhu Hydropower Project was envisaged as 208 MW. Dam site was proposed at location named D1 with river bed El. 2,240 m. The height of the concrete dam was 23 m above river bed level.

Department of Energy (DoE), RGoB allocated the Pre-Feasibility Study (PFS) of the Project to DGPC in 2009. The PFS report was submitted to DoE in November 2010. In the PFS report, Dam Site (D1) and the Power House (PH1) location were at the same location as proposed in the PSMP; however, the installed capacity was a little higher at 210 MW. In June 2011, the geotechnical studies at the feasibility level were completed. As per the geotechnical studies; the dam site at D1 was not found to be suitable; thereby, two alternatives dam sites D2 and D3 were identified.

The geological and geotechnical study show that PH1 lies in fair rock conditions with high permeability, consisting almost entirely of Garnetiferous Micaceous Schist and Mica Schist with intrusions of Quartz and Dykes. From the geotechnical studies, it was concluded that the location of PH1 may be feasible; however, the cost of construction may escalate due to presence of high permeability at PH1. Keeping in view the geological conditions, similar to the one being encountered at Dagachhu Hydropower Project which has led to time and cost overrun, an alternative location of Power House PH2 and PH3 were identified. The alternate scheme not only locates the Power House areas in more competent geology but enables the tail water to be released into the reservoir of the 720 MW Mangdechhu Hydroelectric Project for increasing electricity generation.

Based on the merits of combining the Nikachhu Hydropower Project with the Mangdechhu Hydroelectric Project, Druk Green's Board in its 30th Meeting approved the study of the combined scheme.

After the approval, the PFS Report which was prepared in November 2010 was updated in December 2011. In the updated PFS, six alternatives were considered for the study. The six alternatives are as under;

1

Nikachhu HPP

Page 2

Description	Alt # 1	Alt #2	Ålt#3	Alt#4	Alt#5	Alt#6
Dam Location	D2	D3	D2	D3	D2	D3
Power House Location	PH1 ·	PH1	PH2	PH2	PH3	PH3

The locations of the Dam and Power House are as under;

Loca	tion of Dam Site and Power	House				
	Coordmates					
Location	Latitude	Longitude				
D2 at Lorim	27°26'55.41"	90° 22'22.21"				
D3 at Banglapokto	27°26'32.49"	90° 24'9.34"				
PH1 at Tansibji Village	27°26'29.46"	90° 27'17.90"				
PH2 at Norbuodi	27°29'28.36"	90° 29'5.37"				
PH3 at Chipchipokto	27°28'39.94"	90° 28′50.19"				

In the updated PFS Report, it was recommended to carry out Feasibility Study for Alternative Alt #3, Alt #4, Alt #5 and Alt#6 keeping in view the following:

- i) -The levelized tariff for Alt#3, Alt#4, Alt#5 and Alt#6 are lower than Alt #1 and Alt #2;
- ii) From the surface geology, the geology of PH2 and PH3 especially in the Surge Shaft, Pressure Shaft, Power House and Tail Race Tunnel is good and far better than at PH1;
- Social and Environment Impacts of developing the Nikachhu Project in combination with Mangdechhu Project are far lower than developing the stand alone Nikachhu Project with PH1.

The Tender for Design and Engineering at Feasibility Level has been floated and shall be awarded in March, 2012. The Inception report shall be scheduled to be completed in June 2012. One of the outcomes of Inception Report is the selection of the best project from the above four alternatives (i.e Alt#3, Alt#4, Alt#5 and Alt#6). The location of the selected alternative shall be furnished to the Consultant during the tenure of this Consultancy Services. Thus the ESIA under the Scope of this ToR shall cover only one of the project alternatives. However, for the estimation and understanding of the project, the technical's details of the four alternatives are given below;

2.1. Technical Details of the Project

The Project is found on topographic map Wangener Thorese, sheet no. 78 I/7 in scale 1:50,000 with counter interval of 40 m published by Department of Survey and Land

	<u> </u>	4
Nikachhu	HPP	

Records, 2000, 1st edition, Bhutan. Below is the surveyed map of the project area with tentative location of intakes and Power Houses.



The main East-West highway runs along Nikachhu from Chendebji Chorten past the project intake and the powerhouse area viewed from Chejapang, MHEP Dam access. The diversion site D2 and D3 are located on Nikachhu approximately 3.5 and 8.6 kms respectively, downstream of Chendebji Chorten. The Power House, PH2 is located at Norbuodi (Alt#3 and Alt#4), close to Mangdechhu Dam, and PH3 at Chipchipokto (Alt#5 and Alt#6).

Access road to the intake may take off from the main highway at Lorim (D2) and Bangla Pokto (D3).

The tables below provide the Technical Details of Nikachhu Hydropower Project;

Descriptions	Unit	Alt#3	A [+#/	A Love I	
Power			201010	Alt#5	Alt#6
Potential					
Design Discharge	m³/s	30.74	33.08	30.74	
Net Head	m	504.19		50.74	33.08
Installed			353,19	504.18	353.19
Capacity	MW	130	ONMENT COR	130	98

a. Salient Features

Updated Terms of Reference –Environmental and Social Impact Assessment (ESIA)

Descriptions	Unit	AJt#3	Alt#4	Alt#5	Alt#6
Energy (90% dependable year)	GWh	497.17	372.89	497.17	372.89
Additional Energy from Mangdechhu Power House	GWh	373.34	390.67	373.34	390.67
Total Energy	GWh	870.5	763.56	870.5	763.56
PLF (90% dependable year)		0.44	0.43	0.44	. 0.43
Hydrology Catchment Area	km ²	373	398	373	398
Mean Annual Runoff	l/s/km ²	49.23	49.23	49.23	49.23
Design Flood	m ³ /s	446.53	476.46	446.53	476.46
Minimum Environmental Flow	m³/s	0.05	0.05	0.05	0.05
Average flow	m ³ /s	18.36	19.59	18.36	19.59
Maximum flow	m³/s	109.58	116.92	109.58	116.92
Minimum Flow	m ³ /s	2.94	3.13	2.94	3.13
Reservoir					
FRL	masl	2,280.05	2,121.11	2,280.05	2,121.11
Gross Storage	mill. M ³	0.0199	0.0125	0.0199	0.0125
Live Storage	M^3	0.0078	0.0037	0.0078	0.0037
Dead Storage	mill. M ³	0.0122	0.0088	0.0122	0.0088
Length of Reservoir	m	464.41	289	464.41	289
Reservoir Area	km ²	0.0213	0.013	0.0213	0.013
Dam					
Туре		Concrete Gravi	ty Dam		
Dam top level	masl	2,281.55	2,122.61	2,281.55	2,122.61
River bed elevation	masl	2,262.00	2,103.00	2,262.00	2,103.00
Dam height above river bed	m	19.55	MISSION +	19.55	19.61
Crest Length	m	48,5	In Say 46.8	46.5	46.8

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Updated Terms of Reference – Environmental and Social Impact Assessment (ESIA)

Descriptio	ons U	nit Alt#3	3	Alt#4	1	A 11-85	11002
Headrace Tunnel					1	All#3	Alt#6
Length	1	n 13	250	10.2	10		-
Optimum di	a.		200	10,310		12,3	00 9,1
Of tunnel	I	n .	3.3	:	3.4	3	.3
dia. Of tunn	el n	n	4.5	4	4.5	4	.5 4
Design discharge	m ²	/s 33	3.82	36.	39	33.8	32 36
Velocity	m	/s 2	13	2.	20		
Surge Shaft			-		67	2.1	3 2.2
Number	N	2	1		-		
Orifice			1		1		1
diameter	m	12.	.36	12 3	16	12.2	6 100
Height	m	59	24	56.1	1		12.5
Top Elevation	n mas	1 2 308	50	21404	1	56.93	3 52.
Pressure Shaft			50	2,148.1	2	2,307.46	5 2,146.43
Number	No		1		-		
Туре		Steel Lines	1			1	I
Diameter	m	3	1		-		-
Rated	-3/2		-	3.4	-	3.4	3.4
Discharge	10.75	33.8	2	36.39		33.82	36 30
Velocity	m/s	3.7	2	4.01	-	2.70	
Length	No	53.	5	375	-	3.72	4.01
Main Access Tunnel				514		528	369
Diameter	m	(5	6	-		
ength	m	576	5	576	-	6	6
Power House Complex			1	576		651.5	651.5
уре		Undergroun	d				
ize of Power	172	00110100	T				
louse	111	80X18X39	80	X18X39	802	(18X39	80X18X39
ransformer Im GIS	m	47X13.5X20	47X	13.5X20	47X1	3.5X20	47¥12 €¥20
avern					47X13.5X20		
umber of	No	2					
ins inacity of		2		2		2	2
ch Unit	MW	65		40			
peof		V		49	-	65	49
rbine		Pelton	Ve	rtical	Ver	tical	Vertical
	-	I UILUII	DOMAR.	HONCOA.	Pelt	on	Pelton

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Updated Terms of Reference - Environmental and Social Impact Assessment (ESIA)

Descriptions	Unit	Alt#3	Alt#4	Alt#5	Alt#6
Speed of rotation	RPM	375	300	375	300
Type of Generator		Synchronous, 0.9 pf lag	Synchronous, 0.9 pf lag	Synchronous, 0.9 pf lag	Synchronous, 0.9 pf lag,
Generator Voltage	kV	11	11	11	11
Transformer and GIS		6 + 1 spare, 30 MVA, 1 ph., 11/132 / √3 kV GTs	6 + 1 spare, 30 MVA, 1 ph., 11/132/ √3 kV GTs	6 + 1 spare, 30 MVA, 1 ph., 11/132 / √3 kV GTs	6 + 1 spare, 30 MVA, 1 ph., 11/132/ √3 kV GTs
		220 kV GIS	132 kV GIS	132 kV GIS	132 kV GIS
Maximum Gross Head	m	530.72	371.78	530.72	371.78
Net Head	m	504.18	353.19	504.18	353.19
Tailrace Tunnel					
Length	m	1,140	810	1,970	1.960
Size	m	4.7	4.7	4.7	4.7

b. Land Requirement Estimate for the Project by various Project Ancillaries

Permanent Colony Total area required for proposed roads Transformer and Electric line for Permanent Colony Water Tank for Permanent Colony Labour Camp, Store & Workshop for Dam site Labour Camp, Store & Workshop for Power House, Surge Shaft Temporary Site office and Quarters for Power House	Area (Ha)
Total area required for proposed roads Image: Composed roads Transformer and Electric line for Permanent Colony Image: Colony Water Tank for Permanent Colony Image: Colony Labour Camp, Store & Workshop for Dam site Image: Colony Labour Camp, Store & Workshop for Power House, Surge Shaft Image: Colony Temporary Site office and Quarters for Power House Image: Colony	5.83
Transformer and Electric line for Permanent Colony Water Tank for Permanent Colony Labour Camp, Store & Workshop for Dam site Labour Camp, Store & Workshop for Power House, Surge Shaft Temporary Site office and Quarters for Power House	11.5
Water Tank for Permanent Colony Labour Camp, Store & Workshop for Dam site Labour Camp, Store & Workshop for Power House, Surge Shaft Temporary Site office and Quarters for Power House	0.02
Labour Camp, Store & Workshop for Dam site Labour Camp, Store & Workshop for Power House, Surge Shaft Temporary Site office and Quarters for Power House	0.05
Labour Camp, Store & Workshop for Power House, Surge Shaft Temporary Site office and Quarters for Power House	1.73
Temporary Site office and Quarters for Power House	2.99
1 Contraction of the state of t	0.21
Temporary Site office for Dam site	0.21
Labour Camp area for Dam site	0.66
Aggregate crushing plant near Dam site	1.62
Batching and Mixing plant near Dam site	1.21
Batching and Mixing plant near HRT site	0.81
Batching and Mixing plant near Power House site	0.81

Note: The above land requirement is tentative.

c. Tentative areas required for Muck Disposal

Muck Disposal Area for;	Area:(Ha)
Dam site	Contraction 12.02
Nikachhu HPP	
+	8

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Updated Terms of Reference - Environmental and Social Impact Assessment (ESIA)

HRT, Surge Shaft, ADITs	·····
Power House	3.47
Magazino	1.36
Magaznie Area	0.12

The Consultant shall identify muck disposal areas for Nikachhu Hydropower Project at the vicinity of various Adits and other project components.

Alt	#3	Al	t#4	1 41	+##		
ADIT	Length (m)	ADIT	Length (m)	ADIT	Length	ADIT	Length
ADIT 3-1	911	ADIT 4-1	647	ADIT 5-1	911	ADIT 6-1	(m) 647
ADIT 3-2		4-2	638	ADIT	940	ADIT	638
ADIT 3-3	535	ADIT 4-3	1,568	ADIT 5-3	535	6-2 ADIT	1,308
ADIT 3-4	1,069	ADIT 4-4	1,083	ADIT 5-4	781	6-3 ADIT	280
ADIT 3-5	1,105	-	-	ADIT	347		
Total Length (m)	4,560.0 0		3,936.0 0	5-5	3,514.0 0		2,873.0

d. Tentative Adit Lengths for various Project Alternatives

The locations of the ADITs for all the alternatives are give in the Project Map in Section 2.1.

e. Total Volume of Muck likely to be generated from various Project Components

Unit	Alt#3	Alt#4	Alt#5	Alt#6
m³	4,899.38	7,805.66	4 800 29	2 005 00
m ³	13,639.05	13.639.05	13 630 05	12 620.05
· m ³	30,288.75	34,744.50	30 288 75	13,039.05
m ³	210,732.14	163,973,47	195 623 05	144 720.05
m ³	7,107.91	6,732.36	6.830.74	6 211 21
m ³	4,857.37	3,404.70	4,793.82	3 350 22
m ³	19,778.37	14,053,05	34 178 41	24 004 01
m³	16,286.020	NMENT 6,286 324	18,420.73	18,420,73
	Unit m ³ m ³ m ³ m ³ m ³ m ³ m ³	UnitAlt#3m³4,899.38m³13,639.05m³30,288.75m³210,732.14m³7,107.91m³4,857.37m³19,778.37m³16,286.023	UnitAlt#3Alt#4m³4,899.387,805.66m³13,639.0513,639.05m³30,288.7534,744.50m³210,732.14163,973.47m³7,107.916,732.36m³4,857.373,404.70m³19,778.3714,053.05m³16,286.02316,286.024	UnitAlt#3Alt#4Alt#5m³4,899.387,805.664,899.38m³13,639.0513,639.0513,639.05m³30,288.7534,744.5030,288.75m³210,732.14163,973.47195,623.05m³7,107.916,732.366,830.74m³4,857.373,404.704,793.82m³19,778.3714,053.0534,178.41m³16,286.02818,420.73

ADIT	m ³	79,113.47	68,287.42	60,965.95	49,844.96
Power House	m ³	56,160.00	56,160.00	56,160.00	56,160.00
GIS Cum Transformer	m³	12,690.00	12,690.00	12,690.00	12,690.00
Total volume of muck generated	m ³	455,552.46	397,776.22	438,489.87	381,700.49

f. Summary of Access Road (km) Requirements

Description	Alt#3	Alt#4	Alt#5	Alt#6	
Highway to D2	1.34		1.34	-	
Highway to D3	-	3.77		3.77	
Access road to Surge Shaft (Alt# 3 and	2.12	0.46			
A1t#4)	J.13			100 N 10 M	
Access road to Surge Shaft (Alt#5 and	-	-	1.58	1.13	
Alt# 6)					
Access road to Power House (PH2)	0.42	0.42	-	-	
Access road to Power House (PH3)	-	-		-	
Read to ADIT	5.92	11.48	5.79	11.53	
Total Road Length (km)	10.81	16.13	8.71	16.43	
Bridges (m)	-	-	171.2	171.2]

3. Regulation for Environmental Clearance of Projects

Under Section 29 of the Regulations for the Environmental Clearance of Projects, if the National Environment Secretariat or Competent Authority requires the applicant to conduct environmental assessment, the following provisions apply:

29.1 *Terms of Reference:* The Applicant will draw up the Terms of Reference (ToR) for the environmental assessment.

29.2 Preparation and Submission of the Environmental Assessment Report: The applicant shall prepare the environmental assessment report consistent with the ToR approved by the Secretariat or Competent Authority. The environmental assessment report shall, wherever possible, follow the format described in Annex 3 and the guidelines issued by Secretariat or Competent Authority

29.3 Public Notice of Availability of the Environmental Assessment Report: The applicant will comply with the public notice requirements in Section 31 of this regulation

29.4 Within the time limit specified in Annex 1 regarding receipt of complete environmental assessment report and completion of the public notice procedures, the Secretariat or Competent Authority may issue an environmental clearance based on the environmental assessment report.

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Updated Terms of Reference -Environmental and Social Impact Assessment (ESIA)

4. Objectives

The objectives of this Consultancy Services are to:

- Review of earlier Environmental and Social Impact Assessment Reports and update for the extended areas;
- Ensure that the resulting ESIA Report will be suitable for review and evaluation by NEC, DGPC and other stakeholders including development partners;
- Serve as a standard document against which the subject matter covered by the ESIA report will be evaluated and;
- Provide specific guidelines for:
 - ✓ Identification and description of the issues to be investigated;
 - Fitting the ESIA studies into the context of existing policies, rules and administrative procedures.
 - Public consultations and disclosure;
 - ✓ Collection of data;
 - Examining alternatives;
 - ✓ Assessing impacts and
 - ✓ Developing an Environmental Management Plan (EMP) and Resettlement Plan (RP).

4.1.Scope of Work

The ToR is being prepared for an ESIA at the Detailed Design and Engineering Stage of the project cycle. ESIA for Nikachhu as a standalone project has already been carried out in 2010 (Annex-I). The scope of work under this ToR shall cover ESIA of the extended project areas including environmental assessments of its various project ancillaries. The scope of services to be provided by the Consultant shall be, but not limited to the following:

 Incorporate findings of the previous Environmental and Social Impact Assessments that covers Power House area PH1 and Dam Alternative D1 (Annex-I);

- Conduct ESIA of the extended Project Areas of the Combined Scheme;
- Conduct ESIA of the identified access roads (roads to adits and road connecting various project components): The assessment should comply with the NEC's Sectoral Guideline for EA of Highways and Roads;
- Preliminary Environmental Assessment of Transmission and distribution lines (describe the structure (pole/tower type, height, average span, right of way width, etc), significant or sensitive features in the corridor, likely impacts of the line and main impact mitigation measures that will be implemented): in compliance with NEC's Sectoral Guideline for Transmission and Distribution lines;
- Detailed Management Plan for Muck Disposal Sites;
- Prepare Mitigation Measures, Environmental Management Plan, Auditing plan and Monitoring Programmes;
- Conduct Social Impact Assessment for the project;
- Prepare Resettlement Plan (RP) in accompanie Owith the internationally accepted standards and guidelines;

✓ Assess the identified sites for colonies, labour camps, batching plant, adits, etc. (tentative locations to be provided by Druk Green)

Incorporate any other information that may be determined by the NEC in line with the provision of the Environmental Assessment Act 2000 & its Regulation 2002.

5. The Contents of the Report

The following sections outline the Report for the ESIA of the Nikachhu Hydropower Project.

5.1.Name and Address of the Project Applicant

This section of the report should provide a concise description (corporate overview) of the organization that is submitting the report and should include:

- Name of the project;
- Name of the Applicant;
- ✓ Present mailing address including telephone number, fax, and email address of the applicant;
- ✓ Name of the environmental focal person of the applicant (as per Section 3 of "Regulation for EC of Projects, 2002");
- Qualification/designation of the focal person;
- Telephone number of environmental focal person;
- The name and contact details of the company that prepared the EA report.

5.2. General Introduction of the Proposal

This section must clearly state the objectives of the project, and its relevance to the Kingdom's socio-economic development. The objectives of the study and the relationship of its results to project planning, design and implementation should also be highlighted in this section. It should highlight critical points in the decision-making process linking Environmental and Social Impact Assessment and project execution. This will require descriptions of the construction and operational phases of the proposed project and should include the project;5

- ✓ Location and accessibility;
- ✓ Design and layout;
- ✓ Size and capacity;
- ✓ Land requirements;
- Access requirements;
- Transmission lines and distribution networks;
- ✓ Construction materials;
- ✓ Construction activities;
- ✓ Energy and power source for construction;
- ✓ Schedule;
- ✓ Staffing;

- ✓ Operation and maintenance activities O^{MIMISSION}

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In the Application for Environmental Clearance - Guidelines for Hydropower Development, these are addressed under i) Project Physical Details, ii) Project Biological Environment and iii) Project Social Environment. The Guidelines also include tables and matrixes for presenting the information. However, the information should be more detailed for those parts of the project where significant environmental and social Impacts have been identified.

5.3. Policies, Laws, Rules and Directives

Review of the country's legislative and administrative framework within which the ESIA is to be undertaken to ensure that the project is in compliance with national environmental and social requirements.

A summary should be made of the guidelines, procedural aspects, acts, rules, regulations and policies and sectoral guidelines, hydropower policies forestry regulations, etc, to be followed in the preparation of the ESIA report for the proposed project. Particular emphasis should be given to the policies and legal framework for sensitive issues such as pollution standards, protected areas, endangered species, criteria for impact evaluation, and the relocation of and compensation for project affected peoples.

5.4.Description of the Existing Environment

The data need to be collected only for additional/extended area.

The report must present relevant baseline information pertaining to the geo-physical, biological, socio-economic and cultural situation of the area under study, including any changes anticipated prior to project implementation.

5.4.1. Data Collection for the Preparation of ESIA Report and Methodology of Data Collection

The evaluation of the effects of hydropower project on the environment and socioeconomy require adequate knowledge of the ecosystems, including the human communities which exist within the area of influence of the project.

This section should summarize what baseline data and information was gathered, describe how they were gathered, and explain how they were used. The study goals must be clearly defined. The methodologies used for data collection should be briefly described. Predictive, quantitative models and standards should be proposed wherever possible to avoid vague and subjective predictions. In addition, public involvement to focus the analysis on locally important concerns and issues, and to ensure peoples' participation, should be employed.

5.4.2. Methodology

Methods used for collecting data should be infortioned. In analysis of air, water and noise, methodology adopted, instruments used etc., should be mentioned. The landuse/land-cover pattern of the area should be determined through interpretation of google



earth images, topographic sheets and ground truthing. Standard methods should be used for characterizing the diversity and other significant features of the biota and details of field survey given.

The baseline studies should be conducted in the following study areas but not limited to;

- i. The whole project area including the Catchment and Submergence Area;
- ii. Mangdechhu Dam site and Tailrace;
- iii. Project Areas to be acquired for various works area (including access roads, transmission lines, muck disposal area, colonies, batching plant areas, etc).

Adverse impact on land stability, catchment soil erosion, reservoir sedimentation and spring flow (if any) due to (a) considerable road construction/widening activity (b) interference of reservoir with the in-flowing streams (c) blasting for commissioning the HRT, TRT and some other structures should be studied. Besides, the following maps should be included in the report.

- The location map of the proposed project;
- The project layout, superimposed on a contour map of ground elevation showing main project features (viz. location of dam, head works, main canal, branch canals, quarrying, muck disposal sites, infrastructures etc.);
- Drainage map of the catchment up to the project site;
- ✓ Soil map of the study area including the Catchment area;
- Geological and seismo-tectonic map of the study area showing main project features;
- ✓ Interpretation of google earth images, topographic sheets along with ground verification developed for the land use/land cover pattern of study area using overlay mapping techniques viz. Geographic Information Systems (GIS).

5.4.3. Baseline Data

The Consultant shall collect data for the extended areas and areas where data collection is deemed necessary based on the review of the earlier study. Baseline data for the followings shall be collected.

i. Geological and Geophysical Aspects

- ✓ Geography & physiography of the project area;
- Design discharge & its RI (Recurrence Interval);
- Regional geology and structure of the catchment;
- Seismicity, tectonics and history of past earthquakes in the area;
- Critical review of the geological features around the project area;
- Impact of project on geological environment;
- ✓ Justification for location & execution of the project in relation to structural components.

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ii. Seismo-tectonics

Provide site-specific information on earthquake paragete

ili. Hydrology of the Basin

The hydrological data shall be made available by Druk Green.

In the report, baseline description of hydrology should be presented. The monthly flow rates and the average annual flow rates of Nikachhu and Mangdechhu rivers should be presented. The baseline description of hydrology on previous report has to be updated and improved. In doing so, the following points should be taken into consideration;

- Hydro-meteorology, drainage systems;
- Catastrophic events like cloudbursts and flash floods, if any would be documented;
- ✓ For estimation of sedimentation rate the data shall be provided by Druk Green;;
- ✓ Water availability for the project and the aquatic fauna;
- Design discharge and its recurrence interval.

iv. Biological Resources

Additional data for the extended areas should be collected with respect to the followings;

- Flora
- ✓ General vegetation pattern and floral diversity viz trees, shrubs, grasses, herbs, significant microflora etc. including lichens and orchids;
- Forests and forest types;
- ✓ Water body inundating forest area;
- Vegetation profile, no. of species in the project area, etc;
- ✓ Documentation of economically important plants, medicinal as well as timber, fuel wood etc:
- Endemic, endangered and threatened species;
- Impact of impoundment and construction activities on the vegetation;
- Cropping and Horticulture pattern and practices in the study area;
- Location of National Park in the vicinity of the project.

Fauna

- ✓ Inventorisation of terrestrial wildlife and present status;
- Endemic, threatened and endangered species.

Avifauna

- Fauna study should be carried-out;
- ✓ Status Resident/Migratory/Passage migrants;
- ✓ Endemic, threatened and endangered species & fossils;
- ✓ Impact of project on threatened/endangered fauna; if any, Inventorisation of terrestrial wildlife and mesent status.

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Aquatic Ecology



The study/sampling should at least cover eight sections at various locations as follows;

- above Nikachhu intake; i.
- 2 sections between Nikachhu intake and Nikachhu-Mangdechhu confluence; ii.
- 2 sections between MHEP Dam and Nikachhu-Mangdechhu confluence; iii.
- 3 sections between Nikachhu-Mangdechhu confluence and MHEP Tailrace; iv.

The study should comprise the followings but not limited to;

- ✓ Fish and Fisheries;
- ✓ Fish migrations, if any;
- ✓ Breeding grounds;
- Impact of dam building on fish migration and habitat degradation;
- ✓ Overall ecological impact up to Mangdechhu tailrace and the impact of untreated
 - and waste water in to the river.

National Park areas status of threatened/endangered fauna

✓ Biotic Pressures;

✓ Management plan for National Park and threatened/endangered fauna.

v. Water Quality

Collection of data pertaining to water (physico-chemical and biological parameters) and likely impact during construction and post construction periods should be carried out.

vi. Air Environment

- ✓ Baseline Information on ambient air quality in the project area covering aspects like SPM, RSPM, Sox, NOx;
- Noise Environment;
- ✓ Traffic density in the project area.

5.4.4. Identification of Environmental Impacts

The ESIA report should contain a list of both the adverse and the beneficial impacts anticipated as consequences of the proposed project at different stages of project cycle (Location, Construction and Decommissioning stages) and the following ancillary activities but not limited to:

- Permanent colony, labour camps, offices, stores and other temporary structures
- ✓ Proposed road
- Batching and mixing plants
- ✓ Construction materials extraction (Quarry)

- Transmission lines (transmission line construction power and
 All other Ancillant facilities and power evacuation line)

URC

All other Ancillary facilities

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It is recommended to refer the various Sectoral Guidelines for Environmental Clearance, NEC, 2004 for detailed assessment of environmental impacts of the project activities and then accordingly submit to NEC as appendices.

The impacts should be predicted and quantified as far as possible in terms of their magnitudes, location and duration contexts. Matrices, networks, checklists and questionnaires used in the process of identifying impacts should be appended in the annexes. Any environmental quality standards or socio-economic measures that were applied in the assessment must be stated. The impacts should be grouped into three basic categories as follows:

i. Physical

- Air
 - Changes in ambient levels and ground level concentrations due to total emissions from point, line and area sources;
- Effects on soils, material, vegetation, and human health;
- Impact of emissions DG sets used for construction power if any, on air environment.

Assessment of likely Greenhouse Gas (GHG) emissions from the Project (Dam) and its implication on Carbon Neutral Policy of the country

- Noise
- Changes in ambient levels due to noise generated from equipment, blasting operations and movement of vehicles;
- Effect on fauna and human health.
- Water
- ✓ Changes in quality;
- ✓ Sedimentation of reservoir;
- Impact on fish and other aquatic fauna;
- Impact on aquatic life in the dewatered stretch of the river;
- Impact of sewage disposal.

A prediction of the likely changes to water quality along the downstream river section due to the release of the environmental flow and sub-catchment inflows is required.

Hydrology

Given that Nikachhu Hydropower Project is now likely to involve the inter basin transfer of water into the Mangdechhu river, hydrology has to be described pre- and post-project for the affected sections of each river. The baseline flows and post-project flows should be presented on the Nikachhu and Mangdechhu rivers, clearly showing changes in river flow from the combinat Meneory of the Nikachhu and Mangdechhu HEPs. The four locations that need to be covered are: (i) Nikachhu immediately below

the dam; (ii) From the Dam of Nikachhu to the Nikachhu-Mangdechhu confluence; (iii) From the Dam of Mangdechhu to the Nikachhu-Mangdechhu confluence; and (iv) From Nikachhu-Mangdechhu confluence to the Mangdechhu HEP tailrace outlet. This discussion should clearly indicate the flow data and estimation method/s applied, and describe the catchment size and land cover; seasonality of river flows; and elevation, grade and accessibility (for river use) of the river sections where flow is reduced.

Downstream flows along river sections below dam - the estimation of post-project flows down the river sections where reduced flow has to take into account: (i) the proposed minimum constant environmental releases, if required, from the Nikachhu and Mangdechhu HEPs; (ii) average monthly spill flows from each HEP, if any likely during the monsoon; and (iii) intermediate catchment flows estimated to discharge into both rivers below each dam diversion.

Land

- Changes in land use and drainage pattern;
- Changes in land quality including effects of waste disposal;
- Riverbank and their stability;
- Impact due to submergence.

ii. Biological

- Deforestation and shrinkage of animal habitat;
- Impact on fauna and flora (including aquatic species if any) due to decreased flow of water;
- Impact on rare and endangered species, endemic species, and migratory path/route of animals, if any;
- ✓ Impact on breeding and nesting grounds, if any;
- Impact on animal distribution, migration routes (if any), habitat fragmentation and destruction due to dam building activity.

iii. Socio-economic Aspects

The details and Scope of Work are given in Section 5.5 of this ToR.

5.4.5. Alternatives for Executing the Proposal

Scoping matrix, likely impacts identified for various aspects of environment (aquatic, terrestrial and socio-economic) during construction and operation phase of the project must be discussed in brief for the selected alternative. This section should outline how the 'No Action Option' will be compared with the option of implementing variations in the design of the proposed project. The proposed methods will be expected to be capable of evaluating the advantages and disadvantages of both options in term of economy and environment. The 'No Action Option' is the existing scenario and describes status quo condition; whereas, under the condition with proper database timplementation, some changes are bound to take place. It is very important to explain here how different stakeholder groups will be incorporated into the consideration of alternatives such as:

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- ✓ Design;
- Project site;
- Technology and operational methods, schedule, required raw materials;
- Acceptability or otherwise of the risks likely to emerge while implementing the proposal; and
- ✓ Other relevant points.

Design, site, technology and operational alternatives should be compared systematically in terms of potential environmental impacts, capital and recurring costs, suitability to local conditions, institutional training and monitoring requirements. The environmental costs and benefits may be quantified and economic values for each of the alternatives should be given. The next step is to evaluate the policy under which the proposed project is being considered. Evaluate the existing policy and examine whether implementation of proposed project under the policy bring social benefits, protects the environment and achieves sustainability. However, if these are not attainable, then there is a need for policy intervention in order to identify a policy alternative that is socially acceptable and environmentally sound.

5.4.6. Mitigation Measures, Environmental Management Plan and Auditing

i. Mitigation Measures

The roles and responsibilities of concerned agencies at the central and local levels of administration in the implementation of mitigation measures proposed must also be included.

The ESIA report should propose pragmatic mitigation measures for all the activities likely to have an adverse impact. As mitigation measures cannot be expected to eliminate totally the adverse impacts, it is recommended that compensatory measures be proposed as well. It is essential that the cost effectiveness of mitigation measures be analyzed against viable alternatives. Present the mitigation plan in sufficient detail as far as possible so that it can be incorporated into the criteria for the project design. Explain specific aspects about the mitigation plan to be included in tender documents for the project construction contractor.

Appraise the plan for involuntary resettlement and describe any measures taken to minimize the number of relocates. Examine the success of previous resettlement programs and recommend changes in the current plan accordingly. Evaluate the incremental contribution to the long-term degradation of local natural and social and economic system. In doing so, compare the severity of cumulative impacts with those from other previous development activities.

ii. Environmental Management Plan (EMP) and Environmental Management Office

The ESIA report should provide a comprehensive EMP. It describes activities in support

of the following:

- project monitoring;
- ✓ project management;
- ✓ the verification of predicted environmental impacts with the impacts actually arising, and;
- ✓ the agencies responsible for these measures, costs and schedule.

The EMP should include but not be limited to the following.

- Delineation of micro-watersheds in the river catchment and mapping of critically degraded areas requiring various biological and engineering treatment measures;
- Identification of area for treatment based upon GIS methodology and Silt Yield Index (SYI) method of AISLUS coupled with ground survey;
- The prioritization of watershed for treatment based upon SYI. Spatial Information in each micro watershed should be earmarked on maps in the scale of 1:50,000.
 The CAT plan would be prepared with year-wise Physical and financial details;
 - ✓ Creation of Green Belt Plan around the Periphery of the Reservoir and Compensatory Afforestation Scheme in consultation with the Department of Forests;
 - ✓ Biodiversity Conservation and Wild life Management Plan for conservation and preservation of endemic, rare and endangered species of flora and fauna (in consultation with the Jigme Singye Wangchuck National Park (JSWNP));
 - Fisheries Development plan for conservation/management of reverine fishes and management plan for aquatic biodiversity in the dewatered stretch of the river.
 - Resettlement & Rehabilitation (R&R) Plan along with social/community development. R&R plan would be framed in consultation with the Project Affected Persons (PAPs), Project Authorities and the local government;
 - ✓ Energy Conservation Measures;
 - ✓ Dam Break Analysis of the selected alternative & Disaster Management Plan;
 - Restoration and landscaping of all working Areas: reclamation of borrow pits (quarry sites), muck disposal sites and construction areas;
 - Public Health Delivery System including the provisions for drinking water facility for the local community;
 - Management during the construction of Roads and all other Project components;
 - Sanitation & Solid Waste Management Plan for domestic waste from colonies and labour camps, etc;
 - Water and Air Quality & Noise Environment Management during construction and post-construction periods;
 - Forest Protection Plan especially guarding access to JSWNP;
 - ✓ Reservoir RIM Treatment Plan;
 - Environmental Monitoring Programme (With physical & financial details covering all the aspects form EMP);
 - Muck Disposal Plan (Suitable sites for dumping of excavated material would be identified in consultation with the DGPC, NEC and JSWNP);
 - Setting up of Air quality monitoring stations, management and reporting schedule to NEC.



Muck disposal is a major issue during project construction due to the large volume of material generated (from dam site preparation, tunneling, power station cavern excavation, road works, etc.) and the limited stable disposal sites available in proximity of the construction sites in the steep-sided valleys where project facilities are proposed. The minimum level of information that should be presented in the report should clearly indicate the plans for muck/spoil disposal proposed disposal sites and predict the impacts associated with it. The management plan should include:

- estimated total volume of spoil to be generated from each site (volume after excavation, assuming spoil will be compacted upon disposal);
- proposed spoil disposal site though tentative locations shall be provided by Druk Green (with the boundary of each site illustrated on scaled maps), and estimated capacity of each site based on site contours and final landform proposed;
- land cover and legal status of each proposed disposal site;
- general management measures to be implemented i.e. topsoil stripping and stockpiling; final landform/landscaped slopes, retaining structures and drainage; compaction in layers; site revegetation works; and
- final land use of each filled landform.

The volume of spoil/muck discussed in the ESIA should be the volume of spoil after it has been dumped and compacted at disposal sites, as opposed to the excavation volume, otherwise the volume required in disposal sites will be substantially underestimated.

Appropriate spoil disposal sites may include riverside land where disposal will not unduly restrict flood flows, lower slope hillside land where stable disposal can be achieved, or hillside depressions/small valleys where there is limited upslope catchment. Lower value land should be used wherever possible, such as riverside deposits, degraded or barren areas, and grassland. The location of project roads and other ancillary facilities should be planned in conjunction with spoil disposal sites so that: (i) the limited available disposal sites are not compromised by ancillary developments that could be located elsewhere, and (ii) project road length is minimized.

<u>Cost and budget-outlay for all the plans (Cost for implementing all the Environmental</u> Management Plans including the cost for implementing Environmental Monitoring Programme, aforesaid compensation, mitigation and management measures, Resettlement and Rehabilitation (Section 5.5), etc.).

The administration of an EMP may require the establishment of an Environmental Management Office to house monitoring staff after the closure of the EIA office. Funding to cover the costs of establishing and operating an appropriate Environmental Management Office to administer the EMP should be guaranteed in the basic project budget.

The EIA report should include a description of the administrative aspects of ensuring that mitigation measures are implemented and their effectiveness monitored after approval of the EIA.

iti. Auditing Plan


The purpose of auditing is to assess the actual environmental impact, the accuracy of prediction, the effectiveness of environmental impact mitigation and enhancement measures, and the functioning of monitoring mechanisms. The ESIA should include the design for auditing and its justification. Provide enough information to serve as a basis for carrying out an environmental audit, with appropriate indicators to be used in the process of the audit study during the operation stage of the project.

iv. Monitoring Plan

This section of the ToR must outline how the monitoring plan of project construction and operation will be elaborated. The report should clearly specify the nature of the monitoring required, stipulating who should undertake these activities, the cost and any other necessary inputs. The time schedule for monitoring should also be specified. Provide a comprehensive plan covering the environmental and social variables to be monitored, and provide the location and timing of sampling and measurement of the variables. Include baseline, compliance and impact monitoring and indicators to be measured for each of them. Name the institutions responsible for monitoring the different variables and show how the management plan is expected to influence the operation of the project. Provide sufficient guidance and prepare a 'training needs assessment' on sampling protocol and analytical standards to ensure the generation of reliable data.

5.4.7. Additional Studies

This section contains a description of other major studies that should be undertaken in support of the preparation of the EIA. If formal studies on environmental valuation and environmental risk assessment have been undertaken as part of the ESIA, these need to be included.

a. Environmental Valuation

Environmental Valuation provides means of assessing the benefits of environmental conservation and its contribution to the national economy. Based on such study, the benefits of the proposed project and environmental conservation can be compared and decisions could be made accordingly. Therefore, this part of the study should assess the economic value of the conservation and protection of environment in the proposed project area and comparison of benefits with the proposed project should be presented.

Environmental Risk Assessment

An environmental risk assessment may be a necessary part of the EIA if there is considerable uncertainty about the likelihood or the magnitude of environmental impacts. The data collected during basic EIA studies previder, much of the information needed for explicitly dealing with the uncertainties relating to environment impacts. There are two major categories of risk: 1) these to buse health, and 2) those to

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ecosystem integrity. The primary goal of environmental risk assessment is to evaluate risks, their monetary costs, the costs of emergency response and/or avoidance of risk.

Environmental risk assessment studies require a high degree of scientific and mathematical rigor and may be costly if not properly planned.

5.5. Social Impact Assessment (SIA)

As a part of feasibility study, Social Impact Assessment for Nikachhu Hydropower Project as a standalone project was carried out. The study areas covered villages of Tangsibji and Drakteng Gewogs (Annex-I). Now, since the project area is being extended and access road alignments for the project have been changed, the potential socio-economic impacts of the project need to be updated.

In order to assess the latest potential socio-economic impacts of the project and prepare mitigation measures for adverse social impacts, the following studies shall be carried out as a part of ESIA:

Component 1: Conduct a SIA of the proposed Nikachhu Hydropower Project; and
 Component 2: Prepare a Resettlement Plan (RP) in accordance with internationally accepted standards and guidelines (ADB or World Bank standards and guidelines will be acceptable).

- 5.5.1. Component I - Social Impact Assessment

i. Purpose and Objective

The overall purpose of the SIA is to assess, analyze, monitor and manage the social impacts of the proposed project.

The objective of the SIA is to produce an independent and robust Social Impact Assessment Report that will satisfy best practice and applicable national and international requirements.

The SIA process should be built on the following three elements:

- A detailed assessment of the socio-economic conditions of the people who may be negatively/positively affected;
- A detailed study of the impacts in terms of the extent of land acquisition, crop and tree loss, displacement, livelihoods and employment impacts, aesthetic impacts, cultural impacts (both tangible and non-tangible), community impacts, demographic impacts, development impacts, economic impacts, gender impacts,
- health impacts, impacts on vulnerable groups and indigenous peoples, infrastructural impacts, institutional impacts, leisure and tourism impacts, political impacts (good governance, human rights, democratization etc.), poverty impacts, psychological impacts, resource impacts (access and ownership of resources), and impacts on social and human capital;
 - A detailed plan to mitigate the identified impacts and an assessment of the costs of such measures. It is essential to generate key indicators based on the SIA in order

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to facilitate monitoring. Most essential of all is that the impact assessments should be transparent, participatory, and verifiable.

ii. Scope of work

The previous SIA has identified all affected people and communities that would be affected by the project. However, the current study should re-assess, update and reidentify all the affected people because of the combined scheme and change in project locations. It should define operationally relevant social issues that may affect project design, delivery, and outcomes, and provide mitigation measures for each adverse impact.

- Tasks
- ✓ Identify stakeholders and people who are directly affected (positively or negatively) and carry out a stakeholders' analysis;
- ✓ Mobilize and train enumerators. Lead and provide overall guidance and supervision to enumerators in data collection. Ensure data quality control. Check and review the outputs submitted by enumerators to ensure accuracy, completeness and consistency of responses, conduct validation checks of a sample of accomplished questionnaires to ensure data reliability and consistency. Data analysis and reporting;
- Provide specific recommendations to avoid/minimize social risks;
- ✓ Inform, consult, and carry out dialogue with stakeholders on matters regarding project design alternatives, implementation of social mitigation measures, and provide specific recommendations on project areas with high social impacts, including identification of areas, such as presence of significant common property or indigenous communities that may require adjustments in project design or special assistance to mitigate the adverse impacts on them;
- ✓ Facilitate and coordinate the participation of stakeholders in meaningful consultations and discussions;
- Document and analyze the local historical setting of the project area so as to be able to interpret responses to the proposed project, and to assess cumulative impacts;
- Collect baseline data (social profiling) to allow evaluation and audit of the impact assessment process and the planned project itself;
- Describe the relevant human environment/area of influence and baseline conditions of the people living in the proposed project area;
- Provide a rich picture of the local cultural context, and develop an understanding of local community values, particularly how they relate to the planned project;
- Conduct a socioeconomic survey of the affected population and provide a socioeconomic profile of the affected population and available infrastructure facilities or services in the project influence area to identify potential positive/negative impacts on poverty reduction and adverse impacts of the project on affected communities;
- ✓ Identify and describe the activities which are likely to cause impacts (scoping) and identify the full range of probable social impacts that will use addressed;
- Predict (or analyze) likely impacts and how different stakeholders are likely to respond;

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✓ Assist in the evaluation and selection of site alternatives;

- Recommend mitigation measures for each adverse impact induced by the project;
- ✓ Participate in the valuation process and provide suggestions about compensation (non-financial as well as financial);
- V Describe potential conflicts between stakeholders and advise on resolution processes;
- ✓ Determine magnitude of adverse social impacts and identify social safeguard instruments as required based on national laws, policies, and regulations;
- ✓ Develop coping strategies for dealing with residual or non-mitigatable impacts;
- Advise on appropriate institutional and coordination arrangements for all parties;
- ✓ Develop a mitigation plan;
- Develop monitoring and evaluation plan/mechanism to assess social development outcomes during the implementation of the project and after its completion.

Methods and Tools •

- Conduct a detailed socioeconomic survey of the households and villages affected by the project:
- ✓ For socioeconomic, cultural, and institutional analysis, combine multiple tools and employ a variety of methods for collecting and analyzing data, including both quantitative and qualitative methods (expert and key informant interviews, focus group discussions, beneficiary assessments, rapid and participatory rural appraisal [RRA/ PRA], and gender analysis);
- ✓ Develop interview schedules, field survey questionnaires, and checklist for data collection and discussions;
- ✓ Screen and prioritize social issues through different techniques, such as mapping and ranking;
- ✓ For determining the magnitude of impact and analysis of alternatives, indicate all information on structures, utilities and abutting land use that is likely to be affected within the project impact zone;
- The selection of SIA methodology should emphasize consultation and participation of project affected persons (PAPs), project implementing and executing agencies at the national, Dzongkhag and Gewog levels. The discussions with relevant government officials and local organizations should be participatory and broadbased, leading to the identification, selection, and agreement on project;
- Qualitative analysis should be undertaken in order to comprehend the intricacies of the causal chain and to inform and supplement the quantitative analysis. Methods could include PRA techniques, key informant interviews, most significant change approaches etc. The mix of qualitative and quantitative methods should be designed in order to maximize the usefulness of both types of data in the analysis, and to resolve shortcomings in either type of material.

5.5.2. Component II - Resettlement Plan

The proposed Nikachhu Hydropower Project will require private land to be acquired for construction of project infrastructure such as; access roads, power house, dam, surge shaft, offices and residential colonies, etc. Such land acquisition may induce involuntary resettlement, disturb indigenous communities/ethnic minorities, and

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impact on cultural properties of significance. Therefore a detailed resettlement plan will have to be prepared.

Cadastral Data required for Resettlement Planning shall be collected by the Consultant.

i. Purpose and Objective

The overall purpose is to improve the living standards, physical security, and productive capacity and income levels of all the people affected or, at the very least, to restore them to former levels or pre-project levels within a reasonable period of time.

The objective of the study is to prepare a Resettlement Plan in accordance with internationally acceptable standards and guidelines which sets out strategies to mitigate adverse effects induced by the project. The RP, among others, will establish the parameters—for the entitlements package for APs, the institutional framework, mechanisms for consultation and grievance resolution, the time frame, and cost estimates.

ii. Scope of Work

The study will cover all affected persons and formulate strategies in order to assist in determining project impacts on the social, economic, cultural, and livelihood activities of affected persons and communities, and provide mitigation measures in the form of fair compensation for losses suffered by APs.

Tasks

- Record any measures taken to reduce land acquisition and resettlement impacts through changes in the design of the project.
- ✓ Mobilize and train enumerators. Lead and provide overall guidance and supervision to enumerators in data collection. Ensure data quality control. Check and review the outputs submitted by enumerators to ensure accuracy, completeness and consistency of responses, conduct validation checks of a sample of accomplished questionnaires to ensure data reliability and consistency. Data analysis and reporting.
- ✓ Conduct participatory rapid appraisal (PRA) in the project area. Identify key stakeholders and conduct meaningful consultations with them about the project and resettlement effects.
- ✓ Identify any vulnerable groups who might require special assistance and consult with them.
- Conduct a census of all the people potentially affected, to determine the scope and magnitude of likely resettlement effects, and to record likely losses. Suggest a cutoff date for entitlements.
- ✓ Conduct a socioeconomic survey of a sample of 30 percent of the people affected. Establish a baseline of incomes and expenditures coefficient and livelihood patterns, use of resources, use of common stoperty (water) sources, irrigation channels, tsamdros, sokshings, etc.), social organization leadership patterns, local

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community organizations, and cultural parameters.

- ✓ Consult with the agencies (central as well as dzongkhag-level) responsible for land acquisition, land replacement, valuation of assets, and compensation rates.
- Review laws, regulations and directives of the RGOB that apply to land
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 Ind acquisition, resettlement, and compensation. In this review consider the method for valuing assets, the timing and method of paying compensation, the legal and administrative procedures applicable, land titling, and registration procedures.
- Prepare an entitlement matrix listing all likely effects of permanent as well as temporary land acquisition. Establish criteria for the eligibility of resettlement assistance and benefits of affected households. Prepare standards for compensation and restoration of the social and economic base of the people affected to replace all types of losses.
- ✓ If APs are displaced and need to be relocated, prepare options for relocation and for income restoration which build upon the existing social, economic and cultural parameters both of the people affected and of any host populations. Provide for relocation costs, lost income, and income support during transition.
 - Prepare a tramework for participation of APs. All APs should be meaningfully consulted when designing entitlements and the implementation of land acquisition and resettlement. Prepare special measures for consultation with any vulnerable groups. Specify mechanisms for the resolution of grievances and an appeals procedure.
- ✓ Prepare an institutional framework that designates responsibilities to provide compensation, undertake relocation work, take responsibility for income restoration, supervise, manage, and monitor the implementation of land acquisition, land replacement and resettlement activities.
- ✓ Prepare a monitoring and evaluation plan, identifying the responsibilities, time frame, and key indicators. Specify the time frame for monitoring and reporting.
- Prepare a time-bound implementation schedule for land acquisition and resettlement in conjunction with the agreed implementation schedule for project components, showing how APs will be compensated before actual acquisition of the affected land, or before demolition of any affected structures.
- ✓ Prepare an indicative budget. Prepare indicative land acquisition and resettlement costs. Prepare budgetary allocation and timing. Specify sources of funding and approval process. Prepare an annual budget estimate for resettlement by major category of expenditures.

Methods and Tools

- ✓ Conduct census, socioeconomic survey, and inventory of assets survey with the help of appropriately designed questionnaires and instruments.
- ✓ Participate in, and validate, the detailed measurement survey of all private land to be acquired by the project in collaboration with the dzongkhag land records officials to ascertain the precise amount, and type, of private land to be acquired and replaced.
- ✓ Conduct focus group discussions (FGDs) to discuss adjustment in designs.

✓ Conduct consultations and discussions with APs, dzongkhag and gewog officials, and the DGPC to finalize the implementation mechanism and to promote informed decision making.

 Develop database for Project Affecte Households to enable monitoring.

5.6. Greenhouse Gas Emissions

The Consultant should present emission savings from the generation of renewable energy as this is one of the major project benefits.

Accordingly, the volume of CO_2 emissions that will be avoided per annum by the generation of renewable energy from the project as opposed to the volume of CO_2 that would be emitted by the generation of an equivalent amount of power from the current mix of generation supplying the Indian grid (NEWNE) should be estimated. This can be presented for: (i) the Clean Development Mechanism (CDM) crediting period for the project (e.g. 21 years, consisting of 7 years + 2 x 7 years renewal); and (ii) the minimum expected project life.

This section should give direction to Project's viability and accession as a CDM Project.

5.7. Outputs and Deliverables.

The final expected outcome of the Environmental and Social Impact Assessment Report should include, but is not limited to:

- Incorporation of earlier studies into the current findings and impact assessments;
- Findings of the Environmental Impact Assessment;
- Findings of Social Impact Assessment;
- Findings of analysis and consultations;
- Outline of social safeguard instruments as required;
- Recommendation for adjustments in designs during feasibility and detailed design stage;
- ✓ Resettlement Plan (RP), with appropriate action plans and entitlement matrix to provide different types of assistance to all categories of affected people, with monetary values wherever feasible. The plan should include a detailed itemized budget and other resources required to implement the RP.

5.8. Qualification and Experience of Consultants

5.8.1. Environmental Specialist

- Advanced degree in relevant field (Environmental Science, Natural Resource Management, Forestry, Botany) preferred;
- Experience in conducting EIAs and writing EIA Reports;
- Experience in data collection and analysis;
- ✓ Good writing and analytical skills.

5.8.2. Social Expert

- Advanced degree in social sciences (anthropology, sociology, social work, economics) (preferred);
- Experience in preparing SIAs (essential) and RPs preferred).
- Experience in fieldwork preferably among project-affected person, including rapid

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of ESIA study, with their addresses and telephone numbers.

✓ Application for environmental clearance for the project components as per the applicable Sectoral Guidelines for Environmental Clearance, NEC, 2004.

NOTE:

- The Environmental Assessment Report is required to be prepared as per the provisions of EA Act 2000, Royal Government of Bhutan
- The Consultant should maintain consistency and accuracy in the report and no subjective statements shall be accepted
- The Consultant shall render technical assistance to project proponent during Public Consultation as per the provisions of section 31 of the Regulation for the Environmental Clearance of Projects 2002.
- The applicant shall be responsible for undertaking any other related study desired by the MEC during the process of environmental clearance
- Finally, the EA report should include all other necessary documents such as clearance from respective Dzongkhag Administration, Department of Forest, evidence of public consultation, etc.
- A soft copy of the report including all the annexes, maps including Google earth images/maps of all project components, GIS data, etc. needs to be submitted along with the hard copy of the report.



- rural appraisal, household census interviews/surveys (preferred);
- Experience in land acquisition (preferred);
- ✓ Experience in data analysis, both quantitative and qualitative (essential); and
- ✓ Ability to manage and train local survey teams (essential).

5.9. Environmental Clearance of the Project

Environmental Clearance of the Project shall be pursued by DGPC. However, the Consultant shall update and incorporate the Report if there are comments from the stakeholders including NEC. The Consultant should have adequately consulted NEC and other relevant stakeholders for comments and recommendations before finalizing the

report.

5.10. Conclusions and recommendations

Based on the findings of the ESIA study, conclusions should be drawn and recommendations should be made regarding project implementation.

5.11. Checklist for No Objection Certificate

In order to obtain an Environmental Clearance for the project, an NOC must be obtained from all relevant parties. Attach these documents to the EIA report. A checklist of agencies from whom NOCs may be required is presented in NEC's Application for Environmental Clearance Guideline for Hydropower, Road and Transmission Lines.

5.12. References

Provide a list of references cited in the text of the main report.

5.13. Appendices

The following should be included in appendices:

- ✓ Maps related to the study;
- Aerial photographs if possible;
- Sample questionnaires, checklists, matrices, charts and photographs;
- Information on the hydrology, meteorology and geology of the project area;
- Information on vegetation, forest and fauna of the project area;
- Location and brief description of sensitive sites;
- Information on water quality, noise intensity and air quality of the project area;
- Audio-visual records of the area if any;
- ✓ Information pertaining to agriculture, livestock, soil and use of fertilizers in the
- Information on socio-economic and cultural impacts;
- ✓ Name and addresses of personnel and the institution(s) involved in the ESIA study; ✓ List of invited and consulted people in the project affected area, their opinions,
- records of public involvement (e summering, workshop, consultation);
- Persons and institutions contacted outside of the project affected area in the process

Minutes of Meetings/Record Note of Discussions and Attendance Sheets

Antoh

สัสจรุลูลุลุณจะีลสาวติ์ จ<u>ริ</u>ราตุลณะนารุ วยู่สุมาวรฐะสัมสมัณฑาระสุ แหน่งขุนเหรือสุของ กั่นสมุณรัฐนายๆ สิ่าทุสูร์ที่สุมิมสมุณการขุน สมายขึ่งว่า त्वन् भेगरेगान्डे नह्युवर्रे देश अहत् महगावीय क्षेत्र लगभग हेंद्र हुत त्वर्ण लुखर हेंद्र वादर भे डर्थेश हेर जरग द्युः मर्देवम्यतेः अव्यक्षरुवामग्रीयमें द्वां व्यक्षयोः मन् द्यन्त्रे ईक्षयम् हुः कृत्युवाये द्यमः वर्द्र ययम्याग् สุราสิญ นุยุลานานยุรามีกล่านหานะสุขานยุลานพ ริการกระสาสนาชิมานหาก นที่สุราสนานยังเรารางงาน มิ มู่ ๆสูงหมาละนี้ๆา สีลามพิงพมัน งานมากๆ หูเมษาา อิงาณ ๆ วินิ งานสินน์ สัมงานูสุดม นสัมพายุสุการกา นุยูตารมานยูกที่ตามณณะสิสาฏิ รถุสานสิสาฏิการกับสามสิตา นย์สายสุกสิทิ ยุขุณณสิรา र्गत्'दे'वयद्'दुरः द'रेश वादवाक्षवश्रहेषांगेरेरः ददुव्यर्थवावाक्षुत् क्रेंगवन्तुः ख्रे'वह्दद्र'ग्रे छवाववादावेक्य वत्रेक्य्प्रिय กลเอยู่น. ลิปเฉปนเมืองลามุรายเกร. นี้.ถื. รูปเลนที่ปละสูาเปลกกฎ. 24เลม. มีรุงแล-20-2023 มี. ฉยึบเซา. นยูกสู้ๆม้พลเฉยิสายิมลกจาวัๆ สูเขสู้ๆม้กายกายก่างที่ยิกๆสุภาณห มีนั่_{วน} จรักรานี รูนผู้สุ ૢ૾ૺૹૹૢઽૡૢૹઽૢૻ૾૾૾૱ૡૻૻૡૻૻઌૻૡૻઌૻૻૡૻૻૡૼૡૻૻૡૼૡૻઌૻૡૼૡૻૡઌઌૢ૾ૡૹ૽ૢૺઽૡૢ[૽]ૡૻૻૼૼૼૼૼૼૡૡ૽ૻ૽૽૱ૡ૽ૻૡૼૡૻૡૼૡૡૼૡૡૼૡૡૼૡૡૼૡૡૼૡૡૼૡૡૼૡ भूदाण्याची हेंदर्ग्त्याग्रेंग देवक भूदावया गिर्दुल्टेद के स्टेंड्स् ही वहारकी भूदकुर्य ही हेंद्र यदन्धी दे क्क्षनः वीन्यन्तवन्यव्याह्यय्यन्ते र्यकेणेया द्वेग्ययद्विः क्रुंन्यर्थे क्वियाय्ययुः यवन्यये कुरम्यहेवर्श्चेग्ययेवयं खरल में रेनेल महत्र मिंगदे नगद र्श्वन वर्रे गुरु रेनेन मार के के हे र्से के क गलत्मुभ मयर भुवर्देव स. नगाद धे गवन पहुं ही में 2012 स. गवन दे लग् हे यहे ने के हरे गवन क्ष्यन्म्यदश्वक्षे क्रम्यन्यम्युनुयी

अर्द्धवर्षीयम्बरुपा जुरु खुर्वुर्थ्यम्

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र्येन्यम्भर हेन्द्रापम् र श्वेद्र प्रवत्यम् ।

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รานท รรัศนธีราวราขสภัติของ สิทาลูส์สาล้านพรรฐมายิ พยารายราสสาผสาผสาสริสาสนาสา เรา พราสราส अन्भेश्वेकेन र्रगविकन्दन दयन्त्रा क्रेयायम कुपश्चेद्देकेन र्यववी पद्वार् केन्येत्र दिनायवी व्येयय्पन वर्गेन्रेंबन्न अससेन्न्यस्य हेवाम्मनी वर्गेन्देवहुं वसुमक्षर वसुनक्षेयस्य हेवा असवमुप्यस्कित् हे गर्देगपति वर्षे दिव महत्र भाषा मुग्द्रमान महत्र दिशा मर देगा कुर्रे माम्य व महारे का महत्र मान्य का महत्र को मह रेक्य अन्हेंक्ययन्त्रेय हेनाग्यावन्द्रेन्धेन्यपथ पश्चत्क्यांवीद्गरणय कवप्रकृत्रेयाययन्द्रीवापय क्युन्द्र्यय พละสูงพายอส รพสิพพาสิมานสิสาร จนูกมา จนูรที่มามาพารสายยาการ รังเกลาบาทหารังกลุมาลุมา भे रत्रेक पहेंक्षक हुपाल के यु न्योव न पाय के र्योत यु पाल पहार पव र ये। यस द्याय के के व के मात के पाल र योव र ala mar af a star a st वेनगमवेन्द्रिन्धायमामहेवः न्दरेशः ख्यायहॅममवन्त्रमः ईव्याह्यम्भावेनः वश्चायव्यविग्ववन्त्रे किनः अर्देक्येईव अर्द्धगण्डन देखे हग्रान्धेकं सन पर्वनगढ़न्द्र के गेयर सेमयन्त्र के गयन्त्र के गयन्त्र मान्द्र मान्द्र मान्द्र मा वगुण्यमहग्विमक्ष्वविद्धं वयन् करवुग भेवन्दर मेथेरप्तः र्येयम्धूव्यतः योक्रयविमन्धन्तुः येग्रभूरत हेर เกล่องเวลา เร่าการสารที่เกาสารที่เการ์สารที่เการ์สารการสารการรับเราร์ เการ์สารการรับเรา พะเร่า हर्र्ग्राणमेगमगर्याप्र भूमा प्रमासहेतामगरहेत्लेन मेर्सरेट के महामहतानहेतात्वराद्य हेन्द्र सहयद्य हराद्या ग्रेन्'न्र्येग तमेगर्येन्'वगश्वर्क्ययाथस्य सन्दरः कुथार्येन्द्रस्य अवत्यत्रेन् भूव्रहेवस्य कुणार्यन्यन्य कभूव् हेवस्य कुणार्यन्य วัสหาสิ่าขี้เสสาว สิ่ารุ่นการะบดสลิกา มีเรอูปสุขพารเข้าของเทพรา การะบรรมปร. พริณารุ่นเรอูปเรอ अर्मेणियर्द्भगर्धेवर्धेन्द्रम्बम्पते. प्रवयमपद्, मेग्रेगर्द्, मन्नर्भवेषित्रदेव. मुन्दर्द्ध ह्रेर्म्यमम्परकुलह्र्यका वैनग्रीभूक्तं २.मठक्षरः वहुबक्षिरवहुर्द्शुप्रवेषकवहिदद्यी मईरेषकाक्लकर्डेबर्ह्णक क्वेक्षेत्र रेकर्मापरकहर महत्रही द्यार् राधेन् भुमुन्दर येन दर्दहा हुन्हे यू प्रपद्ध इक्ष्म्या याप्ते से यहेंद् येत् डेर महत्वयी हेराव्यान्त्रेन्यंग वर्धेयाधन्यसाहत्साव्यामेवर्यन्यंसन्त नुअन्ते हॅंगलय क्षेसेरांगेन्द्रावयन्तुन् हेगाहुः

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गुरुभःश्लेदधुभयते झ्रव्याखः दाष्ट्रे त्युगकुभावनदम कुश्वाईनावम् र्श्वेश्वर्मेश नमायाँग्रेग्वेत्थुभावमत्वम् क्षेत्र कुश्वाईनावम् श्रेष्यम् नमाया अह्याग्रेयाया व्युपायमत्वम् क्षेत्राहेन् त्यम् मेश्रियायस ह्या हेन्मम् दायस मेम् सुम् क्षेत्राक्षेत्र क्षेत्र मेम् मेर्ग्वे स्वायायस्य मेथ्य क्षेत्र क्ष त्यम् मेश्रेप्राययस्य ह्या हेन्मम् दायस्य मेम् सुम् क्षेत्र मेर्ग्वे क्षेत्र मेम् मेर्ग्वे अह्याग्रेयस्य क्षेत्र त्यम् मे त्यन् ध्वय्यम् ह्या हेन्मम् व्ययम् पर्व्या क्षेत्र स्विन्द्र स्विन्द्र मेम् मे अह्याग्रेयस्य क्षेत्र स्व त्यन् ध्वय्यम् क्षेत्र स्व स्व क्षेत्र म् वित्य क्षेत्र मेन्स्य मेन्य्यायस्य केष्ठ स्व क्षेत्र क्षेत्र स्व त्यन् ध्वय्यस्य केत्र क्षेत्र स्व स्व स्व याद्वे प्र क्षेत्र म्यायस्य मेन्य्यस्य क्षेत्र क्षेत्र क्षेत्र क्ष

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- तह्युवागविन्ग्रीय लग्नेजेर्वत्वयप्रनित्तवे. जलत्वाला
- हर महेद र्श्वे या से प्रथम के प्रयोग
- र्युवायेव्ययत्मुवः क्रुरायहर्मी क्रुवाखुरुष

मनिश्रमेलयक्की र्र्व.कृष्ट्, मेललाक्रेंवसेलालुः-

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• तत्रुषामयेलयकी अल्पत्रमाखयहेत. क्युंग्र-क्ये जयकेर्द्रत्युग्लयनस्तुने नह्यात्रक्रेयहे. भू'तवन्यवेश्ववय พลสัญลารางกลา รูปคนมีเพลสุภาพ เริ่าเรียงสารายเวลา แลงย์ ระเทิปคนมีเพลสุกาพ สุปล

विन्यानुष्यार्द्वे वादना हुनुःअयात्रेमालुणी

র্বমাথ্য क्य बकलेगार 222.16 परुष कलेगार 243.40 द्वेंपियक के लेर ही बकदे क के पर हा? ณา วุ่าอองส์ นี้โทที่ที่สู่าานองส์ มนารภาษิมมราก พลาซิสม อาว์โตมเราซิ มักเฮาเลา ฉาร สิทินธราชส์ พิส ลิร.ศูพิ สุขพชมขึ้งเธายุณณฑ พบุสุจาร์ริสสลรางรา สูเม€ราหรัฐสูญ กริตุลอิรุลาร์ เรียนรูสาร์ เรียนสีระมีอยู่ระมีอยู่ระมอง สาระดูสาร จาย เรียนการ เรียนการ เรียนการ เรียนการ เรียน

ने गान भाषाय गामिर गावे मान्नुमा मुम्ब के गानाय में दे की देव के गानिय गाने आवय गामिर गावे मान्नुमान्न के के ल

สายสายภูมิมามาร์สาย การเวลิเกรียน และวิทานสูเชาน กรีลเกรียงการข้างระการข้างเรื่อง มีมีมีการการเป็น

พร. รารสงเวลิมพร.เรลิะเม็นญาพงเสสูนผู้ง. 22.2412.2 มีปกฎกลาวมีกร. 22.248 และเห็ะแต. ปรุ2. यक्षुन मेथ्वेरव्यन् क्रेंतवेगम्यर्वेम नर्डरेगन्तव्युवरेग गठेगेघन्ययवन्तरु सुयक्तन्त्य्य्वयन्त्रे मुपव्यय

ส์ขาพยุสาวี, เวลีะเกราะกูมะกูนะการ กราพขุสเตาผนุขาพระสเพิ่มไ

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พลสมพาสริมีประมาณ ภูพาร์สายการสุขณร์ว่าและรูปรายจึงเรา ภูพาร์รี่มีเชิงไร. พระเนารูปเป็นเรา เป็นการ์การรูปเป็น สายสายการรูประกาณ ภูพาร์รี่มีสายการสุขณร์ว่าและรูปเราะ ภูพาร์รี่มีเชิงไร. สายการรูปเราะ สายการรูปเราะ รูปเราะ

- क्रयम्भवग्रुर खेन्यते कुणिर्श्वेषकोर्षेत् प्रक्षेयर्थन्द्रुकर्धुर्थे २००८ उद्य व्यत् न् र्षेत्र कर्म् तुम्हर प्रवित्ति क्र्यं क्रयत्पुराष्ट्रीय चतेसकी सकवे कन् पति न् त्यक्षुत् सक्वेयर्थन् क्रिक्स क्रिय्त्य क्रय्त्य क्रयत्य क्रयत्य क्रिय्त् क्रयत्पति क्रय वेन् क्रय्य अत्रे क्रय्त्य १०,००० रेन् प् पत्व देवे प्रक्षमन् क्रयत्या क्रयत्या क्रयत्या क्रयत्या क्रयत्या क्रयत्या क्रयत्या क्रयत्या क्रयत्य क्यत्य क्रयत्य क्रयत्यत्य क्रयत्य क्य क्रयत्य व्यत्य व्यत्य क्रयत्य क्रयत्य क्रयत्य क्रयत्य क्रयत्य क्रयत्य क्रयत्य क्य क्य क्रयत्य क्रयत्य क्य यत्य क्रयत्य व्यत्य व्यत्य क्रयत्य क्रयत्य क्रयत्य क्रयत्य क्रयत्य क्रयत्य व्यत्य क्रयत्य क्रयत्य क्रयत्य क्रयत्य यत्य व्यत्य व्यत्य व्यत्य व्यत्य क्रयत्य क्रयत्य क्रयत्य क्रयत्य क्य क्यत्य क्रयत्य क्यात्य व्यत्य त्यात्य त्य क्य
- र्धवर्द्धगण नेवळन मॅन्ज्योनमॅन्व्येव गहन्दी • र्य्वेगसुगल सुद्विग्रेयप्र, २० मेल पर्डेगहुन् (गन्देव इते ऑगल्यो) र्येद ७५,२१९.७० ने डेग वन् प्रयहन्द्दंगला
- मिगावनग्री जूनस्रेर. प्रायनम हर.पर्यं 1,00 म्ह्रुद्वे.रेर. मेलर. वर्ष्ट्राय भी गेर.ग्रीरे रेग्र्य्य क्रा गेर.ग्रीरे राष्ट्राय क्रा ग्रीरे दिला रे ग्री हवा पर
- गर्भेषदन मेथनैगअह्य मुहेद मेंद विश्वेभ
- วยู่มาวันรายสราะ ผู้มานรัสซ์เสของรัสปล์ พรารสารรัสไ
- क्रूटवडोवा वी.ग्रेष्ट्रीक्षेत्रका ।
- भूभाधेग 🕂 विवायस्वा भूमी क्रेजिनस्व

พลสมุณาจรีกลูสามสาวริส येन्छ, लुर्ने न्द्रम इक्रुक्यसम्प्रेथयेन्द्रनः गर्दन्यम् वदयकेवदेर्स्न. भरररेश्वन्तन्वरुग्यन्धे गुर्थायर्स्न्युवर्त्त्वय्यन्य्वय्द्रन्द्र्या

- p fantst

สัมายที่วัจาญญี่รามกิ มิฒิวารณาสูกุณส์ อาสรีการสุขามีรัฐาณมอัพรา แรมพมารัฐกุณบัตราณม สัมายที่วัจญี่สู่รามกิ มิฒิวารณาสูการ์ อาสรีการเพณารัฐสาวนก็มีรัฐาณมอัพรา แรมพมารัฐกุณบัตราณม

ଙ୍କିମ

ईराषगृ वृषभक्त वर्षे दर्यत्र छैभ क्षेत्र भवे दर वैरायई गुभारे पेर, पवि श्रक क्रियाय क्रियाय क्रिय हर प्रहा में भिर्म्स क्ष हुंदा पडेवा देगे क्रिय हर के क्षेत्र भवे दर में प्रदेश मुभारे प्रेत् का माम्स अन्त्र क्षेत्र प्राय भह्य के कि माह का महत्व महत्व के क्षेत्र भवे क्षेत्र भवे क्षेत्र मां प्रदेश का क्षेत्र का क्षेत्र क्षेत्र का क्षेत्र क्षेत्र का का का क्षेत्र का क त्र क्षेत्र का क्षेत्र का क्षेत्र का क्षेत्र व्यू का क्षेत्र का क्षेत्र का क्षेत्र का क्षेत्र का क्षेत्र का क्षे क्षेत्र का का क्षेत्र

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वेर्देदखुण्णनः लुण्णेम्थुणनेर्धेनः चेरल्णे

બઅલયુપ્રયાપ અઢાર્સુનથી ગુમચારૂનિય અલિન્યનુવાય સુંપાય ગ્રેંગુઆવાનું એન્યારે પીયુર્થેવર્પેન્પનન્ વદેવઅએન્ એટ્રેન્ટ્રેન્ટ્ર્સ્ટ્યુવરે ક્રિયુચાર્સુન્સ્ટ્રીન્સ્ય્યીન્ગાવે અઢાયેગન્ડ ર્ટ્સ્ટ્રિયર ગ્રેંગુઆએન્પીન્ગેન્સિયલે પીયુર્થેવર્પેન્ડ્રન્ડ લેગુસ્ટ

र्भुम) ई.स. वयाश्वाभुगायवन्यम्।

भूमेर्त्तराज्यस्य तर्द्यवास्य विविध्यस्य त्रात्र भुव्यस्य स्वत्रात्र भूम् स्वर्थ्य स्वर्थ्य स्वत्य स्वत्य

٤) ร์ชัญลักรงานิส พรรรรัฐสามานิวารร มีราวรัฐเวทัศรุชัน รัสาวรัฐพิสมานส พยาวภัรราชสม ยู่จะพญาสสายจะเรา พราสา ผู้จาญาณาผู้สังกรรา สองเวล์ตรายาลผลัสเวอร์สาญ พรักร์สิมริเวล์สาม हेत् अस्यत्वायावध्रयायस्य देखः वक्नेयात्रदेदःक्तेत्ववत्रवर्म्त्यावद्रन्त्ववस्यक्ते दस्यवयस्य व्यन्त्येन्क्ते वलस्य antigues figues after and and and a second a second a second a second and a second a second a second a second a भैन्भन्यम्बह्यस्य अत्य हेन्<mark>म्वन्यहुराहेन्</mark> अर्रेग्वर्स्र्रेग्वर्स्योया पगम् हे येक्यन्द्रेय्यी प्रप्यायर्ग्न भुर यत् मितकर पार्व रे पर्वे पवन हु गम्म के हु गम्म में दि पह थे। - pfandsh

รสัพสัฐานรุสาพชั้นเป็น สีมีขมางหนุขมายสิงชาตรัสาขู รับขางหนุขมายกรุก รับรัสาพนิพมักพลัง รรัพนะสามพชั้นเป็น สีมัญลา และกาสามพรัสาขรัสาขารัสาขารัสาพนาทัศาพนิพมัสสานสาก และ วัฒนะสาวารัสาขนิมัญญา และกาสามพรัก และการัวรัสาพนาทัศาพนิพมัสสานสาก รัสาชสุส์ เทศพณฑรัสาสาวารัสา เป็นผู้สานรัชานาร์ เป็นเป็นเพลาเรียงการสานสานสาน รัสาชสุส์ เทศพณฑรัสาสาวาร์สา เป็นผู้สานรัชานาร์ เป็นเป็นเพลาเลี้ยงเป็นเพลา

नेंआपम मेंग्रियेगम्पत्पाय गविकालपद्दः दर्षे मेंग्रियेगम्पत्पायः मस्परभ्रुव्यप्यद्वान्यस्पत्पत्वः भूमसम्पद्धिददः अप्पद्देशदर्षेत्रदेवहेप्पद्दापतिः दमायर्ग्रेगसद्दःभुम्भस्र्त्व्दंग्रेभ्रेदः क्रैंगस्य क्रम्भद्द् भ्रमसम्पद्धिदःस्त्रंग्रेभ्रेदः वर्षेत्रदेवहेप्पद्दापतिः दमायर्ग्रेगसद्दःभुम्भस्त्र्द्धाः क्रिंग्रेभ्रेदः क्रैंगस्य भ्रमसम्पद्धेन्यदः यास्रयाप्यवद्दवायश्चमायम् स्यावदःभ्रेक्तं अवस्याद्धान्द्वंग्रेभ्रेदः क्रैंगस्य क्रम्भद्दात्य भ्रमसम्पद्धेन्यदः यास्रयाप्यवद्दवायश्चमायम् स्यावदःभ्रहः अवस्याद्वन्द्र्याक्र्याय्यवद्

अफ्रिंश ग्रिंग्यक्रेंग्नर कुर्यर युद्धेय रेखवहेव्यक्रेयेयं प्येत्यवे विषक्वियक्षि

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रेगीणवृणु अश्वयाभावर्रे केवयीक वगवक्यवर्गेर्द्यवरीक कुपक्षेत्र मेववर्त्त हुम् मुराम्य मक्षयभी रेणस हें पहेंद स्व वहेंद वर्यन् ने वर्चे हुगस्य देद अववर्यमें गवस्य स्वर्यन्त क्रुपाल्य अववर्रेद न् मुपाल्य स्वर्यन्त स्वर्यन्त स्व भगवस्यी के केन्द्र हुं स. मक्षम्यन्य याद्य पहेंद्र विश्वद्व पेन्द्र येन्द्र देवे ने स्वर्यन्त क्रिया वहीं स्वर्यन्त क्रिया प्रमान होता स्वर्यन्त क्रिया प्रमान क्रिया क्रिया स्वर्यन्त क्रिया स्वर्यन्त क्रिया स्वर्यन्त क्रिया स्वर्यन्त क्रिया स्वर्यन्त क्रिया स्वर्यन्त क्रिया प्रमान क्रिया क्रिय

อิริขณณิตาลส์ปีเวียา เวลิพร สมัญของบรุณเวลียยุครายเลขายาเรื่อง อิรูนคงสู่สะสีบเป็น พระการของกล์ปีเวียา เวลิพร สมัญของบรุณเวลียยุครายเลขายาเรื่อง

हेंदाय्यायायायायर्गेन्स्विद्येय सेन्यन्भुयर्म्र द्येसहर्म् इय्येंग याकलेग्रन्य्य देवेग येन्सेन मेंगवोग्भयत्रणुग पर्ह्त मुद्द कार्यन्य दर हुन्दे सेन् केन् ही देवल यलग्दन याग केन् हुन् ने सेन् ने सेन् केन् पगुरः लुद्रों अस्तर श्रे कुंबेर लेगर् दे डेगर्ड्द से दे गदे कुर कर गवुर प्रवेश महद वन्द्र श्रे व - por del

મ) દેમાગળામાં રાષ્ટ્ર વાયર્જ તે માર છે આ પ્રચાર પ્રચાર કરે છે. આ પ્રચાર પ્રચાય પ્રચાર પ્રચાર પ્રચાય પ્

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र्योह्य हॅर यन् पायिश्व हार हुन्हुं तहर यहर यह प्रयाप के प्रयाप हो या प्रयाप के स्विय अवस्थित का कि स्वय के स्वय स्वय के स स्वय के स् स्वय के स

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अन्स्थेयहेः हॅंगव्यस्व व्यवायस्य का विवयस्य के क्रियायन्त्र हें रेगव्ययोग्वियये क्रियां मुग्रेय्युयायन्त्रुन्यने वेगयु क्षेत्र स्व असेर हुं वहें व गई प्रेंग्व कर्मव हे क्विन्यु नहेत्र हें हूँ भे ठेग केत्र स्वयात्रेन्यस्य देन सुर्खे गर्हेन क्रेंत्र में से वहुत्य के प्रेंगव के प्रिंगव्य प्रत्ने के क्वियये क्रियाय के क्वियत्वित्याय दन हसूर हु या गर्हेन क्रेंत्र में से वहुत्य के प्रेंगव्य प्रत्ये क्वयान्त्र ये किंगवी क्रुन्यहाय के क्वयात्रेन्यस्य दन के क्षेत्र स्व गर्हेन क्रेंत्र में से वहुत्य के प्रेंगव्य क्वयान्त्र ये किंगवी क्रुन्यहाय के क्वया के क्वयत्व के क्वया क्वया के प्रयोग के दन वही क्षेत्र स्व क्वया क्वया क्वयी प्रध्य वहीं प्रत्य के प्रयोग के प्रत्य के क्वया के प्रयोग के क्वया के प्राय के क्वया के प्रयोग के क्वया के प्रत्य के क्वया के प्रत्य के क्वया के प्राय के क्वया के क्वया के प्राय के क्वया के प्रयोग के क्वया के प्रयोग के क्वया के प्रयोग के क्वया के प्राय के क्वया के क्वया के क्वया के क्वया के क्वया के प्राय के क्वया के प्राय के क्वया के प्राय के क्वया के प्राय के क्वया के क्वया के क्वया के प्राय के क्वया के क्वया के क्वया के प्राय के क्वया के प्राय के क्वया क्य के क्वया क्वया के क्वया के क्वया के क्वया के क्वया क्वय क्वया क्वय क्वया क्वय क्वया क्

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พิ.ศิพทีศาสริณารุรณาสราชิมีพิษัสหาศิก พธศาบิพอารุฐรารอีพรัสาญ พอพิทุราริญา รุรณาขม

รर्गेलहॅमप्रपाय त्वेगपत्वयन्त्वेद्वय्य दिन्द्वन्यम् देवन्द्वन्यद्वय्द्वन् वर्ष्य प्रमान्द्रेप्याय व्याप्त्वय्याय द्वेय्याय्या केन्द्र स्थाय द्वेय्याय्या केन्द्र स्थाय स्थाय केन्द्र स्थाय स्थाय केन्द्र स्थाय स्थाय केन्द्र स्थाय स्याय स्थाय केन्द्र स्थाय केन्द्र स्थाय केन्द्र स्थाय केन्द्र स्थाय स्

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मेश्र श्चेष बहर दर्भेष्य दरः देत्यरः अख्रभद्द्वेय न्यू र पर्देश ययद्वेयः नुरुष्यु वर्गेत्त्वय्यया स्वियय्वः त्रिः त्यत्यत्रा मर्यय्या गर्थवाय विश्वे स्वित् क्व क्व विश्वे श्व अर्थ्वय्य द्वे य्या स्वय्य वर्गेत्त्वय्य स्व इतः क्वेर श्चेश्वर क्वे दुन्दः हेत्य्य्या यद्यु क्वे य्या क्वे ये अर्थ्वय्यद्वेयः व्या व्या स्वय्य वर्गेत्त्वय

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हेदाण्ण से त्याय में द्रमें हु ही सा महत्य स्वय्थ देव था हो सा पड़ाय दे साहित हु आया यहाय ही यू दत् यक मा कर क ये महत्य दे दुर्थ सुद्र केंद्र स्वतित्या यह केंग्र केंस पड़ाय है पडय हुँद्र यय प्राय महत्य पड़े यहत्य दे केंद्र

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यदः यद्वित्वराल्यी

न्वेभाष्याकेम्बडेरःखुर्धन्।

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५२ र्डेग्रायद्वयग्रीयकर गविषाई से तमद देंदा के लियेंदा

देश्वेदः वर्ष्वित्तावीः कुत्ताव्हक्रामेण्यमः नानेत्वन्त्रयोन्तान दमेमादा द्वम्तावनुका अध्यक्रुव्वयाक्ष्रव्य यळावेद कुत्तिर्व्यत्वेद्धं: दाव्हेवेः वमाद्वण्यमः वज्ञवर्क्षुत्, वचदाक्षवतुन्वयमः व्यत्त्वेम्रालुखन्त्

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इर्वेका हेंदरम्पद्यां मेर्ये हेंद्रावयायद्या क्रिंहाय श्रुमाणक का का का का महेत्र भवि केंग्राय मन्द्र दर्द का कव क्रेंद्र भोत श्री ชี้พุฒน พุสินธุ์พุฒนารานสิลสามพ รุฑนาณพาสินเาลรานา มูนพานริรัตร์ นิยัมสุรารภัณรา શેશેર છે. શાક્ષ્ય વ્યવસંધુન, વચર વસ્તુભૂર શાસ્ય તથા પશ્ચિત્ર શાસ્ય શાસ્ય તથા છે. શાસ્ય શાસ્ય શાસ્ય શાસ્ય શાસ્ય

भ्राया द्वापार केर्स रम रेवे येवाय र युपर म म्रुव हे रेव रेर जेर जाय र याय

สามการะ อุเรล้า แน่นอนไหญสมุณสาระ ภูมิเล เป็นการ์นี้นี้ เกิดรูการ์ เป็นการ์น अर्हरअयर क्रेंक्स्यायदे रूर वरे पड्डा मेंपल्टर देव करेंद्र येत के क्रा के का के का के का का के का के का के का क रहेनर्याणसस्छिक्षेयेन्द्रनः र्र्युगयेलयन्त्रायः पर्विक्रमायक्षय्यायहेवर्त्रेः मविष्ठियः र्युन्मेन्यून्द्र्यं व्ह्युक्रेक्षक्षे १२२४ सुर रेपालकी दिशामर रेपी बेरें रेपु रत्येविमेलकर रत भाष इगा ही युवाल तमुन रत्य सूत्र परे กลาวสีเกา นอาสีมีขาวอาวานรูเมืองเตี. ที่เล่หูกอา มีเมืองกฎปะราร. เลลเลก นิยาร่างการย่าง กลาวนี้เกา र्देवयुः वै'लेर ग्रीश्वक घच्यवेद पहित पहिल पहिल देवे वे लेर ग्रीश शकाले गर रे युः वे युर्ग् पहित पहित र मेंग्रोगरेंद्र सेन् केन् मन्य भु'देगे 10,000 रें इंच एन्सर्येन् भुगमन्न लवनगृतः इंग्यदेव मेथु मेर्द्र

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สู้ทามิณ๙กุญณหร้า สายคามาริที่ทรัสทุณพ ผลราวอังกระ สูนาเลพอสเอินกุญระสู่ทุพานใหญ่ทุพสู่สาระ मुन क्रे. १४५८८१४ नहीव:१ विदायनमध्दिय हेवासहराने, नमेवानक्रें विदायेर हो हो, भर्मायनसूर्व विदाय เส้มพญิญญาพี่มางพรรม ติมติมาสรรม พยุญาพี่มายการที่มาง

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Q & A session minutes for Technical and ESIA presentation of 118 MW Nikachu Hydroelectric Project Venue: Raven Hotel Date: December 12, 2013

SI. No	Agenda/Issue	Discussion	Recommendation/Resolution	Action to be followed
1	Land compensation	Need for initial assessment & study on private land	Initial assessment & study to be carried out before the onset of project works to compensate accordingly at later stage	Focal person from Nikachu project & Dzongkhag Land Lease committee
2	Location for Batching plant and stone quarry	Need for initial assessment and study to be carried out	Initial assessment & study to be carried out for appropriate location. The batching plant to be same as mentioned in DPR and not based on contingency.	Focal person from Nikachu & Dzongkhag Environment committee
3	Transmission Line	Need for study	Study & assess the transmission line corridor and incorporate in the project report	Nikachu Project
4	Eco-tourism	The need to explore & fund tourism site especially bird watching along project area	Eco-tourism to be explored and incorporated into project plan	Nikachu Project
5	Muck disposal, waste management & water	 The need to identify and plan muck disposal site before the onset of project works The need to plan waste & sewerage before the onset of project works for people living in camps The need to check and treat water before consumption 	 To refer Water & Waste management Act To get necessary clearance for all environment and culture related works before the onset of project works To conduct open space planning to find adequate space to muck disposal, recreational site filling etc. 	Nikachu Project & Dzongkhag Environment Officer

6		- The need to identify & work out estimate &	-	To treat water as separate entity and the need to produce clearance To identify & conduct measurement, and	
	Identification, measurement & estimation of infrastructure	measurement of all those infrastructure alongside project area before the onset of project		estimation in order to reduce receiving harassment from public and to cut down cost at later stage	Nikachu Project
7	Royal Tsamdro	 The need to identify royal tsamdro along project area 	-	To identify royal tsamdro & seek the royal assent	Tangsibji Gup, Mangmi & Tshogpas & Dzongkhag
8	4 Acres Wetland	 The need to avoid 4 acres wetland, if possible, in view of tedious conversion procedure 	-	To avoid wetland in view of the hassle laden conversion rules	Nikachu Project
9	Private land	 The need to authenticate private land with Dzongkhag Land Record office before land transaction 	-	To authenticate record with Dzongkhag Land record office	Nikachu Project
10	Mini-hydel channel at Tangsibji	 The need to keep the continuity of water flow from the channel without disturbance from the project 	-	DGPC shall fulfill the mandate on paper and instruct the companies working on the site	DGPC
11	Tangsibji farm road & crop compensation	 Tangsibji farm road falling under project area Crop compensation to affected farmers 	-	Tangsibji farm road to receive upgradation if project uses it Crop compensation to be paid after investigation	Nikachu Project

12	Health facilities in the Gewog	 Not in the plan to construct health and school facilities 	 Companies to look into strengthening existing health facilities Nikachu to identify health focal person from the project 	Nikachu Project
13	Park Services	 The budget for conserving park services to be less & was not consulted with Park office 	- To depute a team to work out proper estimate, if time permit	Nikachu Project
14	- Land acquisition - Local Utility	 Nikachu project to proceed land acquisition before the start of the project as informed by Project To use the local service as much as informed by the project 	 Land acquisition shall take time owing to the difficulty in finding proper land substitution Project to use local service to the best and private land to be recuperated and handed over to leasers toward the end of project 	Nikachu Project
15	 Arable wetland Letter of Intent Right of Way Public consultation 	 The need to recover wetland into arable land after project activity The need to issue letter of intent from the govt. agency To study 'right of way' for private land The need to fixed a date for public consultation 	 Explicitly mentioned in Project ESIA To issue 'letter of intent' from the govt. agency To look in 'right of way' before encroaching private land Public consultation on January 27, 2014 at Tangsibji Gewog Center 	Nikachu Project

Members from Dzongkhag Administration Gewog

Dasho Dzongda Dasho Dzongrab Dzongkhag Principal Officer Dzongkhag RNR Sector Heads Chairperson Dzongkhag Health Officer Dzongkhag Planning Officer Dzongkhag Environment Officer Dzongkhag Accounts Officer Dzongkhag Land Record Officer Park Manager, JSWNP, Tshangkha Territorial Ranger, Trongsa Territorial Ranger, Chendebji

Members from DGPC

Director, Projects Department, DGPC Chief Designer (electrical division) Survey Engineer Environment Officer

Administrative Officers ADB Consultant

Members from

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Attendance sheet for the DPR presentation nteeting regarding 118 MW Nikachhu Hydropower Project at Trongsa

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Venue: Raven Resort, Trongsa Viewpoint

December 12, 2013

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Minutes of Detailed Project Report (DPR) Presentation for 118MW Nikachhu Hydropower Project (NHPP) to National Environment Commission (NEC) and other stakeholders.

Venue: Conference Room, National Environment Commission, Thimphu

Date: December 27, 2013

Participating Agencies:

- 1. National Environment Commission Secretariat;
- 2. Druk Green Power Corporation Ltd;
- 3. PwC Consultants;
- 4. Department of Road, MoWHS;
- 5. Bhutan Tourism Council;
- 6. National Biodiversity Center, MoAF;
- 7. Jigme Singye Wangchuck National Park, DoFPS, MoAF;
- 8. Department of Forest and Park Services, MoAF;
- 9. National Land Commission;
- 10. Gross National Happiness Commission;
- 11. Bhutan Electricity Authority;
- 12. Department of Culture, MoHCA;
- 13. Department of Geology and Mines, MoEA;
- 14. Mangdechhu Hydroelectric Project Authority;
- 15. Department of Hydropower and Power System, MoEA;
- 16. Bhutan Power Corporation;

The list of participants is enclosed as Annexure I.

Director (Projects), Druk Green welcomed all the participants to the DPR presentation and conveyed Dasho MD's apology for not being able to attend the presentation as he has become even busier due to his appointment as the Chairman of the 2nd Pay Commission. Director (Projects) made presentation on the existing hydropower plants, projects under investigations and revenue contributions from DGPC. Other works being undertaken by Druk Green, such as subsidiary companies like Bhutan Hydropower Service Limited (BHSL) and Dagachhu Hydro Power Corporation, other projects like Tsibjalumchhu Diversion Scheme (TDS) which will add annually 93 GWh of energy production from the Tala Hydropower Plant; starting of a hydropower construction company; establishment of Research and Development Center by amalgamation of the existing Centers of Excellences, obtaining of a Consultancy License to market the expertise of Druk Green were presented. He also informed that Druk Green is fully able to manage operation and maintenance of hydropower plants with Bhutanese and that substantial competency have now been developed to investigate, design and construct hydropower projects. He remarked that all Bhutanese must take justifiable pride in the Bhutanese capacity of management of hydropower assets from water to wire and thanked all agencies for their continued support and cooperation in the success of this important sector.

Following the welcome address, Mr. Tenzin Khorlo, Chief Environment Officer (Environment Service Division), NEC as the Chairman of the meeting gave the opening remarks. He thanked Director (Projects) for his presentation on the status and progress of hydropower sector in the Kingdom. He then briefed on the standard procedure of carrying out an Environment Impact Assessment (EIA), mentioning the need for carrying out EIA or Initial Environment Examination (IEE) based on the type of project and its magnitude of impact. He also mentioned that for projects requiring EIA, a Terms of Reference (ToR) needs to be prepared by the project developer and endorsed by NEC. The EIA to-be-prepared should be in line with the approved ToR.

Mr. Karma Tshering, Project Manager, Nikachhu Hydropower Project (NHPP) made detailed presentation on the technical aspects of the project. A copy of the salient features of the project and Executive Summary of the DPR were distributed to all the participants. The following were highlighted:

- Project background;
- Project layout and project salient features;
- Hydrology and power potential studies;
- Civil structures;
- Electro-mechanical equipment;
- Transmission line & construction power;
- Infrastructures & construction facilities;
- Construction schedule;
- Cost estimates;
- Financial analysis;
- Ownership structure and financing structure.

The presentation also highlighted on the financing and ownership structure of the project. The project shall be developed on 70:30 loan equity ratios. It was informed that ADB has already committed USD 120 million for the project: USD 80 million as loan to the project, and USD 40 million as grant/loan to provide the equity of Druk Green. Out of the 30% equity, 51% of the share shall be owned by Druk Green, 23-25% issued as Initial Public Offering to the public of Bhutan as equity shares, and 26% to a strategic partner.

On this, the following comments and discussions were made:

• Mr. Tenzin Khorlo, Chief (ESD) enquired on the process of floating shares and suggested if the preference could be given to the Project Affected People and those in the project area.

In response, Director (Projects) clarified that the allocation of shares has not yet been decided and this aspect could be examined before the issuance of IPO.

• Mr. Tashi Penjor, Dy. Chief Environment Officer, NEC also inquired on the need for strategic partner if Bhutanese could also subscribe to the 26% share which is proposed to be allocated to a strategic partner.

Director (Projects) clarified that seeking a strategic partner is for strategic reasons such as being able to bring in new technology or processes, ability to raise capital, influence in the targeted market for sale of electricity, etc.

• Mr. Ugyen Wangda, HoD, GSB, DGM raised concern on the impact of blasting as was in the case of Trongsa Dzong due to MHEP.

On this, Director (Projects) cited the example of the Tsibjalumchhu Diversion Scheme (TDS) in which a construction adit tunnel has been blasted right from the top of Tala Dam without having any impact on the THP Dam. He informed that there are controlled blasting techniques to limit impact on even attached structures and the Druk Green has the experience not to have any damage on Trongsa Dzong or other structures near the project components.

Mr. Pema Dorji (Environment Officer), Druk Green presented the Environmental and Social Impact Assessment (ESIA) of NHPP as contained in the DPR. He informed that ESIA was prepared in line with the ToR approved by NEC vide letter NEC/ESD/DGPC/1837/2012/3480 dated 26th March, 2012.

The following points were discussed during the presentation:

- Mr. Tenzin Khorlo, CEO, NEC reminded that while opting for alternatives, besides technical aspects, it is also important to take into account environment and social aspects. Mr. Ugyen Wangda, DGM also supplemented on the importance of geological stability, citing the example of Punatsangchhu-I HEP which has encountered geological problems at its Dam site. Director (Projects) informed that NHPP was initially planned as standalone 210 MW project with its Power House originally located at the confluence of Mangdechhu and Nikachhu, under Tangsibji village. However, due to poorer geology, greater environmental and social impacts, less electricity production despite higher capacity, the present scheme, with the tail water being discharged into the Mangdechhu reservoir to provide additional energy generation, was selected as the best alternative. Even for the present scheme, he informed that two sites for Power House and three sites for Dam were examined.
- Mr. Tenzin Khorlo, NEC stated that baseline data should be ideally for four seasons. However, he said that at least two seasons baseline data must be provided. Druk Green agreed to provide baseline data for at least two seasons.
- Mr. Letro, Forest Officer from JSWNP, informed that JSWNP area has actually 37 species of mammal species as per updated data instead of 22 as presented, and also that buffer zone is to be considered as 1.5 to 2 km outside the park boundary.

Mr. Tenzin Khorlo, NEC supplemented that the raw data should be, as far as possible, be obtained from primary source.

Mr. Tashi Penjor, Dy. CEO also enquired whether surveys were carried out in the submergence area since NHPP shall submerge 6 acres of park, to which Ms. Deki Yonten,

Local PwC Consultant recruited by ADB, clarified that surveys, as per standard practice, were done all over the project area and that the submergence area was also covered.

• Mr. Pema Dorji also informed that the Adit-2 of the project falls in one of the Biological Corridors connecting JSWNP and Wangchuk Centennial Park (WCP). Several flora and fauna species are present in the project area and none of which are endangered in the IUCN list.

To this the CEO, NEC suggested that reference be made to the Schedule-I of Forest and Natural Conservation Act of Bhutan.

 With regard to E-flow, Mr. Tenzin Khorlo, NEC informed that a study on environmental flow for all hydropower projects was carried out with Nu. 2 million contributed by Druk Green, which recommended 60% of the minimum flow as E-flow. However, he mentioned that the figure shall be site specific and studies shall be continued to decide on a specific figures. He expects to establish the figure of environmental flow within a year or two and the project developer should keep some provision to incorporate the changes, if required.

Director (Projects), DGPC informed that even with 10% of the minimum flow proposed as Eflow for Nikachhu Project, the tariff for electricity required from this project is quite high. He said that a sensitivity analysis would need to be conducted to examine if higher E-flows made the project financially un-viable.

Ms. Tashi Pem, DHPS recommended that the Department of Hydropower & power Systems which is the nodal RGOB agency for development of hydropower also be consulted/involved in the determination of E-flow for different projects. Mr. Tenzin Khorlo agreed to this.

 Mr. Ugyen Wangda, DGM raised concerns on impacts of reservoirs like RIM instability and reservoir-induced seismicity. He cited the example of Kurichhu Hydropower Plant (KHP) which has its reservoir RIM undergoing erosion. Therefore, studies could be carried out on reservoir stability and reservoir induced seismicity for Nikachhu.

Director (Projects) informed that reservoir RIM instability study is part of the DPR studies and that in view of the small submergence and geology of the area, reservoir rim instability is not a problem with this project. As for the reservoir-induced seismic activity, he informed that this problem is anticipated only from reservoirs with huge volume of water storage. However, based on the recommendations of the participants, he agreed that Druk Green could examine this later.

Mr. Tashi Penjor, Dy. CEO, also cited example of Amochhu HEP having reservoir rim treatment plan. To this, Ms. Pratigya Pradhan, Head, P&DD, Druk Green clarified that the right bank has good rock and for the left bank, reservoir stability plan has been included in the DPR.

• Mr. Tenzin Khorlo, NEC pointed out that an EMP should have technical details including controlled blasting and listing vulnerable animals. He also mentioned to put the monitoring
details including schedule of monitoring and institutions responsible for it. Besides the environmental parameters, he recommended to monitor blasting to eliminate adverse impact on Trongsa Dzong.

Director (Projects) informed that Druk Green has a team of experts (Center of Excellence for Vibration and Thermographic Analysis) who have the experience and knowledge to monitor vibrations from blastings. For monitoring, he also submitted that Druk Green has gained valuable experience from Dagachhu Project. He, therefore, assured that required monitoring shall be put in place.

• Mr. Tashi Penjor, NEC also enquired whether the quarry will be outsourced or operated by project developer. He recommended if this be outsourced to the Bhutanese contractors, since it is one of the activities whereby local contractors can be involved.

Director (Projects) clarified that it has been proposed to have the quarry operated by the main civil contractor but the proposal shall be examined.

• Mr. Tashi Penjor also enquired whether the impact on downstream users due to river diversion has been studied.

Mr. Pema Dorji, EO, Druk Green informed that no direct downstream users are present, and moreover ,11 perennial streams downstream of the Dam provide a minimum combined flow of 0.72 cumecs.

• Since 31.01 acres of private land shall be acquired affecting 12 households, Mr. Shankar Sharma from National Land Commission mentioned that the new land *Tharms* have been issued and therefore, project should use these to identify and quantify land requirements. He also suggested compensating all the Project Affected People at one go to eliminate compensation issues later since PAVA Rates are revised once every three years.

Director (Projects) informed that total EMP cost of Nu. 55 million shall be revised, if required, after comments from stakeholders during the DPR Presentation to Trongsa Dzongkhag on December 12, 2013. Latest PAVA Rates shall be considered while making the revision.

- Ms. Tashi Pem, DHPS, enquired whether the cost for land development has been taken into account while working out compensation amounts. Mr. Kuenzang Yonten, Local PwC Consultant of ADB, clarified that the land development cost has been covered.
- Mr. Choki Gyeltshen, NBC inquired on how the sampling for epiphytes on trees like orchids and fungal species were carried out.

Ms. Deki Yonten, Local Consultant responded that no specific survey methodology has been adopted for epiphyte. The number of only those epiphyte found on the trees falling in the plot were counted.

In response, Mr. Tenzin Khorlo, NEC said whether the Biodiversity Impact Assessment was necessary or not in the first place. Since the project area is near JSWNP, information could be collected from the park office.

Mr. Tashi Penjor, NEC suggested if the methodology for biodiversity inventory could be done in collaboration with DoFPS or with the method approved by the Department for future projects.

• Mr. Shankar Sharma, NLC suggested that the muck dump sites after reclamation could be given to the people as compensation. He also mentioned if the project could look into health issues due to workers influx, job opportunities to Bhutanese, possibility of taking local infrastructures like housing and aligning project roads with existing farm roads.

Director (Projects) responded that the muck dump site can be given back to interested/relevant people according to laws since the muck dump sites shall be acquired only temporarily during the construction period. Regarding the health facilities, it was informed that the major EPC contractor shall be required to to have their own basic health facilities for their workers as at Dagachhu HPP.

On the job opportunities, he said one job per family can be given, during the construction period, to those affected adversely as per Sustainable Hydropower Development Policy 2008, depending on their skills. The project can rent local houses, if suitable. As for the alignment of projects road with existing roads, it was informed that the possibilities have been taken advantage of by aligning the road to Adit III with existing Tansgibji farm road to the extent possible, road to Adit V with the existing quarry road and road to muck disposal site at Tsangkha with existing Power Tiller Track.

• Mr. Leki Dorji, DoR, raised concern on whether separate budget has been allocated for maintenance of existing highways.

Ms. Pratigya Pradhan, Druk Green clarified that no budget has been allocated for existing road maintenance except for the maintenance of project internal roads.

Mr. Tenzin Khorlo, NEC added that maintenance of highway can be carried out once the project construction gets completed, however, proper traffic management must be done during construction phase to minimize impact on road condition.

• Ms. Tashi Pem, DHPS enquired whether the free 10,000 unit of electricity per acre of land acquired for the project annually to affected households have been considered to which Director (Projects) clarified that this has been taken into consideration as per the Sustainable Hydropower Development Policy, 2008.

Mr. Choening Dorji, DoC, commented if the report could cover impact on cultural sites and if
extensive studies can be done in the field. Director (Projects) assured that the impact of
project on cultural sites has been covered in the project and that the Department of Culture
has already provided NOC for the project.

Mr. Tenzin Khorlo also supplemented that this is one of the issues NEC should look into to include in future EIAs.

 Mr. Gorab Dorji, BPC enquired whether the Environment Impact Assessment (EIA) for transmission line for power evacuation has been carried out to which Mr. Pema Dorji, Druk Green responded that a walk-on route survey was done by BPC and detailed EIA Report is under preparation.

Mr. Tenzin Khorlo, NEC also added that EIA for transmission line is a huge exercise, but at least mention about the preliminary details need to be given in the report to inform the stakeholders.

• Mr. Letro, JSWNP also requested if the project developer could get the revised biodiversity data from the park office and also to look into secondary information on presence of Red Panda, one of the endangered species, at the dam site.

Ms. Deki Younten, PwC Local Consultant assured to work with DoFPS for secondary information.

• Ms. Namgay Bidha, DoFPS, commented that instead of capturing the wild animals, they may be allowed to pass since capturing may result to death of animal due to stress. She also enquired on the presence of muck disposal site in biological corridor, and if downstream users like animals, has been considered. On the 2:1 compensatory afforestation monitoring, she cautioned about the survival of plantation.

Director (Projects) clarified that the muck disposals of ADIT-2 falls in the Biological Corridor for which clearance have been applied to Territorial Division and that required management shall be ensured. He also assured that plantation for compensatory afforestation shall be done in consultation with DoFPS. Mr. Tenzin Khorlo, NEC, also added that for the movement of animals downstream it is mandatory for all structures, except for dam, to keep a buffer of the required 100 feet from the water body.

 Mr. Tshering Dorji, NEC, commended on incredible primary baseline data that has been provided. He, however, said that data is confined to project area and data within the periphery of 5 km may be provided. He said that technical details of landfill, bioengineering and compensatory afforestation needed to be provided. Further, he added, if species rescue plan, like MHEP, can be incorporated such as use of eco-duct, eco-structure and habitat enrichment activities where applicable. Ms. Deki Yonten, clarified that the Risk Assessment and Environment Valuation which was in the previous ESIA report has been dropped while updating since the information was found inadequate and weak: this would be updated and provided upon getting comments from NEC.

• Mr. Tshering Dhendup, NEC enquired on the decommissioning aspects of roads to ADITs, labor camps, recreational plans, and on the version of SPSS used for Social Data Analysis.

Director (Projects) informed that no specific decommissioning of access roads required for construction has been considered. Mr. Tenzin Khorlo also mentioned that the decommissioning plan is one important part of EMP which needs to be included.

The program concluded with the vote of thanks by Director (Projects). He said that Nikachhu Project is the first project that Druk Green is implementing from the basic investigation and ongoing consultations with stakeholders as with the present one has provided a lot of valuable education and feedback to Druk Green so that it can manage such future projects much better. He thanked all the stakeholders for continuing to support Druk Green in its continuing quest for sustainable development of hydropower for the common welfare of all Bhutanese. He also assured that all issues raised shall be appropriately managed by Druk Green.

The meeting ended with a vote of thanks to the Chair.

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Venue: National Environment Commission Conference Room DPR Presentation for 118 MW Nikachhu Hydropower Project Date: 27th December, 2013 Thimphu

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उड्रयमार्थटहे स्वार्थ्येवच्टे प्रतेटतवुन स्वाप्टी ज्याष्ट्रवेग्री कर जडुन्देगती. वर्ट्रवेट वीर्थन्ववेयेट के र्टराय्येनलारट. पुंचष्ठीतावीट क्रेंजन्द्रीय रेड्लालय रेगीजाटना कुन. रेवीट क्रियिजनात. नहियोजनात्वर य ख्येजय वीवट्य्यवार्थटरे ब्रेन्डुर रेड्यव्युर्थयाय वर्धदयत्विन् प्रचैयरेट वहुत्वड्यजर्थ व्र மवीक्रमालय ज्ञय केंद्रे केंद्र पहलय वर्षट इन्द्र केंद्र यहे के यह के के प्र केंद्र यहे के यह के यह के यह के यह के प्र केंद्र यहे के यह के य כלצל אל אמשיר. מהרמשלבתו המינטינים ומששד להל של על של של אלרה של מציד אל הר. של מציר. लिलाबेह्न जीरत्व की नडेर्य नडे वेल विवेश केर तन का की र तर्व की विवेश हो देवा दर्ग क जल क्टल्ड्रे प्रकट्ये प्रकार वेविट विवय क्रियों के प्रकट नकी के प्रकट के विद्योग विदे हे प्रवाद के विवय के के क कर्मद्रमा बहुद्र करे में करे के का कि कि कि कि המושמות של האי הצפי באל ממש שני שא איר המא לציחר השמורחק. לעול בי שיו שממה המשלטת כל שא הא שמת שצי ב בשמיר א שהומבשר. र्र्यताषुये. वसित्यवरित्य भ्रियेषुम्सार्वेलास्ट्रे. वैलाक्वल. स्वेत्युम्सार्व्वेणड्वोनुर्येषुर्द्र विवर्म्र क्र न्तर्र वर्षरत्वा वर्षत्व इष्ट्रव्युवेलवह्वकावर्, वर्षकट्रत्वुटिकस्ट, कर्षकट्रजवाय्यून्द्रवेलमे. टेनक्रेर प्रेक केवलवर्रसर भवरस्वहर्यत्रार भुत्वभड्र्य र् गर्भमुयेभुजनवाकीनजन भुवहर्यर उत्तर विकेवप्रम. alde. છુવું દ્વેતા ત્વર તાહિત્યા તે કે વાયર. અન્સ્ છે શૈવી મા આ ભારતી આ વર્ષ બદ્ધ વિદ્યા આ પ્રે ને છે. के अस्वर्यर भीजवास्त्री जुर्थसेर इराव्यक्रेवीक्रियेन इवेक्राव्ये, व्हेक्राव्ये, इत्रेक्राव्ये यह इवेधव्रटलण त. रेड्लइवेधवरेकरे. ईटपवारटेवझिटक्रिक्यवेड्वोवेल विवेधवर्यप्रेश्रेयेतर. भुजररेकर. वरिवजुरप्राज्येत यह त्वरम् इवाकाईरट खाउद्दलवद्ववेवयेटल्टागुर्डवन्ने. वीर्वरेहीयर्थुर वोषेय इज़्येश्रज्ञ्ये क्रियेटत. इटाव्योक्टेबीहर. घुरे, युवेद्वेवीहर्टर वहावार्ट्र जयादियाक्वीयेत्यूरे य भूवाभुजयात्वीता वर्षु स्वीयम्बर खेलाउद्वया द्ववीय होत्य के हिंदे हो हो हो हो हो है ह क्रियजन्दे मैग्रेटवीवज्वल बहुबेलेशर्टीहर्ट्यवेलयुज. ह्येन्यउत्परयम्हेन्द्र वहीरमवर्थतम् हुर्थे हुर्थे है भूविष्ठमासार्वाम. पुरुषष्ट्रमारेट. रहेवेष्ठितगुर्मेर् प्रदेवीक्षर प्रहिटमुवीभुजसायहर्थन्तु मैवज्ञवीत्रसावसाक्र क्रिसेंट केल्फ्रेटकेलाडी इवीलटेक्टल ब्रिवीयुवीयुटेख्रेल वर्जुर्थटेवीउत्प्रूट यूटेज्रेट वीलटल वेर्धि ह स्त जयावीजजयादिरयम् इचेड्रिय स्टी.जन्ही.सहरी.ड्रेबेवीबेट.स. जयाउद्वीर त्यूरे रूप्रे देवेय जयावीजस्वाय

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জ ব্যাহিয়ীবার্তারার্ত্রীরার্তার্যান্য বর্ষার্থ জি ব্যাহিয়ীবার্তারার্ত্রীরার্তারার্ত্রীরার্তার্ত্রীরার্ত্তার্ত্রীরার্ত্তার্ত্রীরার্ত্তার্ত্রীরার্ত্তার্ত্রীরার্

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वरिवेव स्विक्वविष्ट्रतन्नुवे ईलाटाव्यविदियं क्षेत्रदेशदित्यदिन्दविष्ठविष्ठवात स्विक्युंग्रविन्द्रभुविद्युंग्रविन्द्रभुवेद्र देवविष्ट्रवित्रिय प्रदे वर्व्यविर्ध्रदेवद्वेषा अर्थटिवर्ग्रदे क्षेत्रवेत्राविष्ठदेशे देश्व स्वरूप्य स्वरुषेत्र व्यव्हेवेतव्येस्य भष्ट्रवेव र्रम्ग्रेवे वर्ष्यवर्ध्रदार्ग्रस् प्रेक्ट्रेस्ट्रायुर्धत्स स्टर्ग्रेव वर्ष्य्युव्य स्वव्हेवेतव्येस्य प्रुष्टेव्येव र्रम्ग्रेवे वर्ष्यवर्ध्रस्य प्रेक्ट्रेस्ट्रायुर्धत्स स्टर्ग्रेव स्वर्थ्यात्र र्त्या र् प्रुष्ट्रव्येव र्रम्ग्रेवे वर्ष्यवर्ध्र स्वित्रिर्ध्रस्य क्रिय्त्रव्येत् र्द्र्या स्टर्भ्यात्र्ये रिज. प्रुष्ट्रव्येव तब्यदीयात्व, स्टर्ग्रेव्येव्यित्विर्ध्रेव्यत्विर्ध्रे व्यव्हेव्येव्यं द्र्याव्यद्व्येव्यं क्र्य्ये प्रूर्यव्येव तब्यदीयात्वर, स्टर्व्येव्यद्व्यां क्रेट्युर्ग्रेव्युं व्यविव्यद्व्येत्वयं क्र्य्येव्यं व्यत्येत्व क्र.णे रेस् क्रुप्रवेयत्व्यत्वात्वव्यत्व्यत्व्यं क्ष्याः स्टर्ण्युव्याया व्यस्टः स्टर्ग्येव्यं व्यत्येत्व क्र.णे रेस् क्रुप्रवेयत्व्यत्वात्वव्यत्वे व्यस्य स्वीयद्वात्यं क्रिस्टः प्रविव्यद्वे व्यत्येत्यं द्रस्त रेस् क्रुप्रवेयत्व्यत्वात्वव्यत्वे व्यस्य स्वीयद्वात्यात्र्यं व्यस्य स्त्र्युंव्यात्य त्येत्र्यं व्यत्येव्यं द्रस्त रेस् क्रुप्रवेयत्व्यत्वात्वव्यत्वाय्य्वायाः स्ट्रिय्य्यात्यं क्रिस्टः प्रियोय्य्यायाः स्वर्य्याय्यं व्यत्वेत्यं व्यत्वेव्यत्य व्यत्येव्यत्व्यत्व्यत्व्यत्वेयत्वात्यद्वेव्यत्यद्वायात्यक्र्येयाः व्यत्यवित्यायाद्व्ये क्र्य्याव्यत्व्यत्व्यत्ये व्यत्वेव्यत्व्यत्व्यत्वायत्व्यत्वाय्य्याय्यात्यात्यक्र्येयात्याः व्यत्वस्यः प्र्वियद्व्यत्व्यत्व्यत्व्यत्व्यत्व व्यत्वित्यत्व्यत्वाय्यत्वात्यद्व्यत्यत्वायद्व्यत्यात्य्यत्वात्यद्व्यत्वात्यद्व्यत्व्यत्यत्यत्व्यत्वे व्यत्व्यत्व

ਹੈਕ ਬੁਲੰਟ ਬਬਹਾਸ਼ਣਾ.ਕੀਬੇਕ.ਸੈਂਟਕ.ਕੋ. ਕੀਏਟੇ.ਜਟੇਟਕਬੇਜ ਤੇਲਕ ਕੀਏਟੇ.ਖੋਬੇਲਕਲੇਬੇ.ਕੈਂਟਗ੍ਰੇਬਰਕਲਕ ਕੜ੍ਹਟੇਟ ਤੇ.ਪੁੱਖਿਕ.ਕ. ਪਰੰਕੀਯੋਟ-ਪਰੈਂਟਸ਼੍ਰੋਕੀਬਲਕਪਛੁਬੀਡ ਬਬਹਾਸ਼ਣਾ.ਕੀਬੇਕ.ਸੈਂਟਕਰਕੀਟੇਜ਼ਬੇਰਕਲਕ ਅਕਪਰੀਯ. ਕੀਬੇਟਲੀ

विकाईवेयन्देषुं वुष्ठेषणव जवादवेनर्द्र्वर्तमुप्रतीत्त^दः इसक्वे वङ्ग्रेसपुंटक्योर.³⁰ ्रवेवद्वक्वेश्वत दंदवक्वीवेवत्वद्वव्यवद्वं, भुदेषत्ददेव्युव्यव्ववेवेवनत्द्वव्यक्ष्रेषणवः भुष्ट्रदेदत्व्वेवनपुंवेवेदेर्द्र् भूतविवर्ष्ट्र्व्युर्थेत वेवलर्ष्ट्रेवे ववेक्वाय्व्यिनमुदेद

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ज़री घाउंट, जयावीजाजवावड्रेये. क्षेत्रवर्ष्ट्रियोवचु. केंटलुक्रैवर्ष्ट्रायोग्रेक्रुटते.वीर्षटवचयाइयोइट. वयलपक्टरब. बीड्ये स्टब्ल्रेयेक्रियाइयेज्रूट. वीर्षटर्द्र्यात्वद्रेये. जयावीयाज्ञ. व्यून्टियेज्रुज्ञ्द्रती.वीर्षटर्द्र्य क्रे ५.) केजवराजनीवाइयेथ्य. तर्श्येवराउरिणकुबर्ध्रिये. जयावीयाज्यावड्रेये घुर्नुती. पुन्न्ये.वीड्योप्टर्य. बीर.

चर्वजी प्र्वजी भुजररेक्षटते. वेष्टेटवरवज्रसेरडवरेट. व्हेश्जकारवरं दड़वे. वरिड वेषेट्रहेकेराचु प्रवच्यज्ञेतडु. 3) इंटज्रुड्रेवर्ष्ट्राव्वेय. जन्नव्वेयज्ञेच्येव्यव्यट्टरं क्टज्रुड्रेवेयच्ड्रेर्ट क्रेवेल्टर. इंटज्रुड्रेन्ड्रेर

षु भुषेतर. वर्ष्यत्वेपडूट बैर. भुरूटे विवरेट जुन सरिजर ट गुंब वर्ष्ये हेर्ट्य वर्ष्ट्र वर्ष्य देवेवस ह्यूनाइट. वर्यवाष्ट्रवीक्ष. जनावीनकुन वर्ष्यून्येट वर्ष्ट युद्धे एक्टर ग्रूटे इरकट. इर्य मुटे हैंट लड़े वर्ष्टट

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d. ज्यूरिट.ज्यू जल इसजुबलप्रेसक्रैतर्य्यूत. ज्वाङ्रा

अन्यटस्मार्ग्रस्टेट इटवन्येन इवन्येनज्ज्यद्रेवर्डव वहूनज्ज्युन्सेवयवर्ष्ट्रवेत्वेनड्रे सरेटलज्ल्यज्ञ. टवप्रिवइटव्यवेषष्ट्रवीयेव व्यून्सेयज्ञ्य्टर्स्ट्रेस्ट्र. ४८.ज. छे२.४८ज्र्येर्थ्रवयुन्सेवय्रेष्ठेद्र रेक्ट.इर्व. छ



છેલ ધ્રૈવીઝાલાવડોળ.તોનર.ત્વિત્વેછ.સ.ટેટળ. વ્યૂન્સિપ્ટ્રેટ્સીનપુન્લલાવ્કર.સૂર્યળેતોલ.ઉ.ભી ળવેલપ્રેલવરિર્ક, હન્દર્ટવૃષ્ટ્રિલલાકુર.mc.ભાલત્વટ.વેશિસ્લાનેક્ટ.ભી સુર્વેટર.દ્વાંતર્પલટવેળખાલ ગ્રુ.ક્ટ.સંદપ્રેલ ન્લુગાલ.વંધેળકુવીસુરેશભાલ. છુલટ.સુર્વતર. સદ્દક્રેદ્દવર્ણ્યુ શ્રીપ્રેર્વાહવેડ્તાર લૂટરૂટે યુગ્રુષેલાખાલ સ્પૂનલાશ

ष्विकार्ट्ट्राच्ट्रावेकरणी भवकाटरवरेकर्स्नेटर्ट्स् देशेट वर्ष्रोवचेव्य्रेश्रवटर्व्याद्व्येत्रद्व्ये वर्ष्रोवचेव्टर्स्टव्येव्य्ट्राट्य्योट् वेग्स जवव्वीजजव्यक्रव्याद्व्यास्ट्राट्र्य्वाष्ट्रीय वर्ष्राचीपुर्व्यट्य्याद्व्यीयुर्ग्रास्ट्रेव्य्योट्य्योट्य्योट्र्

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तर्ध्य इंग्रुक्ष क्षेट्रक्रुक्वियेवटवेट. क्येबीक्स्वयंक्र क्रियम्बर्य, हेटज्यूर्यब्रेल्यु, क्रिक्वच्य्र्यार्थजी

र्ट्रजन सट.ई.ब्रुवीय.क्षु, रे.जन, वीर्षप्रदि,जी.वीर्षटर्य्यून्ड्र.बी.वर्द्धय.बु) इर.बीरिट्य.जी

રળમું પ્રથિન્ન મુમનનન સ્ટારન્ટ્રો કરતેના યુક્રો કન્બ્લપુનર્ સુવાયેટલ્ટક્ટ્રો સિંદ્યુક્તે ન્યુપ્રેક્કિવેનટ સુવેટ્ટ નન્યવેન થયેલ પ્રદેશે છે. વ્યવ્યેયેટ દ્વેન્યન્ટ્ર સુવાયેટલ્ટક્ટ સિંદ્ય વ્યુપ્રેક્સિન્ટ સુવેટ્ટ નન્ય છે. ગ્રેન્સે હતા નક્ર્યુક્ટ્સીન્ટ સુવાયેટલ વ્યુપ્રેક્સિક્ટ સ્ટાર્ગ્સેન્ટ સુવેટલે સ્ટાર્ગ્સે છે. સ્ટલ્ડ્રનાંટ યુન્સે ન્યાર સ્ટાર્ગ્સ સ્ટાર્ગ્સ છે. સુવેટ તે વ્યુપ્રેક્સિન્ટ સ્ટાર્ગ્સ સ્ટાર્ગ્સ સ્ટાર્ગ્સેન્ટ સુવેટ સ્ટાર્ગ્સ પ્ર યુન્સે ન્યાર્ગ્સ સ્ટાર્ગ્સ સ્ટાર્ગ્સ સ્ટાર્ગ્સ્ટ સ્ટાર્ગ્સ ન્યાર્ગ્સ સ્ટાર્ગ્સ સ્ટાર્ગ્સ સ્ટાર્ગ્સ સ્ટાર્ગ્સ યુન્સ ન્યાર્ગ્સ સ્ટાર્ગ્સ સ્ટાર્ગ્સ ન્યાર્ગ્સ્ટ સ્ટાર્ગ્સ સ્ટાર્ગ ચ્યાર્ગ્સ સ્ટાર્ગ સ્ટાર્ગ્સ સ્ટાર્ગ્સ સ્ટાર્ગ્સ સ્ટાર્ગ્સ સ્ટાર્ગ્સ સ્ટાર્ગ્સ સ્ટાર્ગ્સ સ્ટાર્ગ્સ સ્ટાર્ગ્સ સ્ટાર્ગ સ્ટાર્ગ્સ સ્ટાર્ગ સ્ટાર્ગ સ્ટાર્ગ સ્ટાર્ગ્સ સ્ટાર્ગ સ્ટાર્ગ્સ સ્ટાર્ગ સ્ટાર્ગ સ્ટાર્ગ સ્ટાર્ગ્સ સ્ટાર્ગ સ્ટાર્ગ સ્ટાર્ગ સ્ટાર્ગ સ્ટાર્ગ સ્ટાર્ગ સ્ટાર્ગ સ્ટ્ર સ્ટાર્ગ સ્ટ્ર સ્ટ્ર સ્ટાર્ગ સ્ટાર્ગ સ્ટાર્ગ સ્ટ્ર સ્ટ્ર સ્ટાર્ગ સ્ટ્ર સ્ટ્રિક્ટ સ્ટ્ર સ્ટ સ્ટ્ર સ્ટ સ્ટ્ર સ્ટ સ્ટ્ર સ્ટ્ર સ્ટ્ર સ્ટ્ર સ્ટ સ્ટ્ર સ્ટ્ર સ્ટ સ્ટ્ર સ્ટ્ર સ્ટ્ર સ્ટ્ર સ્ટ સ્ટ્ર સ્ટ્ર સ્ટ્ર સ્

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मु जन्मजीना के पश्च प्रदेश हे मुलेसप्रट देशुपेश्वर स्वरूष हत्यत्व के जन्मजीन कि जिस्ता के प्रत्य के प् के प्रत्य के प्र के प्रत्य क

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มีรส. กลเสบิญลติ.ปร.เจรไทยิปลกจายไ. 28 และปฐานสะไหน พลงอย่านในแก.

रेक्रेक्सकर वेटल व नर्षस्रकल्टीनजव संतिवन्न स्रिये व्हारज्य इर्वे वोट्टल्य स्वयद्वी से विद्रज्ये ९) इंटलक्र क्रेल्यमूर्व्य इंटलक्र क्रेल्यू मुंबर्व्य व्हारज्य जनवीन क्रिल्ट. जवीज्ये द्वाव रेक्रेल्य जन

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वर्षिटलयलय मुम्ने¹⁰ प्रमार्ट्य्ययेलय् वेषण.न्यरंवीयटल विज्योड्र.बिल्री हेव्रीयह्त्व्यवीषष्ट्र्यावेल्य, यूर्व्यव्युयेवड्रेटी, ष्ट्राव्ट्येव्युयर, ड्री.वरेटज़ीलयलेवोयलेट घट^{3-उ}ईरेबिवड्र्य प्रयत्वव्वटीवेड्र.वंटिट्यट लव्यव्वेगलयब्टलयट्ड्येक्ट्र्यावेल, उट्टेलेट प्रूवेक्षेत्रे वर्टटट्ट येत्ज्ञूजबीट्रव्वेश व्रेट्टक्ये.वर्जनव्ये लव्यवेगलयब्टलयट्ड्येक्ट्र्यावेल, उट्टेलेट प्रूवक्षियेब ट्रोयह्त्व्यवेन्द्र्यां प्रत्व्ये.वर्जनव्ये ज्यावेल्याल्या व्यावेज्यूत्र्यात् क्रिय्यं प्रूवे येत्र्यु

क्षेत्रज्ञी इंजय जवछावेष्वेद्वीजी वीड्रव्ह्येटेट ईवीक्वीक्टेटव्ह्रिय मैं बीजूबीयुद्धेसंक्यवटुं. प्रूटले. वेष्टेटर्यूनपुषित २) हेजावेटजड्रवांयनवीय हेजवटलसंटव्य्युष्ठिव्यक्तिव्ह्येक्त प्रविष्ट्रिट्युस्ट्रज्ञ. जुवोह्टर्टट क्रिकेव

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बिनसेजज़ी इस. २००११२८विधर्जे १.वीर्षटसेव्यरेट. श्रुवक्रैटजन्दन देवीरोपटल जूर्यजन श्रुवोय रेटजूर जम बिरोब्रेलप. हेपुक्र सेल्ट. श्रुवीय पुरस्थिय टलर्यट. यूर्ववाड्रेटजन जूर्यदेवी से ४) सेज्ञष्ट्रवीयन इमुटनजल्लाई हे जुन. रेजर्रट बेटजपुर्द्रयोग्रेल रेट. क्योट बीववी बहेनजूरी जर. रे.

वसिवावर. ਉन्नाबिये, स्ट्रियेलयु. उष्टर.वोष्ठेयूटेतजन स्र्वेयष्ट्रेटजन्मजुदेव्ययेट.हत्व्यप्रेट.हत्य, व्युयेयूट्य वसिवस्ट्रेट.वज्रस्य स्ट्रियेलयात्व. देप्रप्रेट.वट्य वोट.हत्व्यटेट. ये.गावट.जपु. भुज्यत्वीटर.³⁰ जूर.जुम्प्रेय ६) क्षेट्रज्ञ व्यूय्यूय्र्येय प्रोटवेलय येजाष्ट्रवीयत्य्र्येन विभुष्ट्र. थ्रे.ग्रेक्रियलप्र्येल.स्र्येतस्यियप्रस्

लुर्यन्द्रये. टक्स्वलम्बर्ववार्थ्रटमलम् ट्रेय्रेट्र्यिय्युय्वयुद्ध्युवीय्रेट्र्यियम्र त्वेन्न्यत्वय्वयेल् स्वत्युय्युयुत्वन्त् युज्याल्ट्रट्र्य्युय् व्हेवीय्र्येयुज्यलह्र्य् ^(BbC) स्रश्चेव्रित्वाय्येलय्. युवीयुज्ञवर्ट्य्युयेन्द्रये उन्टर्युयुद्धे. वहीवयिर्ट्यव्युय्युव्यय्युयेवय्थ्रयेवय्थ्र्येट्ट् टेर्ड्र् टत्व्र्य्य युवीयुज्जवर्ट्युयेन् यु यूट्युज्यति. वहीवयिर-व्हेट्यूवीयुज्ञम्बद्ध्ये जयाव्वीयाल्यवित्य्य्यर्ट्य्य्य्युयेन्य्य्येव्य्यायर्थ्य

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ट्यूनइट्ट्र्य्यायूच्यू जयात्वीग क्रियहेट्या जय देत्रेवायेट्यु क्रुये देत्य स्विय व्यवस्त्रीज रेट स्रेट्यु ये

टेट.क्सॅश्वक्रेमपुर.dक्रियमु जसफ़्रिस. उक्ट.alg.sc.get.get.str. सम्ग्रीयमुखपुख्यकात्र. उक्ट.alg.sc.get.get.cget. जयत्वीनक्रेत. घटवायुर्डाटी बीज्र. जयत्वीजाजयवित्यकर्ष्ट्रप्रे आष्ट्रवे. देवभूविद्र-देव्ये स्टूर्व्ये प्रवर्धे. जय. घवीठटवीवईजयब्रुविद्य व्युवेश्वर्यु प्रवेश प्रदेशियदिर्द्ये प्रवर्धे. देवभूविद्र-देव्ये प्रवर्धे. इवोछाड्येक्टव्येवहेजयदेर्द्यायूट द्व्येष प्रदेश ट्येक्याद्वी प्रवर्ध्र द्व्येप्ट. यूर्थ्य प्रवर्ध्र दद्य देवय्र्युवेवरवर्टर्य्यायूट्य द्व्येष प्रदेश र्ट्याय क्रिस्ट प्रवेश द्व्ये प्रवर्ध्र प्रवर्ध्र जया क्रिस्ट रव्यस्ट. द्व्येय््रियेष्ठ्याय द्व्येय्र्या १.२८. द्व्येष्ठ द्यांसद्वी व्युवे. द्व्येव्ह्ये व्युवेदे यूर्वा क्रिय रव्यस्ट. द्व्येय्य्येय्यवर्ध्रायू स्ट्राय्य्या स्ट्राय्य्यायद्वी जयाद्वी व्यायद्वी प्रवर्ध्र व्युवेद्वी व्युवे

पहुंचे न्ह्रेट. इटाक इवे ट्रूवेवेटटेव्रेन्छ क्रिक्र क्रिक्र क्री क्षेत्वक ईटीक्र न्ह्रेवर्ट्र क्रेट्रेक्टन्जन, वस्तटेट.क्रेट.क्रेक्स् ट्रांक्ट.जुर्व वेवेट.न.डुर्व टवीट्रेटट स् क 11) स्टाव इवोटह्र्यटेक्ट.क्रुक्र स्वुवलक्ष्ट, जवाद्वीनक्रीवेवस्रीवन्द्र्येजी. वस्त्रनवेवीलटेट वोर्वन.

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रविष्ठेवव्र्य वहरे.वोवेटत.इयेव्रट.खेली भर. मर्टर्ट्याय रेडेटवीमजेन्येन्याइचे ममजीमर्ट्युजर ब्रेड्व्या स्वर्ष्ट्याय देडेट्रेड्रेड्याम uage sangale figder Uzdalenge zelan 120 aprinage delana. ful zangale भग्रे क्रांतनहीं बालत सुर्व कर कर्यन हर्यन वर्ध्व कर जय केर्ट्य हरि क्रिय कर जय कर कर जय के क्रांत कर कर जय

नहित्युत्वरित जयाजीमज्ञया वहेवीषुत्र स्वर्धात्र प्रमुद्ध संस्थम स्वर्धत्व हो उत्तर्युरे उत्तर रेष्ट्राराम नहेरे लेखे तरेट हेर्र्यास. हे यो इवील्टरे जर बेट. ध्रिय ये द्वीयरे अघट जहूर बोर्ड संहरण रेट उद्वेत ट्यूम्ह्टत्र्येवस्ट्र्येक्र यष्ट्रेज्याक्र्यूचे दिर्द्रान्ड्ये याजरणुर्ये हेल्यायुव्दे रेलट जन्मरे

र्द्रह्मित्रायात्वरेषे वरिषेक्षित्रवीषेर्रत्यु जीर्द्र वर्द्र्या वर्द्र्य प्रमायवेत्र विवद्रावर्ध्वी नपुरा क्या जन यही प्रवी वर्तवार हर में के व्युधे के विद्य के के कि के कि के कि के कि के के कि के के के के के के रवेश्वालः क्री.जिवापी क्षेत्रजाता लर.कृटवर्षिट वन्वयार्टत इषे ज्रूटी वहेत.) तर्य प्रमुखेयीयी रविश्व रेज्य के प्रत्याप्य के रिजाया के 100000 जन्द नहे ये हो

ชื่อเลยุวิชาญรีพมิ. แลงสมญญชื่อเปินการช. อไซเกมโกลเรอมการเมาหายริช นูป. นูป.- มีรายป वर्षणवर भव्युणवर भक्ष्मरात्वाईवाप्रवेत्व महक्रेमवा महक्रेमवर्ष्य वर्ष्ट्रवेत्य वर्ष्ट्रवेत् वर्ष्ट्रवेत् वर्ष्ट्रवेत् युर्वायर्थ्य जवयुर्वायर प्रवेशमा युर्धर दिमासाये दिमासाय रे. भेत भेत भेर प्रार्थर सुरे . महामर होर मध्य के मार्ग के मार र्टर देशचे इतववस्त्री ईरेडियली जयाजीलजेलयनड्रे बोड्रेरे श्रेचेड्रज्वेंटराइचे. वरूद्रबीयप्रेट्रियेडियडिय ट्यूलइट्ट्र्य्यासूर्य्याय, धेरेज्वलर, प्रस्यायप्रेट्र्य्ट्र्य्याय्ये, वर्षिट्युज्ञ्यात्र्य्यार्थ्य्यु

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नरे स्रिस्टिटः इत्राज्येयेत्रः ट्रेनेल्योका बिव्युजर्यती १०) व्युवलीय्र्येकप्रेय ज्ञुद्रवायुपेटे. स्रियुजीय्रीय्रो⁰⁰⁰⁰ इ. इर्युअर्ट्सेट्टल्य.स्र्युय्य. स.स.स.प्रेट

अवरण्या-4-(0,000.00) 'श्रुषे) हम्पारेते हैवर्घनवेद्यम्प्र्यान्त्रेत्र स्वान्त्रेत्र स्वान्त्र्यम् स्वान्त्र्यम् द्वान्य्यम् स्वान्त्र्यम् स्वान्त्रम् स्वान्त्र्यम् स्वान्त्रम् स्वान्त्रम् स्वान्त्र्यम् स्वान्त्रस्य स्वान्त्रम् त्व्य्यम् स्वान्त्र्यम् स्वान्त्रम् स्वान्त्रम् स्वान्त्रम् स्वान्त्रम् स्वान्त्रम् स्वान्त्रम् स्वान्त्रम् स्वान्त्र्यम् स्वान्त्र्यम् स्वान्त्रम् स्वान्त्रम् स्वान्त्रम् स्वान्त्रम् स्वान्त्रम् स्वान्त्र्यम् स्वान्त्रम् स्वान्त्र्यम् स्वान्त्र्यम् स्वान्यम् स्वान्यम्यम् स्वान्यम् स्वान्यम्यम्यम्यम् स्वान्यम् स्वान्यम् स्वान्यम्यम् वित्यम्यम्यम् त्वय्यम्यम् स्वान्यम्यम् स्वान्यम्यम् स्वान्यम्यम् स्वान्यम्यम् स्वान्यम्यम्यम् त्वान्यम्यम्यम्यम्यम्यम्यम्यम् व्यान्यम्यम् व्यान्यम्यम् व्यान्यम्यम्यम् व्यान्यम् व्ययम्यम्यस्यम्यस्यान्यस्यस्यस्यस्यस्यस्यम्यस्यम्यम्यस्यम्यस्यम्यस्यम्यम्यस्यम्यम्यम् स्वान्यम्यम्यम्यम्यम्यम्यम्

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७५. ६५ फ्रूटरटक्रेनउड्डानउडीन्सरी व्यविधकुष्ट्रिट वैकेन्यभुन्द्रेटलकुर.बिन्द्र्यावदी। केंद्रज़वेद्रवय वीक्रात्स्वीवह्र्यटावन्द्रेख़बेरीट लङ्चजुःस्ट्रिल्ट इटाववीक्रेवट्ड्रण.वीर्ष्टर्यूलपुक्रिनर्ख २५) हेटक्रुक्रैवड्रविलत्व्रीय वङ्गलवट्वीलवर्ष्ट्रिक् प्रद्र्वाटर्स्ट्रीट्डिल हेन्वलन्द्रे हीवजुलच्रेच्री वीर्थ

युवकसेर्युत्वभूरे रेड्लकृवसैटक्रिक व्लाष्ट्ररेन्द्रज्युलत्तरे. जनववीनरेट इंटावचे भूरिवो कैनत्त्र्यलक. ट्यूबईटवर्याभष्ट्रवीक्र लक्ष्वरेटकी.व्हल्सूंर.लभारीवेनजीर. इंटाव्योव्हेरेर्युरोज्ट. देते. वश्रित्रव

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जुषेप्रे स्वाष्ट्रवेनस्रीनाव्दुषं स्त्री स्वयन्त्रानववीगस्त्रिवार्षस्यस्य स्वित्यवार्षस्तु वर्षुस्रला स्वाष्ट्रविवनस्य प्रवार्त्य देवरात्राये प्रेषितजय वाष्ट्रव्यस्य वहुषे उत्तर्यु. ह्राववीष्ट्रवेवर्ण्या वार्षस्य व सुर्वयाज्य कुस्ट्रस्टेटस्य व्हेष्ट्रविजय. वश्व्य द्वार्य्य्य प्रवाद्य व्याप्य स्वयः केवय खन्नतरः संसर्षुर. सुर्यास्य द्विवीति. रहियाज्य (0'000'00 (व्हेरीस्त्र) ह्यात्र द्वार्य्य द्वार्य्य प्रेप्ये देव वश्व्यत्रे वश्व्यत्वेव स्वर्येत्य स्त्रियेति. रहियाज्य (0'000'00 (व्हेरीस्त्र) ह्यात्र द्वार्ये स्त्रेप्रेय वास्य वश्व्यव्यवस्यत्य स्ट्रियेनस्र्येत्ये प्रेप्युत्वस्र्येत्ये स्थित्र्यात्र 200'000 (व्हेरीस्त्र) ह्यात्य स् युर्वा स्व्युव्यवस्यत्य स्ट्राव्यवस्यत्य स्ट्रव्यक्रीयेवीन स्ट्रियाज्य व्याप्य स्त्र्येत्य्य्रे युर्वा क्रिय्येष्याय्यवीयत्री वार्टयावस्त्रीयवीन स्र्रेणस्र्येत्य्यार्यः द्वार्य्यायस्त्र्यायद्वीयक्र्यात्य्य्य

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³⁷) घोतुक्र ८.५००५७.वक्षिटक्र घेलसुटक्षिकाष्ठ वर्षटस्विवयुजी जुवलटेवेठजुउटक्रिस्टइवीक्ट प्र सन्य ६न्वर्वावेवर्ट्रस्वेवन्वर्ट इजलपहुर्वर्ट्युत्वसुर्ट्रज्याहरूज्यो

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Minutes of Public Consultation Meeting with Tangsibji Gewog for Nikachhu Hydropower Project at Trongsa (Translated)

Venue : Multi Purpose Hall, Tshangkha Lower Secondary School, Tangsibji.

Date : January 27, 2014

Chairman : Dasho Dzongda Tshewang Rinzin, Trongsa Dzongkhag

Participants: Dorji P. Phuntshok, Director (Projects), Druk Green Power Corporation Limited (Druk Green); officials from various sectors of Trongsa Dzongkhag, representatives from National Land Commission and Department of Forest & Park Services (DoFPS), Gup, Mangmi, Tshogpa and public of Tangsibji Gewog.

Opening Speech

Director (Projects) welcomed Trongsa Dongkhag's Dasho Dzongda, Dzongrab, officials of various agencies, Gup, Mangmi, Tshogpa and people of Tangsibji Gewog, and representatives from National Land Commission and DoFPS to the Public Consultation Meeting for Nikachhu HPP. He also apologized on behalf of Dasho Chhewang Rinzin, Managing Director of Druk Green for not making to the meeting as he was occupied with his additional responsibility as the chairperson of the pay commission, and conveyed his assurance to conduct the meeting successfully. He also acknowledged and thanked Dzongkhag and Gewog Administrations and the people of Tangsibji for their kind support and cooperation, and requested Administration for cooperation and assistance hereafter.

The Chairperson of the meeting, Dasho Dzongda expressed his appreciation for the concern shown by Managing Director of Druk Green for the meeting despite his absence as he is tasked with numerous works. He also extended appreciation to Director (Projects) and other officers from Druk Green for the preparedness to provide a detailed explanation about the Project to the people. He extended his pride over the planning & investigation of the Project, conducted by expert officials of Druk Green and which is now at stage to get implemented. He also mentioned that Nikachhu HPP's first consultation meeting was held on December 12, 2013 at Raven Resort at Trongsa with Trongsa Dzongkhag Administration, Gewog Administration and officials from other relevant agencies. He also stated that the second round of meeting is conducted with the aim to involve people of Tangsibji, in decisions on land substitution and compensations, and committee to be formed with members from the Dzongkhag Administration. He expressed his

confidence and hope, that Nikachhu HPP will not cause any inconveniences like Mangdechhu Hydroelectric Project Authority (MHPA).

He mentioned that the meeting is not time bound and it shall continue until people are pleased with the information. He stated the reason behind importance of hydropower and its contribution towards solving the rupee crunch. He also informed that except for electricity, other products are not abundantly available and therefore, have to import everything from India. He informed that it was monarch and government's plan to invest in hydropower to generate revenue for the common welfare of Bhutanese. He clarified that people are as important as the Project, so it is the appropriate time for holding such meetings to clarify doubts, sort out any issues or discrepancies, raise concerns at the beginning for harmonized future. He also reminded people that they are aware of situations in their Gewog, and after conclusion of meeting and recording the minutes, people shall not complain about the Project; therefore people are required to fully participate in the meeting.

He also requested people to cooperate with Project in case of land acquisition for the Project and informed that the land will be acquired in line with the existing Rules and Regulations, and compensations paid would be paid accordingly. He also informed that, the affected person in terms of land acquisition shall have the option to choose land for land or cash compensation.

He encouraged people to express their views or concerns without hesitation so that problems in future can be avoided. He mentioned that few problems might arise to one or two people which should be dealt as per the existing norms or procedures and expected appropriate comments and suggestion. He also mentioned that, although Managing Director, Druk Green is not present at the meeting, he informed that Director (Projects) has been authorized to provide justifications and expected Director (Projects) and officials from Druk Green to make decisions.

Director (Projects) from Druk Green informed that under visionary leadership of our kings, Bhutan has now developed the much needed technical capacity in health, education, agriculture and has also come a long way in the field of technological advancement. Till now, Bhutan had been dependent on external human resources to carry out the studies for hydropower development. However, he informed that in case of Nikachhu Hydropower Project, investigations have been carried out by the in house experts and Druk Green has the capacity to carry out works in the field of science and engineering. The technical specifications of the Project were then presented to the public: Presentation covered the following aspects:

- Project background;
- Revenues from hydropower sector;
- Projects under implementation by Royal Government of Bhutan (RGoB);
- Projects under Druk Green;
- Details of the Project;
- Project financing and ownership.

Director also informed the public regarding the ownership of the Project. He said that unlike Mangdechhu HPP and Punatshangchhu which are being constructed under grant from Government of India , the ownership of Nikachhu HPP is proposed to be shared between Druk Green (51%), Joint Venture partnership (26%) and public (23-25%). Since Nikachhu HPP is located in Tangsibji Gewog under Trongsa Dzongkhag, and if the people of Tangsibji are interested to own shares, It shall be proposed to the RGoB. To supplement this Dasho Dzongdag reiterated that the shares have to be bought by paying certain sum of money and cited example of purchasing shares from banks. He also clarified that this has not been finalized and has to propose to the government for the final decision with regard to floating of shares for the Project to Public.

Mrs. Thinley, Environmental Officer of Druk Green presented the environmental and social aspects of the Project.

The presentation focused on both the positive and negative impacts of the Project and on mitigating the negative impacts from the Project. The social issues of the Project pertaining to the land holdings and on land acquisition were also presented. She informed the public since it is a public consultation meeting with the Project affected families; the focus shall be to resolve the social issues arising from the Project through mutual discussion and deliberation. The Project shall affect 24 families and shall acquire 10 acres of dry land and SRF land of 243.69 acres. The Project shall require a total land of 253.69 acres and therefore private land acquisition, land substitution, cash compensation and likewise crop compensations shall be made in accordance with the Land Act of Bhutan, 2007 and current Property Assessment and Valuation Agency (PAVA) rates of the Ministry of Finance. Project shall avert acquisition of wet land or acquire as less as possible.

Since the construction of Project will require cutting down of 158,688 numbers of trees Project will carry out plantation at the ratio of 2:1 that is plant two trees to compensate the loss of one tree. She also mentioned that during the construction phase, due to shortage of Bhutanese workers, labors from India will be brought by the Contractors. With the influx of workers, there might be impact like on cultural conflicts and dilution in the locality, risk of communicable diseases and generation of wastes. She mentioned that mitigations measures have been formulated to address these issues.

Some of Project induced benefits that outweigh the negative impacts are:

- > Employment and contract work opportunity;
- Business opportunity;
- Improved road and transportation services;
- > Development in education and health services;
- Earn revenue mostly in rupee amounting to Nu. 1.7 billion annually and also bring rural development;
- > 815.29 million units of energy will sequestrate 75, 8219.70 CO2e ton of carbon dioxide.
- As per the Bhutan Sustainable Hydropower Development Policy 2008, for every acre of land acquired by the Project, 10,000 units of electricity or monetary compensation in lieu of electricity will be given to affected family.
- For the Project Affected Family having to resettle, one member from the family will be provided employment as per his/her qualification and skill.

The Environmental Management Plan and implementing agency were also presented:

SI. No.	Environmental Management Plan	Responsibilities				
1	Noise Pollution Management	Project Authority/ Contractors				
2	Waste Management	Project Authority/ Contractors				
3	Muck Disposal Site Improvement	Project Authority/ Contractors				
4	Plantation	Project Authority, Gewog, Dzongkhag Administration & Department of Forest.				
5	Laborers Colony Management	Project Authority/ Contractors				
6	Land acquisition, land substitution and	Project authority, Gewog and Dzongkhag				

ſ	compensation	Administrations

Regarding the availability of employment opportunities, contract works, and business opportunities, Director (Projects) emphasized that it will depend on individual's capability, ideas, dedications and enthusiasm to make use of such opportunities.

The Chairperson informed people that opportunity is available for them to inquire about the locations of Power House, Dam, Access Road, muck disposal sites, Project Affected Persons with respect to land acquisition, and impacts of the Project, He also invited views and suggestions from officials representing various sectors of Dzongkhag, in line with their respective sector plans. With that, the floor was opened for discussion.

Details of question & answer session with public

1) Mr. Pema Dorji from Naladangla village requested Project Authority for up gradation of the existing Grade 2 Basic Health Unit (BHU) and donation of an ambulance.

In response to his request, Director (Projects) explained that, the construction of the Project will be awarded to two major contactors and they will have both health facility and ambulance, which will also benefit the local people around the Project area. Regarding up-gradation of the existing BHU, he stated that it is important people should know that unlike Punatshangchhu Hydroelectric Project and Mangdechhu Hydroelectric Project which is financed through 40% grant and 60 % debt, Dagachhu and Nikachhu HPPs are small Projects, totally financed through debt. Therefore, the Project may not be able to provide such facilities like other mega Projects and requested people to be aware of this difference.

2) Mr. Pema Wangdi from Naladangla expressed that the Project will have both positive and negative impacts. Since Tangsibji Gewog will be affected by the development of Project, he requested the Project proponent to explore possibility of allocating the shares to the people of Tangsibji. Further, Tangsibji Gup requested to ensure availability of public shares to the Mangdue region and exclusively for Tangsibji Gewog. He also wanted to know the percent of share likely to be allocated to them.

Responding to this, Dasho Dzongdag reminded that shares are not free, and prospective buyers have to purchase it to avail profit, one should be well versed with price of share, duration of investment and dividends but informed that if the Project runs into loss, their investments will not be refunded.

Director (Projects) thanked the Chairperson for clarifying on public shares and, further assured that this would be subjected to governments' approval and to decide on percentage of allocation (23-25%) for the public. He also said that the value of share shall be determined and communicated. He also mentioned that the Project is to be handed over to the government after 30 years of its commissioning, so the shares and profits likely to be generated within 30 years needs to be determined. He also explained that profit from hydropower Projects is due to huge investment, for instance, in 2013, Druk Green generated 7,700 million units of electricity amounting to Nu. 12 billion but the net profit was only 11 % so it is essential to calculate at the beginning.

Director (Projects) stated that for construction of the Project, list of people losing land to the Project, along with details of land type, size of land with signed copy of the list is circulated for information and might be already aware of it. He also informed that the exact land requirement will be known with the start of construction works and there might be differences in the size of land which shall be further discussed with the people.

The Chairperson reminded people of having full authority to purchase shares depending on availability of capital, but cautioned them about the risks associated with such investments. However, majority of the people confirmed keen interest to invest in shares of the upcoming hydropower Project.

Supplementing the Chairperson's remarks on shares, Director (Projects) informed the floor that opportunity to invest in share might have to be given to every Bhutanese and if many investors turn up, then it may not be possible to provide huge percent of shares.

Pertaining to Directors information, Dasho Dzongda requested, the preference of share allocation to be in the order of first Tangsibji, being the Project affected Gewog, followed by Mangde Tshozhi and then to other Bhutanese.

- 4) In response to the request made by Mr. Pema Dorji of Tangsibji Gewog, for one surgeon Doctor at Tangsibji BHU, Dasho Dzongda explained that since Trongsa General Hospital is already there, it will be not feasible to have these facilities at Tangsibji BHU. However, Dzongkhag Medical Officer should propose for such requirements, if found necessary and it is better to be in line with the health policies.
- 5) Tangsibji Tshogpa, shared that the location of Tangsibji Village within two rivers (Nikachhu and Mangdechhu) protect village and their crops from wild animals, and was worried that development of hydropower on these rivers might make their village and crops accessible to the wild animals. He also recalled the presentation made in December 12, 2013 in which a muck disposal site was mentioned to be located above the existing Tangsibji Micro Hydel, which provides water for irrigation purpose. Since people are dependent on agriculture (mostly wetland) for their income and livelihood, he showed his concern over the anticipated impacts on the farm road and irrigation channel by construction activities. In addition to these, he requested for construction of agricultural produce sale outlets. He also expressed his gratitude to Project developer for the assurance to implement mitigation measures to avoid adverse impacts on the house and land due to movement of heavy vehicles in the area and added that his concern is due to the problems he heard of caused by development of projects in other places.

In response to Tangsibji Tshogpa, Director (Projects) reassured that micro hydel and irrigation channel will not be affected, but since the Project will be constructed by other group of people, there might be certain inconveniences. However, he assured that these issues shall be clearly mentioned during the award of work to the contractors. Regarding his concern over easy access for wild animals to villages, he said that Nikachhu already got low flow in winter months and in monsoon, hydropower plant will not be able to utilize all the water, and moreover, during investigations, no issues pertaining to wild animal problems in and around the area has been recorded. Moreover, the financer of

the Project, Asian Development Bank (ADB) have strict social and environmental safeguard policies in place and will ensure harmony.

Dasho Dzongda also added that Project must be having mitigation plans to avoid damages to farm road and irrigation channel, and even if it not in place, the Dzongkhag Administration will propose for such plan.

6) Tangsibji Gup explained that since the existing farm road in the Tangsibji village which caters to 60 households will also be used by the Project he requested that if Project developer would consider black topping the farm road.

In response to Tangsibji Gup, Dasho Dzongda replied that Project may black top the road till school as they will also use the farm road till school, black top of entire road might be possible. To the proposal by Dasho Dzongda to at least black top the farm road till car parking below the school (1-2 km away), Director (Projects) responded that they will appraise it later. Dasho also added that construction of agricultural product outlet shed shall be constructed accordingly with general rules and shall be constructed 50 feet away from the edge of the road.

7) Nyala-dangla Tshogpa, requested for preference of employment (office assistant, security guard, laborers etc) in Project to the youth and people of Naladangla and Tangsibji village, as per their capacity and education background.

In response to Nyala-dangla tshogpa, Dasho Dzongda, explained that the employment distribution should be as per government's new employment policy, for example if all the jobs are offered to the people at the Project locality, what will happen to the places like Gasa where there is no Project at all, so there will be problem in the country and to the people. He also added that as presented earlier the Projects affected families will be given at least one employment opportunities for each family as per their education and capacity during the construction of the Project and also informed that opportunity will be as per to the availability of the vacancies in the announcement and there will be selection procedures. He also informed that as per the employment report from MHPA it shows that many people from Mangde region are involved in the Project, ranging from petty contractors, office assistant to laborers etc. The

people form Tangsibji gewog were also involved in the Project, so informed that the Project has greatly benefited the people in and around.

- 8) Mr. Passang Dorji, Nala tshogpa, explained that they have two different temples and two different monastic institutions at Nala and Dangla respectively and still they don't have proper electricity. He also informed that thought there is farm road till village there is no road connection till temple, so during performing ceremonies and festivals it is great problem without the road connectivity. So he requested for additional road connectivity till temple and electricity.
- 9) To complement Nala tshogpa, Tangsibji Gup also added that for the construction of Nikachhu hydropower Project, the construction distribution line are being carried out, so he requested aside construction if the electricity are also provided to the village. He also stated that Naladangla has around 30 household and requested for renovation of the existing farm road.

In response to the above queries, Director (Projects), explained that Druk Green is not an authorized electricity distributer, but for construction of Nikachhu Project transmission line are being carried out by Bhutan Power Corporation, and if the people wish to avail electricity they may have to apply and request to BPC and Druk Green is ready to give you no objection certificate.

Dasho dzongda also added that even if Project developer is willing to give NOC, only BPC is authorized to give and distribute electricity, and moreover electricity distribution equipments like transformers needs to check whether it can also take load or not. Pertaining to electricity distribution, the Project is not yet started, so when Project gets started, contractors might help us with electrification. With regarding farm road Director (Projects) already mentioned that they cannot do anything and moreover he stated that farm road construction may be or may be included in current five year plan and Gup might have the knowledge and he also warned that if it is included in current five year plan then it is better not to jumble with Project.

10) Mr. Pema Wangdi, Nala said that the people in their village depends on agricultural and livestock products, so when the Project starts at Lorim, the noise and dust pollution might affect them, therefore it might be better to stay at Goenpa. However as already said by tshogpa, there is no road connectivity, so he requested for farm road, and he

also stated that, as there is no community school in the village and children has to walk long way to Chendebji to study. There by heavy vehicles from MHPA plying the road pose danger to the young children. Even if we want to drop them to school, we cannot afford it, so he requested if Project can help them to provide with one bus to ferry child children or if they can get lump sum fuel allowance.

In response to above queries, Dasho Dzongda questioned that, if bus is donated by Project, who will operate, maintain and bear the running cost? So it will be not viable. For that reason it is better to discuss with the Director (Projects) and request for construction of small dormitory for the students about 15 and more. If they build dormitory for the students, parents of the students might have to give care and cook for students on rotation basis. He also informed that if after construction of the dormitory, parents should not let the dormitory used less and the parents have to sign and accept the terms. This shall be done with consultation between dzongkhag education officials and Project officials.

11) Mrs. Rinzin from Tshangkha, explained that her land fall in the Project location for temporary use for materials storage and temporary houses for workers. So she request that instead of acquiring and compensating her land, to lease her land till the commissioning of the Project and she also requested to construct for her with agricultural products outlet shelter.

To this dasho dzongda, said that if the land will be acquired for temporary purposes, then as per the government rules it will be leased and regarding the agricultural product outlet shelter shall be decided for its viability as said earlier.

12) Mrs. Pema Seldon from Tshangkha, said that her land will be affected by access road to one of the muck disposal site, so she requested to divert the road, if not at least lease the land. She also requested to investigate and study the dumping of the muck in the big opening near the land which might help both the people and the Project.

To her response, dasho dzongda said that land used for road cannot be lease since it is for use and regarding the dumping of muck at that big opening, Project has to study whether it is feasible or not. 13) Mr. Pema Dorji, said that crop compensation of Nu. 12000 for acre of land are very less, so he requested to increase the amount of crop compensation. He also requested to make the useable agricultural land leased for Project to convert back to its original condition, and he also expressed his concern over that blasting that might affect the house and how it will be mitigated.

Dasho Dzongda, said that if the crops are cultivated then compensation will be compensated accordingly with PAVA rules and if not it is ineligible. Regarding damage to the house by activities from Project, engineer shall inspect the house and as per the calculation, the owner will be compensated. He also explained that Dzongkhag Administration will support if owner and Project developer have clearly stated in agreement to convert the leased land, back to its original condition when they handover the land back to owner, if it was not in the agreement and owner complains about the lands condition at later, he cleared that Dzongkhag Administration might not be able to do anything.

14) Mr. Tashi Phuntsho inquired about what size of the land affected by the Project will be compensated with free electricity of 10,000 units every year.

To his queries, Director (Projects) explained that as per the Bhutan Sustainable Hydropower Policy, 2008 section 13.2, for every acre of land affected by the hydropower Project, 10,000 units of electricity shall be given yearly and the compensated will also be calculated as per the size of the land affected. If they feel that they cannot consume the entire units in a year due to 100 units free electricity provided by government to the rural every month, they can also opt for monetary compensation. The monetary compensation for 10,000 units will be calculated based on rates as per the rates of electricity exported to India. For example, if the rate per unit of Nu. 4.5 for exported energy, the affected family will get compensation between Nu. 40,000 to Nu. 50,000 in a year.

15) Mr. Pema Dorji, Nyala tshogpa, inquired about the compensation rates for the cypress tree that are currently growing in the affected land and he also raised concern over the dust pollution during the construction.
To his queries dasho dzongda responded that whatever are growing on the affected land shall be compensated according to rules and regulation. With regarding the pollution by dust, there is no other ways then to will be deployed vehicles to sprinkle the water and suppress the dust. He also said that the people working in the Project are also working in the dust, and if the dust pollution affects the health of the nearby people living, then the Project authority should look into it.

16) Tangsibji tshogpa, inquired about the land substitution and compensation agreement document and who will take responsibility to take care, he also requested to Dzongkhag Administration help to select suitable land for substitution, since if he select the land by himself it might create chaos with other villagers.

Dasho Dzongda said that for land substitution and compensation shall be done through Dzongkhag Administration and there is no requirement for any extra agreement, as the outcome from this meeting among, Project developer, Dzongkhag Administration and gewog shall be presented to the National Land Commission. He also explained that the reason for giving to owner to choose the land substitute is to give him/her the opportunity to choose good land for agricultural purposes. He also said that as suggested by tshogpa, to choose land for them from the map by the Dzongkhag Administration, which will not be feasible, as we may not know the actual land condition and may not be suitable for agriculture. For his suggestion for land substitution to given owner the responsibility for selection of land was agreed by the people in the meeting.

- 17) Gup also added that finding suitable land for land substitution is the responsibility of the owner not the Dzongkhag and the owner shall be assisted by gewog Administration to choose the land. To this Dasho Dzongda responded that for land substitution, Dzongkhag Administration also has full support for finding the suitable land for substitute. He also said that unlike before, as assessed as per the current land survey map and *tharm* details there will be no discrepancy at all with the other party.
- 18) Tangsibji Gup, expressed his gratitude for successful deliberation of comprehensive and detailed consultation meeting and he also expressed his opinion:
 - ✓ What they will do if the land substituted are located where there is no connectivity to drinking water and electricity.

- ✓ He also expressed his concern that during the construction of Project will increase the local population and lead to solid waste issues, so he requested for waste dumping site and waste transportation vehicle.
- ✓ He also requested to provide support to community forest and conservation of the environment.

To Gup's opinion, Dasho Dzongda explained that as a best means the land substitute will be given to the choice of the owner and as per the ADB rules and guidelines the affected families shall be granted Nu. 100,000 per acres of wet land for development and reclamation and for dry land Nu. 80,000 will be granted. With consultation with people, if they choose the lands substitute from government land, the land will be good and it will be convenient. He also recommended that waste dumping site is also very important, and the site shall be identified through the Dzongkhag Tshogde and for waste transportation he supposed Project to donate one.

Director (Projects) also said that gup's opinion on waste and community forest was good suggestion and he also mentioned that grave concern for Druk Green power Corporation is also the waste generated at Paro and Thimphu, which ultimately get washed away by river and end up in power plant thereby causing problem to the machine, so to solve the problem of solid waste he assures that Druk Green shall identify the list of waste dumpsites and provide the vehicle for waste collection and transportation. Regarding community forest he said that they have plan to plant the double the number of tree's affected and it shall be done with consultation with people, Gewog and Dzongkhag.

19) Director (Projects) also informed that till date the name of the Project had always been kept the name of river, so he asked for people opinion whether to keep the name of Project as Nikachhu HEP or if people have any suggestion of name for the Project. He also mentioned that to suggest new name the people have to suggest and give opinion and this advice shall be consulted with relevant government and stakeholders and other relevant authority for approval.

Tangsibji Tshogpa, expressed pleasure on behalf of people for giving opportunity suggest the name for the Project and he suggested that the Project to be called as Tangsibji Hydroelectric Project since the Project is located Tangsibji. In response to his suggestion as Tangsibji Hydroelectric Project, majority of the people agreed with name

suggested and they all came to agreement to proposed name for the Project as suggested by the people.

The main outcome of this public consultation meeting were, commissioning of Nikachhu HEP would also help to generate revenue and it will play important role in economic growth of the country. Moreover it is the Project that will benefit the people of Bhutan and likewise when comprehensive consultation meeting and discussion were conducted on negative and positive impact of the Project, safeguard approach, benefits to the people and land substitution and compensation, no one opposed for the construction of the Project.

Conclusion Speech

To the end of the meeting, Chairman Dasho Dzongda, reminded people that before start of the Project, it is responsibility of each people to make plan to invest in business and it is also important for those people who have livestocks and agricultural land to take opportunity to do business.

Then he also expressed his appreciation to Director (Projects), Officials, representative from National Land Commission, Officer from DoFPS, and people of Mangde tshozhi for successful and fruitful completion of the meeting. He also expressed his well wishes for successful commissioning of Nikachhu HPP and he reminded that for successful commissioning of the Project it is very important to have support and cooperation from the people.

He thanked all the people who attended the meeting and participated in the discussion and , also reminded that if again such meetings are conducted in future, He expects such active participation from people.

(Singed) (Dorji P. Phuntshok) Director (Projects) Projects Department Druk Green Power Corporation (Singed) (Tshewang Rinzin) Chairman Dzongda Trongsa Dzongkhag

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List of NOCs/Clearances and Approvals



Approvals and Clearances for 118 MW Nikachhu HPP, Trongsa

July 2014

NOCs/Clearances from:

- i. Environmental Clearance
- ii. Cabinet Approval;
- iii. Department of Hydropower and Power Systems (DHPS): Government Directives;
- iv. Bhutan Power Corporation Limited;
- v. Department of Culture, Ministry of Home and Cultural Affairs;
- vi. Department of Roads (DoR);



मुग्पर्यादसम्बदार विंदः महरू अनुसः सुदर्भः सुद्र स्वैग्नभ द्यवाञ्चदार सुगम्बदः । National Environment Commission Royal Government of Bhutan



NECS/ESD/DGPCL/1837/2014/ 8446

July 1, 2014

ENVIRONMENTAL CLEARANCE

The National Environment Commission Secretariat (NECS) is pleased to issue environmental clearance in respect of Druk Green Power Corporation Ltd., Thimphu as per the decision of the Environmental Assessment Technical Committee during its meeting on June 17, 2014 for the construction and operation of 118 MW Nikachhu Hydropower Project at Tangsibji Gewog under Trongsa Dzongkhag with following terms and conditions:

- As per the Section 28.3 of the Regulation for the Environmental Clearance of Projects, 2002, any modification of proposal/application shall take place only with prior approval from NECS;
- The holder shall ensure that the implementation of the proposed project is in line with the National Environment Protection Act 2007, Environmental Assessment Act 2000 and its Regulation 2002, Waste Prevention & Management Act of Bhutan 2009 and its Regulation 2012 and The Water Act of Bhutan 2011;
- The holder shall ensure that this environmental clearance is valid only for the project components/activities listed below;

A. DAM PACKAGE

- i. Construction of Diversion Tunnel (DT)
- ii. Construction of Downstream and Upstream Coffer Dams
- ili. Construction of Dam including Plunge pool and Spillways
- iv. Construction of Desilting Chamber including Gate Operating Chambers (GOC) and its Adit
- v. Construction of Intake tunnel
- vi. Construction of Silt Flushing Tunnel including GOCS and its Adit
- vii. Construction of contractor colonies including site offices, labour camps, internal roads, job facilities and workshops
- vili. Construction of infrastructures for Dam site including offices and residential complex

B. HEAD RACE TUNNEL PACKAGE

- Construction of Head Race Tunnel (HRT) including Adits
- Construction of Contractor's colony including site offices and labour camps, internal roads, contractor construction/job facilities, workshops and explosive magazines for Adits

C. POWER HOUSE PACKAGE

- i. Construction of Butterfly Valve Chamber
- Construction of Surge Shaft



- iii. Construction of Pressure Shaft
- iv. Construction of Pothead yard, Gantry and Dead end towers
- v. Construction of Transformer Cavern
- vi. Construction of Penstock and Intermediate Adits to pressure shaft
- vii. Construction of Main Access Tunnel
- viii. Construction of Cable Tunnel
- Construction of Ventilation Tunnel
- Construction of Power House Cavern
- xi. Construction of Generation Transformer (GT) & Gas Insulated Switch Yard Cavern
- xit. Construction of Power House Infrastructures including internal roads, site offices and residential units
- xiii. Construction of Tail Race Tunnel (TRT)
- xiv. Construction of Grid Supply Poles and substation
- xv. Installation of Diesel Generator set
- xvi. Construction of contractor's site facilities including roads, site offices, labour camps, workshops and other job facilities

D. CONSRTUCTION POWER

 Construction of 33 kV tie line of 5 Kilometers (Kms) with Right of Way of 12 metres from Banglapokto to Dam, Adit I and Adit II

E. APPROACH ROADS

- Construction of 2.1 Kms approach road to dam complex from National Highway (NH)
- Construction of 2.28 Kms approach road to Adit I from NH
- iii. Construction of 1.9 Kms approach road to Adit II from NH
- iv. Construction of approach road to 1.94 Kms Adit III from existing Tangsibji farm road and widening of Tangsibji farm road
- v. Construction of 0.56 Kms approach road to Adit IV from NH
- vi. Construction of 0.42 Kms approach road to Adit V from NH
- vii. Construction of 1.5 Kms approach road to Adit to BVC and Surge Shaft Top from NH
- viii. Construction of 5.7 Kms approach road to Power House Complex from NH

F. UTILIZATION AND MANAGEMENT OF MUCK DISPOSAL SITES

- Muck Disposal Site-I at upstream of Dam
- ii. Muck Disposal Site-II at downstream of Dam
- iii. Muck Disposal Site-III near Silt Flushing Tunnel
- Iv. Muck Disposal Site-IV for Adit I, Site-V for Adit-II, Site-VI for Adit III, Site-VII for Adit IV and Site-IX for Adit V
- v. Muck Disposal Sites-X, XI and XII at Surge Shaft, Pressure Shaft and Power House areas respectively

The holder shall ensure that separate environmental clearances are obtained for activities overed in this environmental clearance as per the provisions of the Environmental environment



Page 2 of 7

- 5. The holder shall ensure that the implementation of the proposed project comply with the Environmental Standards 2010;
- 6. The holder shall ensure strict compliance to the Undertaking submitted to NECS;
- The holder shall ensure that the implementation of the proposed project is carried out as per the Environmental and Social Impact Assessment (ESIA) report submitted for environmental clearance;
- The holder shall ensure compliance to all the terms and conditions of stakeholder clearances at all times;
- 9. The holder shall ensure that the implementation of the proposed project is strictly confined within the allocated area;
- 10. The holder shall be solely responsible for any dispute arising due to the implementation of the proposed project;
- 11. The holder shall ensure that polychlorinated biphenyl is never used as transformer and capacitor oil;
- The holder shall ensure that use of ozone depleting substances are restricted in line with the revised Regulation on Control of Ozone Depleting Substances, 2008;
- The holder shall ensure that import and use of secondhand equipment and machineries are strictly prohibited;
- 14. The holder shall ensure that NECS and any other relevant authorities are informed of any unanticipated or unforeseen chance-find of any precious metals or minerals or articles, that have economic, cultural, religious or ecological importance;
- 15. The holder shall ensure that local residents, households, communities, public, private parties and any religious, cultural, historic and ecologically important sites are not adversely affected by the construction of proposed activity;
- 16. The holder shall ensure structural integrity of project infrastructures considering every site specific geological conditions to avoid undesirable incidences during operation;
- 17. The holder shall ensure that minimum environmental flow is maintained between the Dam and Mangdechu-Nikachu confluence for the sustenance of aquatic life as per relevant existing and future legislations;
- 18. The holder shall ensure that the implementation of the proposed project, except the construction of Dam, does not lead to blockage, storage or diversion of river, stream, irrigation channel, waterfall, underground water source or any other water resource or water course;
- 19. The holder shall ensure that a buffer of at-least hundred feet (100 feet) is maintained between the boundary of the project activities, other than Dam, Intake Tunnel, DT and TRT, and streams as per the application submitted for environmental clearance;
- 20. The holder shall ensure that impact on terrestrial and aquatic fauna in the project area is minimized at all times;
- 21. The holder shall ensure that Biodiversity Management Plan and Compensatory Afforestation Program are implemented in coordination with the Department of Forest and Park Services to minimize biodiversity impacts;
- 22. The holder shall ensure that the construction activities at Adit II including the first 100 metres Adit length is not carried out from 10 pm to 6 am;
- 23. The holder shall ensure that after completion of the initial 100 metres of Adit II length, work is continued even during night but limiting its activities inside the tunnel;
- 24. The holder shall ensure that felling of trees if required are done only upon obtaining approval from the Department of Forest and Park Services and strictly as per the conditions of the approval;
- 25. The holder shall ensure that clear felling of trees is carried out only at those stretches where it is required to obtain minimum ground clearance;

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- 26. The holder shall ensure that illegal hunting and poaching are avoided at all times;
- 27. The holder shall ensure that all construction activities are carried out in an environment friendly manner in order to minimize the adverse environmental impacts;
- The holder shall ensure that Environmentally Friendly Road Construction (EFRC) techniques are adopted for the construction of approach roads to minimize adverse environmental impacts;
- 29. The holder shall ensure that bioengineering practices are adopted on all road side slopes to minimize soil erosion and improve visual impacts;
- 30. The holder shall ensure construction of side drains, cross drains, causeways, and other supporting structures (retaining/breast walls) as required to prevent soil erosion, improve usability and sustainability of the road infrastructure within the project area;
- 31. The holder shall ensure that liquid wastes/effluents from the project activities including workshops and residential colonies are adequately treated prior to their discharge into the surrounding environment;
- 32. The holder shall ensure that air quality stations are established for sampling and monitoring of ambient air quality in the project and adjacent areas and regular results are submitted to the NECS for daily national air quality reporting;
- 33. The holder shall ensure that all project activity sites/facilities especially those located besides the highway are adequately screened/enclosed to minimize adverse visual impact and improve safety;
- 34. The holder shall ensure that all construction sites and muck disposal sites are adequately barricaded and cordoned off for safety and minimizing visual impacts;
- 35. The holder shall ensure that highways, roads and other public utilities are safeguarded from being damaged by Project activities and any damages to these public utilities are restored in the least possible time;
- 36. The holder shall ensure that no raw materials of any kind, machineries, plants, equipments and excavated materials are stacked along the highway at all times;
- The holder shall ensure safe and smooth flow of traffic along the Wangdue Trongsa Highway at all times;
- 38. The holder shall ensure that vehicles passing along the project area travel at or below recommended speed limits in coordination with relevant local authorities to minimize dust generations and avoid mishaps;
- 39. The holder shall obtain prior approval from the relevant government authorities for road closure and opening times and should be announced in the media;
- 40. The holder shall ensure that dusts generated due to the project activities are adequately suppressed at all times;
- 41. The holder shall ensure that the stretch of highway within the project area is well maintained and free of debris and other obstructions at all times;
- 42. The holder shall ensure that blasting activities are done by certified blasters as per the guidelines issued by the Ministry of Home and Cultural Affairs by adopting controlled blasting techniques at all times;
- 43. The holder shall ensure that blasting times are publicly announced in the media, displayed on signboards at appropriate locations at the worksite and adequate sentries posted at strategic locations to avoid mishaps during blasting;
- 44. The holder shall ensure that spillage and roll over of excavated materials are avoided at all times;

45. The holder shall ensure that excavated materials/mucks are dumped strictly at the preidentified/approved dump sites adopting load, haul and dump technique and never



Page 4 of 7

- 46. The holder shall ensure that dump sites are stabilized with appropriate protection measures/check dams of adequate strength prior to dumping of any materials to prevent spillage of mucks into downstream environment and water bodies;
- 47. The holder shall ensure that comprehensive reclamation and restoration plan is prepared for all muck disposal sites with proper landscape designs in consultation with local authorities, Dzongkhag and other relevant authorities;
- 48. The holder shall ensure that dump sites are vegetated with local plant species to prevent potential soil erosion and restore vegetation in the affected areas;
- 49. The holder shall ensure that dust generations from muck disposal sites are adequately suppressed;
- 50. The holder shall ensure that disposed mucks are compacted on a regular basis;
- 51. The holder shall ensure that all vehicles transporting construction materials are properly covered to avoid spillage on the highway;
- 52. The holder shall ensure that wastes generated from the labour camps, worksite and offices are managed as required under the Waste Prevention & Management Act of Bhutan 2009 and its Regulation 2012;
- 53. The holder shall ensure that littering is strictly prohibited;
- 54. The holder shall ensure that 3R (Reduce, Reuse, Recycle) technique is adopted for waste management at all project activity sites;
- 55. The holder shall ensure that no wastes with potential risks of leaching are dumped into the muck disposal site at any point of time;
- 56. The holder shall ensure that adequate sanitation facility is provided for the workers and employees;
- 57. The holder shall ensure that adequate fire fighting facilities are installed at the proposed activity and expiry dates of such facilities are checked and kept valid at all times;
- 58. The holder shall ensure that safety signs are posted at the strategic locations, including signboards indicating area where specific safety gadgets are required;
- 59. The holder shall ensure that adequate safety gadgets and outfits such as safety helmets, eye goggles, breathing masks, ear muffs, safety boots, etc. are provided to all workers and any other person entering the worksite;
- 60. The holder shall ensure that underage workers are not employed;
- 61. The holder shall ensure that first-aid kit is available at the worksite;
- 62. The holder shall ensure that proper health check up facilities are provided to all the employees and health records are maintained accordingly;
- 63. The holder shall ensure safety of every person working underground;
- 64. The holder shall ensure that any raw materials/fuels containing hazardous chemical contents are imported only upon obtaining prior approval from the relevant agencies and the handling, storage, transport and disposal of the same are in accordance with relevant national laws;
- 65. The holder shall ensure that proper and adequate drains are provided for drainage of tunneling water;
- 66. The holder shall ensure that signboard is erected at the starting point of the project area and worksite indicating the name of the Project, Proponent and contact address of the proponent;
- 67. The holder shall ensure that separate budget is maintained for environmental activities;
- 68. The holder shall ensure that a copy of ESIA document are available at site at all times;
- 69. The holder shall ensure that a copy of this environmental clearance is available at the worksite at all times;



Page 5 of 7

- 70. The holder shall develop contingency plan to deal with unforeseen environmental risks, hazards & accidents and submitted to NECS within three (03) months from the date of issue of this environmental clearance;
- 71. The holder shall develop Detail Implementation Plan focusing on the terms and conditions of this environmental clearance and submitted to NECS within three months (03) from the date of issue of this environmental clearance;
- 72. The holder shall ensure that renewal of this environmental clearance is processed at least one month prior to its expiry along with a copy of environmental clearance and a report on the implementation of its terms and conditions;
- 73. The holder shall ensure that all main package contractors have their own environmental units or focal persons with clear terms of reference for strict implementation of the terms and conditions of this environmental clearance; and
- 74. The holder shall ensure that the environmental unit asserts strict implementation of these environmental terms and conditions at all times.

Failure to comply with any of the above terms and conditions shall constitute an offence under the Environmental Assessment Act 2000, its Regulations 2002, the National Environment Protection Act 2007 and any other relevant laws. Penalties for such offences shall include but not limited to suspension and/or revocation of environmental clearance in part or whole without any liability on the part of the Royal Government.

This environmental clearance is valid up to June 30, 2016 and is subject to review and changes.

Jgyen Tshewang) Secretary

To, The Managing Director, Druk Green Power Corporation Limited, Post Box no. 1351 Thimphu

Copy to:

- I. Hon'ble Minister for Ministry of Agriculture and Forests, Vice Chair of National Environment Commission, Thimphu for kind information.
- Director General, Department of Hydropower and Power Systems, Ministry of Economic Affairs, Thimphu for kind information.
- Dasho Dzongdag, Chairman, Dzongkhag Environment Committee, Trongsa Dzongkhag for kind information.
- Director General, Department of Forest and Park Services, Ministry of Agriculture and Forests, Thimphu for kind information.

Page 6 of 7

- 5. Chief Forestry Officer, Zhemgang Forest Division, Department of Forest and Park Services, Zhemgang for kind information.
- 6. Chief Forestry Officer, Jigme Singye Wangchuck National Park, Head Office: Tshangkha, Trongsa for kind information.
- Chief Environment Officer, CMD, NECS for necessary action.
 Dzongkhag Environment Officer, Trongsa Dzongkhag for necessary action.
- 9. Guard File (DGPC) ESD, NECS for a record-



Page 7 of 7



46/DGPC/NIKA/MD/2014//4/

July 2014

Undertaking to the Royal Government of Bhutan (National Environment Commission Secretariat)

Druk Green Power Corporation Limited (hereafter referred to as the Promoter) submits this undertaking for the construction and operation of 118 MW Nikachhu Hydropower Project at Tangsibji Gewog, Trongsa Dzongkhag to the National Environment Commission Secretariat (NECS), Royal Government of Bhutan.

WHEREAS the Promoter recognizes the importance and need to protect and conserve the environment;

WHEREAS the Promoter understands the adverse impact of the proposed activity on the natural environment; and

WHEREAS the Promoter understands that meeting every environmental standards set by the NECS is the precondition to continue the proposed activity:

THE PROMOTER HEREBY UNDERTAKES TO:

- 1. Comply with all terms and conditions of the environmental clearance;
- 2. Carry out the proposed activity strictly as per the Project Document submitted for environmental clearance and minimize adverse impact on the environment;
- 3. Be solely responsible for compensation, restoration and rehabilitation of the local residents, households, public, private parties, and any religious, cultural and historic sites are adversely affected by the proposed activity;
- 4. Manage all wastes generated from the proposed activity;
- 5. Unconditionally take full responsibility of any hazards of pollution to the environment, plants, animals and human health resulting from the proposed activity and to respect the laws and policies of the Royal Government;
- 6. Unconditionally take full responsibility to increase and maintain the minimum environmental flow for the dewatered stage between Dam and Mangdechhu-Nikachhu confluence if the proposed 10% minimum environmental flow during lean season is determined inadequate for the sustenance of aquatic life;

DRUK GREEN POWER CORPORATION LIMITED CORPORATE OFFICE: Post Box1351, Thimphu, Kingdom of Bhutan. Tel +975-2-336413/336341 Fax +975-2-336342 www.drukgreen.bt

- 7. Implement the Biodiversity Management Plan in close coordination with the Department of Forest and Park Services to minimize biodiversity impacts;
- 8. Ensure that surface construction activities at Adit II and first 100 meter Adit II length are not carried out from 10 pm to 6 am to minimize biodiversity impacts;
- Be solely responsible to resolve any disputes that arise due to the proposed activity; and
- 10. Fulfill every condition set by the NECS for the overall environmental management relevant to the proposed activity.

NOW THEREFORE, THE PROMOTER HEREBY AGREES:

- To unconditionally adhere and comply to the terms and conditions of the environmental clearance failing which the construction and operation of 118 MW Nikachhu Hydropower Project shall be stopped without claiming any compensation from the Royal Government;
- 2. That the NECS shall have the authority to stop the proposed activity for any breach of this undertaking or laws & regulations in force without any compensation; and
- 3. That in the event of failure to comply with the terms and conditions of this undertaking, the Promoter shall be liable as per the National Environment Protection Act 2007, the Environmental Assessment Act 2000 & its Regulations 2002 and any other applicable laws.

The Promoter hereby submits this undertaking on 1st July 2014 with full understanding of the implications of signing it.



Managing Director Druk Green Power Corporation Limited Chhewang Rinzin Managing Director Druk Green Power Corporation Ltd.



CABINET SECRETARY

6-3/28/328

ROYAL GOVERNMENT

Cabinet Secretariat **Gyalyong Tshogkhang** Thimphu : Bhutan

20 March 2014

Secretary, Ministry of Economic Affairs, Thimphu.

Sub: Approval of detailed project report (DPR) of Nikachu Hydropower Project

Dear Dasho,

The Government has been pleased to approve the proposal on detailed project report (DPR) of Nikachu Hydropower Project as proposed by the DGPC and endorsed by the MoEA. With regard to three options submitted on financial analysis & tariff, the Government agreed to case (a) as first option and case (c) as second preferred option to pursue in terms of financing model.

The Government, however, directed the MoEA on the following:

- The blasting is to be controlled from the very beginning like done under PHPA i}projects. Furthermore, the machine to detect the effect of blasting is to be installed beforehand wherever necessary. Hend, (med)
 - Comprehensive Corporate Social Responsibility (CSR) is to be included in the DPR ií) and the book of accounts is to be maintained properly. Likewise, the stakeholders are to be consulted and also made aware of the availability of such fund.
 - iii) The damage to the roads by hydropower projects is enormous and thus requiring frequent maintenance of roads by DoR (MoWHS). Therefore, it is crucial to work out cost-sharing mechanism for maintenance of roads during the planning phase of such projects.
 - iv) The quarry site is a problem as it is either located along the National Highway or the site identified contained mineral deposit like the one in Chuserbu with Dolomite. Therefore, the Mineral Development Policy which is in the final stage will help to streamline in identifying the quarry site.

ong Tshogkhang, ThintphorP.O Box No. 1011 Tel. +975-2-336842 (Secretary), 321437(PABX Tashichhadzong), 336667. 336065, 336789/ 336678, 336727, 336844, 336067(PABX Gyalyongkhang), Fax +975-2-321438(Tashieblodzong), 336665(Gyalyong Tshogkhang) Web: www.cablnet.gov.



নঝার্থারা

ROYAL GOVERNMENT OF BHUTAN

Cabinet Secretariat Gyalyong Tshogkhang Thimphu : Bhutan

This letter has reference to the 28th Lhengye Zhungtshog held on March 4, 2014.

With kind regards,

Yours sincerely, (Penden Wangchuk)

Copy for necessary action to:

1. Managing Director, DGPC, Thimphu

Copy for kind information to:

- 1. Hon'ble Minister, All Ministries, Thimphu
- 2. PS to PM, Gyalyong Tshogkhang, Thimphu

Gyalyong Tshogkhang, Thimphu P.O Box No. 1011 Tel. +975-2-336842 (Secretary), 321437(PABX Tashichhudzong), 336667, 336065, 336780, 3366780, 3366727, 336844, 336067(PABX Gyalyongkhang). Fax +975-2-321438(Tashichhodzong), 336665(Gyalyong Tshogkhang) Web: www.cabinet.gov.bt



सुर जहेन श्रेण शुग्र एर एर प्रिन्स जहान जहान हो जिल्ला DEPARTMENT OF HYDROPOWER & POWER SYSTEMS MINISTRY OF ECONOMIC AFFAIRS THIMPHU: BHUTAN



8th April, 2014

106/DHPS/2013-14/126

The Managing Director Druk Green Power Corporation Ltd Thimphu

Subject: Directives of the Government on implementation of Nikachhu HEP

Dear Dasho,

As per the directives of the 28th Lhengye Zhungtshog held on 4th March, 2014, the Ministry of Economic Affairs has been directed by the Government to adhere to certain requirements to be complied and adhered to during the construction of Nikachhu HEP such as controlled blasting, Corporate Social Responsibily etc. The details are provided in the letter received from the Cabinet Secretariat vide Letter No. C-3/28/328 dated 20th March, 2014, a copy of which has also been addressed to Dasho.

In this respect, we request Druk Green to ensure that the directives from the Government are adequately addressed and implemented during construction stages.

Hend, (mx10)

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Thanking you,

Yours sinceryly

(Ve/hi Wangdi) Director General

Cc:

1. The Hon'ble Secretary, MoEA, Thimphu for kind information.





54/BPC/DGPC/MD/2013/ 2.7.3

November 26, 2013

The Director (Projects) Projects Department Drok Green Power Corporation Limited Thimpha: Bhutan

Subject: Issuance of No Objection Certificate for 118 MW Nikachhu Hydropower Project

Dear Sir,

This has reference to your letter DGPC/PD/P&DD/20(f)/785 dated November 5, 2013 enclosing the DPR for Power Evacuation Arrangements of Nikachhu HEP and seeking No Objection Certificate (NOC) of BPC.

BPC has noted the provisions of the DPR in respect of proposal for power evacuation through one 132kV D/C overhead transmission line from Nikaehhn to Mangdechhu and has no objection to the proposed 132kV D/C line. It is noted that this stretch considers only circuit outage contingency, being short-line, and not tower outage contingency, as considered in the case of ATS of other HEPs.

It is also noted that the proposed arrangement is with ACSR Kundah conductor for the overhead transmission line, while the standardised conductor for 132 kV system as per present system and NTGMP is ACSR Panther. While this could be due to the requirement of single-circuit outage consideration, BPC prefers use of ACSR Zebra to cater to this requirement. This is to ensure that standard towers available with BPC could be used for this short stretch of line rather than redesigning the towers as well as avoiding use of non-standardised conductor size in BPC system for this short stretch. This would ensure that in addition to saving in time for redesigns and testing, the inventory issues can also be reduced.

Accordingly, we are conveying our NOC for the DPR in principle and the above may be taken care of during implementation.

While on the subject, this Chapter of the DPR may require corrections in respect of coherence of various information *I* data with the referred documents, existing network and other minor aspects, which have no impact on the final recommendations and the same can be taken care of in the final report. Other aspects like procurement process through ICB may please be taken care of by you, with due consideration to the volume of work for the transmission line component and other associated issues.

Thanking you,



Yours sincerely,

(Bharat Tamang) Managing Director

Phone:+975-2-325095 (Ext. No. 111); Fax No.:331988; P.O. Box-580; E-mail : bharattamang@bpc.bt Web: www.bpc.bt FEGH : DOHS

FAX NO. : 321285

02 Dec. 2013 12:04 P 1

1/11/13

र्मेवायहेत्यवासुन्य

DEPARTMENT OF CULTURE MINISTRY OF HOME AND CULTURAL AFFAIRS Royal Government of Bhutan

DCHS-DoC/L-1/2013-14/6804 286

November 14, 2013

The Director Druk Green Power Corporation Ltd

Subject: Clearance for the 118 MW Nikachhu Hydropower Project at Trongsa

Sir,

This has reference to your letter no.DGPC/PD/P&DD/20(f)/784 dated November 5, 2013 regarding clearance of the Department of Culture (DOC) for the 118 MW Nikachhu Hydropower Project at Trongsa. DGPC has affirmed in the letter that the project does not have impuct on any historical monuments, temples, chocten and nyes based on the detailed Environmental and Social Impact Assessment conducted by the ADB for the project.

Therefore, the Department of Culture issues the clearance for the 118 MW Nikachhu Hydropower Project. However, if the project discovers significant heritage sites in the affected area or it results to unanticipated effect on heritage sites in the vicinity in the course of implementing the activities of the project, we would like to request the project to take the responsibility to plan and implement appropriate mitigation measures.

Yours sincerel (Dorjee Tabering) **Director General**

Head, PeDi) 2/12/13

- Hoa'ble Secretary, Ministry of Home & Cultural Affairs for kind information

- Managing Director, DGPC, Thimphu for kind information
- Dasho Dzongdag, Trongsa Dzongkhag Administration for kind information
- Head, Division for Conservation of Heritage Sites, Dept. of Culture, MoHCA for kind information

Telephone: Director: 00975 -2-322001, EPABX: 00975 -2-322694/325116/325118/322284 Director: Pax: 323040, DCAH Tele-Fax: 321285, DCP, Fax: Box No: 233



Royal Government of Bhutan Ministry of Works & Human Settlement Department of Roads Regional Office : Trongsa

Ref. No.RO/DoR(TRONGSA)/2013-2014/PL-10/ (-1/2)

Date 19th March, 2014.

The Executive Engineer,

Sub-Division,

DoR : Trongsa.

Sub: DoR Clearance for construction of Approach roads for 118 MW Nikachhu Hydropower Project

from Trongsa – Chuserbu PNH.

With reference to your recommendation letter No.FSDT/DoR/2013-2014/W-09/266 dated 17.03.2014 for the issuance of DoR clearance for construction of 8 (eight) numbers Approach roads at 326.80 km, 327.50 km, 327.70 km, 329.10 km, 333.40 km, 341.15 km, 347.65 km and 329.20 km leading towards various components of Nikachhu Hydropower Project from Trongsa – Chuserbu Primary National highway is hereby approved with the terms and conditions attached for strict compilance during the time of execution.

Please Submit the Signed Contract Agreement comprising witness signature for our record.

Encl: Terms & Conditions

(Executive Engineer)

Regional Office;

DoR: Trongsa.

CC:

1. The Chief Engineer, Maintenance Division, DoR: Thimphu along with a copy of the clearance for kind information.

2. Office copy PL-10

Derge

Dzongkhag and Gewog Clearances



In exercise of the powers delegated under the National Environment Protection Act 2007, of the National Environment Commission Secretariat, Section 47, which mandates the Dzongkhag Environment Committee (DEC) as one of the Competent Authorities in Making recommendations to the concerned Ministries, Local Governments, and /or to the Secretariat concerning any measures that need to be taken to protect the quality of the Environment. Also, Dzongkhag Administration is mandated to issue the Dzongkhag Administrative Approval as per the Section 3.10 of Application for Environmental Clearance Guideline, the Dzongkhag Administrative Approval is hereby accorded in favor of Tangsibji Hydro Energy Limited, Druk Green Power Cooperation as per the decision of 7th Dzongkhag Environment Committee meeting held on May 8, 2014 with following terms and conditions:

- 1. The Dzongkhag Administrative Approval is issued based on the No Objections from the EIA and EMP presentations held on December 12,2013 to the Gewog Administration (Gup, Mangmi and Tshogpas) of Tangsibji Gewog, DLLC and DEC members from the Dzongkhag Administration at View Point Resort and the following Public Consultation meeting held on January 27,2014 with affected households of Tangsibji Gewog, General Public, DGPC and Dzongkhag Administration at Tshangkha Lower Secondary School.
- 2. The Applicant to execute the wok as per The Land Act 2007.
- 3. The Applicant to execute the work as per The Waste Prevention and Management Regulation 2012.
- 4. The Applicant to execute the work as per The Water Act 2011.
- 5. The Administrative Approval is accorded only for obtaining Environmental Clearance and does not include Social Clearance, Forestry Clearance, if required thereof.

Further, this Dzongkhag Administrative Approval will stand valid till obtaining the Environment Clearance from the Competent Authority.

Dzongkhag Environment Committee Copy to:

- 1. The Director (Projects), Druk Green, Thimbpul for kind information and necessary action.
- 2. The Project Manager, Druk Green, Thimphu for kind information.
- The Chief Environment Officer, ESD, NECS, Thimphu for kind information.
 The Range Officer, Range Office, Trongsa for kind information.
 The Gup, Tangsibji gewog Administration for kind information.
 Office Copy.

Fax No:-00975-3-521231

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NOC from Project Affected People (Main Package and Transmission Line)

AGREEMENT BETWEEN AFFECTED PERSONS AND THE DRUK GREEN POWER CORPORATION LIMITED (No Objection Certification from affected persons) 07.04.2014

INTRODUCTION

The Royal Government of Bhutan (RGOB) is preparing the feasibility studies for the Nikachhu Hydropower Project in Trongsa Dzongkhag. With the mandate to manage existing power generating facilities as well as to accelerate hydro-power development in the country, the DGPCL, in order to fulfill its mandate, will develop the 118 MW Nikachhu Hydro-power Project in Trongsa dzongkhag.

Some private land will have to be acquired for the construction of project facilities such as; adits, musk disposal sites and batching plants, approach roads, Intake Colonies and Office/Temporary Sheds, Temporary Camps, Surge Shaft Colony, Transmission towers, and other project infrastructure.

Although most of the land that falls within the project area belongs to the government, feasibility studies have revealed that some of the land that falls within the project area belongs to private individuals. In order to facilitate the construction of the components mentioned above the RGOB will have to acquire some land that belongs to private individuals.

NEED FOR THIS AGREEMEN'T (NOC)

This agreement (NOC) is required because 18 households will be losing some portion of their land to the project. The total amount of land to be acquired from the 18 households amounts to 3.817 acres, all 3.817 acres consists of dry land (Kamzhing).

A No objection certification (NOC) from the affected households losing land to the project is a prerequisite for the NHPP to obtain environmental and forestry clearances in order to proceed with the project.

Moreover, this agreement (NOC), as per RGOB's Land Act and ADB's guidelines, guarantees that all compensation for private land acquired will be made and delivered to the Affected Persons before the commencement of any Project construction activity.

CONTENTS OF THE AGREEMENT

This agreement states the following:

- The Affected Persons are willing and agree, without coercion or force, to their land being acquired by the Project.
- 2. The Affected Persons will be guaranteed replacement land for any land lost by them to the Project.
- The replacement land will be identified and delivered to the Affected Persons prior to the commencement of any infrastructure/construction works on the affected lands.

- 4. If cash compensation is desired by the Affected Persons, the cash compensation will be paid to the Affected Persons prior to the commencement of any infrastructure/construction works on the affected lands.
- Any other allowable compensation will be made to the Affected Persons prior to the commencement of any infrastructure/construction works on the affected lands.
- 6. The Affected Persons have no objections to their land being acquired by the NHPP.

In essence this agreement declares that the Affected Persons have no objections to their land being acquired for the Project and that replacement land (or cash compensation, if desired by the APs) will be provided to the Affected Persons prior to any project construction works on their private lands.

We, the Affected Persons, have willingly, and with full knowledge, signed on this agreement on 07.04.2014 without any coercion or force in the presence of our Gup (village headman) who will countersign on this agreement as witness along with the Gewog Administrative Officer, and the Domestic Consultant on behalf of DGPCL.

Attached (annexure 1) is the list of Affected Persons with their signatures that proves that they have no objection to their private lands being acquired for NHPP.

NO OBJECTION CERTIFICATION SIGNED BY AFFECTED PERSONS ALONG WITH DETAILS OF PRIVATE LAND TO BE ACQUIRED BY THE NIKACHHU HYDROPOWER PROJECT (MAIN PROJECT).

	Name of owner	Thram No.	Land Type	Thram Area (Acres)	Amount of Land to be acquired (Acres)	Signature of Affected Person
1	Ugyen Zangmo	58	Kamzhing	0.880	0.107	
2	Dorji	56	Kamzhing	2.150	0.480	BHUTAN 10
3	Namgay Chholing CPS	527	Institutional Land	2,819	0.423	THE PARTY AND TO BHUTTAN 10
4	Sonam Wangchen	255	Kamzhing	1.746	0.342	
5	Dorji Zangmo	270	Kamzhing	1.200	0.183	

BHUT IN 10

07.04.2014

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6	Phub Zangmo	257	Kamzhing	0.563	0.241	
7	Ugyen Tshomo	262	Kamzhing	1.120	0.280	
8	Sonam Pelmo	240	Kamzhing	0.765	0.142	
9	Tshering Lhamo	272	Kamzhing	1.588	0.469	
10	Dorji Dema	258	Kamzhing	1.332	0.393	
It	Tshang Tshang Dotji	269	Kamzhing	1.053	0.352	

12	Kunzang Wangmo	181	Kamzhing	0.370	0.165	A A A A A A A A A A A A A A A A A A A



Mr. Jignie Namgyel



Mr. Tshering Tashi GAO Yun Phunto Tangsibji Gewog Trongsa



Mr. Kunzang Yonten Consultant ADB/DGPCL

NO OBJECTION CERTIFICATION SIGNED BY AFFECTED PERSONS ALONG WITH DETAILS OF PRIVATE LAND TO BE ACQUIRED BY THE NIKACHHU HYDROPOWER PROJECT (TRANSMISSIONLINE COMPONENT).

	Tax -	1	-	U	2.04.2014	
No.	Name of Owner	Thram No.	Land Type	Thram Area (Acres)	Amount of Land to be Acquired (Acres)	Signature of Affected Person
1	Tashi Wangmo		Kamzhing		0.04	
2	Yeshi Choden		Kamzhing		0.04	TE MOTAN IV.
3	Sangay Wangdi		Kamzhing		0.04	
4	Tshering Dema		Kamzhing		0.04	
5]	Phurpamo		Kamzhing		0.04	

6	Lemo	Kamzhing	0.04		-
				2 Constant	
				114 ~ 44351154~11 MU 70 BHUTAN 10	

Mr.Gelay Chhophel Gup Drakten Gewog Trongsa

Mr. Kunzang Yoplen

Mr. Kunzang Yop Consultant ADB/DGPCL

Mr. Kunzang Dorji Mangmi Drakten Gewog Trongsa

Mr. Tempa Ratgay (1) no # 11509002761 Mr. GAO Drakten Gewog Trongsa

Mr. Deewan Thapa

cibno# 11805002243

Park and Forest Clearances



Royal Government of Bhutan Ministry of Agriculture & Forests Department of Forests & Park Service Jigme Singye Wangchuck National Park Head Office: Tshangkha Trongsa Managing Bhutan's Natural Heritage"



JSWNP/Tech-A (15)/2012-2013/ 0299

21[#] January, 2013.

In Charge Dy.Park Range Office Chendebji, Trongsa

Sub: Forestry Clearance for the construction of Dam and Diversion tunnel.

The Hon'ble Director General, Department of Forests and Park Services has approved for issue of Forestry Clearance for the construction of Dam and Diversion tunnel measuring 2acres at Serphuchen Lorim, Chendebji, Tangsibji geog for Nikachu Hydro Power Project, Druk Green Power Corporation, Thimphu vide letter no. DoFPS/Ka-3-2/2013/1636 dated 11th January, 2013.

Therefore, you are asked to mark the trees and the poles within the proposed construction area after receiving the clearance from other stakeholders and handover the timber extraction to NRDCL as per the Forest and Nature Conservation Rule.

Chief Forestry Officer



1. The Chief, Environment and CDM Unit, Projects Department, Druk Green Power Corporation, Phimphu.

Julin, Soman, Deni & Maky for inforshing



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Royal Government of Bhutan Ministry of Agriculture and Forests Department of Forests and Park Services Jigme Singye Wangchuck National Park Head Office: Tshangkha Trongsa: Bhutan "managing bhutan's natural heritage"



No. JSWNP/Tech-A (15)/2013-2014/ 06.32

6th May, 2014.

Forestry Clearance (Developmental/ Recreational Activity)

Jigme Singye Wangchuck National Park is pleased to issue Forest Clearance for Developmental Activity for construction of Nikachu Dam measuring 4acres of Government Reserve Forest Land/FMU/ Protected Area passing from Serphuchen Lorim, Tangsibji Geog, Trongsa Dzongkhag in favour of Druk Green Power Corporation Limited, Thimphu.

This clearance is issued as per the approval of the Ministry/Department as per FNCR, 2006/FNCAR, 2008 Rule no. *DoFPS/Ka-5-3/2014/1796 dated 5th May, 2014* on following terms and conditions:

- 1. This clearance is limited to Forestry perspective as per the detailed field report;
- 2. This clearance is not transferable;
- 3. The validation of this clearance shall be subject to obtaining other relevant clearances;
- 4. Additional clearance should be sought prior to any deviation of the activity/area;
- This clearance shall not be liable for any dispute arising due to the implementation of the activity;
- 6. This clearance is limited within the proposed area for specified one time activity;
- Any damage caused to public/private property shall be borne by the holder of this clearance;
- 8. Any waste generated from the activity should be properly disposed of as per the Waste Prevention and Management Regulation, 2012.
- 9. The existing Forest produce shall be disposed of as per the existing rules and regulation;

Jigme Singye Wangchuck National Park HQ, Tshangkha, Trongsa: Bhutan 975-3-527005/+527006, Fax - 975-3-527049, Email-jsw.nationalpark@gmail.com



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Royal Government of Bhutan Ministry of Agriculture and Forests Department of Forests and Park Services Jigme Singye Wangchuck National Park Head Office: Tshangkha Trongsa: Bhutan "managing bhutan's natural heritage"



- The legal status of the land shall remain unchanged and on any occasion the land shall not be converted to private ownership;
- 11. GRF land shall be released only after the proper handing taking note signed by both parties;
- 12. This clearance shall not restrict casement;
- This clearance shall be revoked without any liability on part of Government if the holder of this clearance violates any of the above terms and conditions;
- 14. This clearance is valid up to one year from the date of issue.

gchu Chief Forestry-Officer

CC to:

- 1. The Hon'ble Director General, Department of Forests and Park Services, Thimphu for kind information.
- 2. The Dasho Dzongdag, Dzongkhag Administration, Trongsa Dzongkhag for kind information.
- 3. The Project Director, Project Department, DGPCL, Thimphu for kind information,
 - The In Charge, Dy. Park Range office, Chendebji for kind information and necessary action. The trees and poles should be handed over to NRDCL for extraction and disposal as per the FNCR, 2008.

२,५२९ . इन्, ५सुमा,गालेर्ट्र) जू. र्थ. र्थ. र्ययाक्ष क्ष्या क्षेत्रा क्ष्या क्ष्या क्ष्या क्ष्या स्ट. क्ष्य. या, ७४८४. ट्रेया, जलाविरक्ष



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Royal Government of Bhutan Ministry of Agriculture and Forests Department of Forests and Park Services THIMPHU



No. DoFPS/Ka-5-3/2014/ 1796 .

May 5, 2014

The Chief Forest Officer JSWNP, Tshangkha, Trongsa.

Sub: Approval for issuance of Forestry Clearance

Please refer to your Office letter No. 0290 dtd 21/10/2013, seeking review and approval for additional 4acres of GRF land falling within buffer area of JSWNP at Serphuchen, Lorim, Chendebji, Tangsibji Gewog, Trongsa.

In this regard, the Department has reviewed the detail field report, accordingly accorded the approval as per the annexure 18(d),(6) for proposed submergence area measuring 4 acres adjacent to the Dam for Nikachu Hydro Power Project in favour of Project Department, DGPCL, Thimphu.

Therefore, you are asked to issue the forest clearance for above activity from your end as per the existing guidelines. The trees and poles within the area which required for felling should be handed over to NRDCL for extraction & disposal as per the F&NCAR, 2008.

(Chencho Norbu) Director General

Copy to:

1. The Project Director, Project Department, DGPCL Thimphu for kind information.

2. The CFO, WCD information.



ZFD/TECH/03/2012-13/16[]

Dated: 24.04.2013

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FORESTRY CLEARANCE

In exercise of the powers delegated under the amended Forest and Nature Conservation Rules 2008 conveyed vide No. DF/Ka-3/2008/702 of the Department of Forests and Park Services, Ministry of Agriculture and Forests, the Forestry Clearance is hereby accorded in favor of Nikachhu Hydropower Project, Trongsa (DGPC, Thimphu) for construction of access road ta dam through GRF land, taking off from Lorim to Subidzim measuring 3.9 ktn length and 10 m width.

This is issued in accordance to letter no.DoFOS/Ka-3-1/2013/2131 dated 09/04/2013 of the Department and as per the field inspection report submitted by Unit Incharge. Chendebji FMU vide no. CFMU/Dol/0/ /2012-13/141 dated 18/12/2012.

The trees and firewood generated from the above land should be hunded over to NRDCL for extraction and disposal as per rules.

This clearance will be valid subject to clearance issued by other concerned agencies as per HI. Prima Daiji / Asst. Harager For man info. 3 m. 9. For man info. 3 m. 9. rules.

(Dawa Zangoa) Offitg. Chief Forestry Officer

CC to:

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- 11 Dasho Dzongdag, Dzongkhag Administration, Trongsa for kind information
- 2) Managing Director, DGPC, Thimphu for kind information
- Guo, Tangsibiji Gewog Administration, Trongsa form kind information
- 4) Unit Incharge, CFMU for information and necessary action

Zhennang, Post Box 394; Tele No. 80 975 - 02 -241205 / 741323 Fax No. 741221/ united Cluzhensäimonligov.bt



ZFD/TECH/03/2012-13/ [609]

Dated: 24.04.2013

FORESTRY CLEARANCE

In exercise of the powers delegated under the amended Forest and Nature Conservation Rules 2008 conveyed vide No. DF/Ka-3/2008/702 of the Department of Forests and Park Services. Ministry of Agriculture and Forests, the Forestry Clearance is hereby accorded in favor of Nikaehhu Hydropower Project, Trongsa (DGPC, Thimphu) for construction of access road to Adit IV through GRF land, taking off from Gongkorchhu to Tshangkha measuring 0.990 km length and 10 m wi⁻¹th.

This is issued in accordance to letter no.DoFPS/Ka-3-1/2013/2131 dated 09/04/2013 of the Department and as per the field inspection report submitted by the Range Officer, Trongsa Range vide no. TR/ADM/2-4(b)/2012-2013/293 dated 07/02/2013.

The trees and firewood generated from the above land should be handed over to NRDCL for extraction and disposal as per rules.

This clearance will be valid subject to clearance issued by other concerned agencies as per rules.

(Dawa Zañgpo) Offitg, Chief Forestry Officer

CC to:

0

- 1) Dasho Dzongdag, Dzongkhag Administration, Trongsa for kind information
- 2) Managing Director, DGPC. Thimphu for kind information
- 3) Gup, Tangsibiji Gewog Administration, Trongsa form kind information
- 4) Range Officer, Trongsa Range for information and necessary action

Zhemgang, Post Box 394; Telo No. 00 975 - 03 -741205 / 741323 Fax No. 741221/ e-mail divzbero@moaf.gov.bt



ZFD/TECH/03/2012-13/1610

Dated: 24.04.2013

FORESTRY CLEARANCE

In exercise of the powers delegated under the emended Forest and Nature Conservation Rules 2008 conveyed vide b o. DF/Ka-3/2008/702 of the Department of Forests and Park Services. Minisity of Agriculture and Forests, the Forestry Clearance is hereby accorded in favor of Nikechhu Hydropower Project, Trongsa (DGPC, Thimphu) for construction of access road to Surge Shaft through GRF land, taking off from Trongsa-Thimphu Highway to Surge Shaft at Norbuodi measuring 3.6 km length and 8.5 m width.

This is issued in accordance to letter no.DoFPS/Ka-3-1/2013/2131 dated 09/04/2013 of the Department and as per the field inspection report submitted by the Range Officer, Trongsa Range vide no. TR/ADM/2-4(b)/2012-2013/293 dated 07/02/2013.

The trees and firewood generated from the above land should be handed over to NRDCL for extraction and dis-losal as per rules.

This clearance will be valid subject to clearance issued by other concerned agencies as per rules.

(Dawa Zangpo) Offitg. Chief Forestry Officer

CC to:

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- 1) Dasho Dzongdag, Dzongkhag Administration, Trongsa for kind information
- 2) Managing Direc or, DGPC, Thimphu for kind information.
- 5) Gup, Tangsibiji Gewog Administration, Trongsa form kind information
- 4) Range Officer, Trongsa Range for information and necessary action

Zheingang, Post Box 394: Tele No. 00 975 - 03 -7412057 741323 Fax No. 7412217 c-mail diozheni@inoaf.gov.bi



ZFD/TEC11/03/2012-13/16/S

Dated: 24.04.2013

FORESTRY CLEARANCE

In exercise of the powers delegated under the amended Forest and Nature Conservation Rules 2008 conveyed vide No. DF/Ka-3/2008/702 of the Department of Forests and Park Services, Ministry of Agriculture and Forests, the Forestry Clearance is hereby accorded in favor of Nikaethu Hydropower Project, Trongsa (DGPC, Thimphu) for lease of 0.910 acres (3682.60 m²) of GRF land located below Surge Shaft (Norbundi) for use as muck disposal site.

This is issued in accordance to letter no.DoFPS/Ka-3-1/2013/2131 dated 09/04/2013 of the Department and as per the field inspection report submitted by the Range Officer. Trongsa Range vide no. TR/ADM/2-4(b)/2012-2013/295 dated 07/02/2013.

The trees and firewood generated from the above land should be hunded over to NRDCL for extraction and disposal as per rules.

This clearance will be valid subject to clearance issued by other concerned agencies as per rules.

(Dawa Zangpd) Offity, Chief Forestry Officer

CC to

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- 1) Dasho Dzongdag, Dzongkhag Administration, Frongsa for kind information
- 2) Managing Director, DGPC, Thimphu for kind information
- 5) Gup, Tangsibiji Gewog Administration, Trongsa form kind information
- 4) Range Officer, *rongsa Range for information and necessary action

Ziemgang, Post Box 394; Tele No. 00 975 - 03 -741205 / 741323 Fax No. 741221/ e-mail diozliem@imnaf.gov.bl

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ZFD/FECH/03/2012-13/ 160 8

Dated: 24.04.2013

FORESTRY CLEARANCE

In exercise of the powers delegated under the amended Forest and Nature Conservation Rules 2008 conveyed vide No. DF/Kn 3/2008/702 of the Department of Forests and Park Services. Ministry of Agriculture and Forests, the Forestry Clearance is hereby accorded in favor of Nikaeliku Hydropower Project, Trougsa (DGPC, Thimphu) for construction of road to PH and Colonies through GRF land of Adit V, Chipchipoleto measuring 0.2 km length and 8.5 m width

This is resuld in all ordence to letter no.DoPPS/Ka-3-1/2013/2131 dated 09/04/2013 of the Department and as per the field inspection report submitted by the Range Officer, Trongsa Range vide no. HVADM/2-4(b)/2012-2013/293 dated 07/02/2013.

The trees and firewood generated from the above land should be handed over to NRDCL for extraction and disposal as per roles.

This clearance will be valid subject to clearance issued by other concerned agencles as per rules.

(Dawa Zangpo) Offitg, Chief Forestry Officer

CC to:

- 1) Dasho Dzongdag, Dzongkhag Administration, Trongsa for kind information
- 2) Managing Director, DGPC, Thimphy for kind information
- 3) Gup, Tangsibiji Gewog Administration, Trongsa form kind information
- 4) Range Officer, Trongsa Range for information and necessary action

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ZFD/TECH/03/2012-1.5/ 16/2-

Dated: 24.04.2013

FORESTRY CLEARANCE

In exercise of the powers delegated under the amended Forest and Nature Conservation Rules 2008 conveyed vide No. DF/Ka-3/2008/702 of the Department of Forests and Park Services, Ministry of Agriculture and Forests, the Forestry Clearance is hereby accorded in favor of Nikachhu Hydropower Project, Trongsa (DGPC, Thimphu) for lease of 11.602 acres (46950 m²) of GRF land located at Gongkorchhu-Tsangkha for use as muck disposal site, Adit IV.

This is issued in accordance to letter no.DoPPS/Ka-3-4/2013/2131 dated 09/04/2013 of the Department and as per the field inspection report submitted by the Range Officer, Trangsa Range vide no. TR/ADM/2-4(b)/2012-2013/295 dated 07/02/2013.

The trees and firewood generated from the above land should be handed over to NRDCL. For extraction and disposal as per rules.

This clearance will be valid subject to clearance issued by other concerned agencies as per rules.

(Dawa Zangpo) Offitg, Chief Forestry Officer

CC fo:

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- 1) Dasho Dzongdag, Dzongkhag Administration. Trongsa for kind information
- 2) Managing Director, DGPC, Thimphu for kind information
- 3) Gup, Tangsibiji Gewog Administration, Trongsa form kind information
- 4) Range Officer, Trongsa Range for information and necessary action

Zuenigang, Post Box 594; Title Nu. 00 975 - 03 (741205 / 741325 Fax No. 741227/ e-mail dfözhenk§jmaaf gov bi



ZED/TECH/03/2012-13/1613

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Dated: 24.04.2013

24 Apr. 2013 10:17PM - PF

FORESTRY CLEARANCE

In exercise of the powers delegated under the amended Forest and Nature Conservation Rules 2008 conveyed vide No. DF/Ka-3/2008/702 of the Department of Forests and Park Services, Ministry of Agriculture and Forests, the Forestry Clearance is hereby accorded in favor of Nikachhu Hydropower Project, Trongsa (DGPC, Thimphu) for lease of 14.583 acres (59015 m²) of GRF land located at Surge Shaft for use as muck disposal site.

this is issued in accordance to letter no.DoFPS/Ka-3-1/2013/2131 dated 09/04/2013 of the Department and as per the field inspection report submitted by the Range Officer. Trongsa Range vide no. TR/ADM/2-4(b)/2012-2013/295 dated 07/02/2013.

The trees and firewood generated from the above land should be handed over to NRDCL for extraction and disposal as per rules.

This clearance will be valid subject to clearance issued by other concerned agencies as per rules.

(Dawa Zangpo) Offitg, Chief Forestry Officer

CC to:

- 1) Dasho Dzongdag, Dzongkhag Administration, Trongsa for kind information
- 21 Managing Director, DGPC, Thimphu for kind information
- 3) Gup Tangsibiji Gewog Administration, Trongsa form kind information
- 4) Range Officer, Trongsa Range for information and necessary action

Zherogrog, Post Byx 594; Tele No. 00 975 - 03 -741205 - 741323 Fax No. 7412237 e-mail diozherogémoaf.gov.bt



ZFD/TECH/03/2012-13/ [6] 4

Dated: 24.04.2013

FORESTRY CLEARANCE

In exercise of the powers delegated under the amended Porest and Nature Conservation Rules 2008 conveyed vide No. DF/Ka-3/2008/702 of the Department of Forests and Park Services, Ministry of Agriculture and Forests, the Forestry Clearance is hereby accorded in favor of Nikachhu Hydropower Project, Trongsa (DGPC, Thimphu) for lease of 61.023 acres (246950 m²) of GRF land located below Tsheringma drupehlui for use as muck dumping and batching plant sites at Adit III.

this is issued in accordance to letter no.DoFPS/Ka-3-1/2013/2131 dated 09/04/2013 of the Depurtment and as per the field inspection report submitted by the Range Officer, Trongsa Range vide no. TR/ADM/2-4(b)/2012-2013/295 dated 07/02/2013.

The trees and firewood generated from the above land should be handed over to NRDCL for extraction and disposal as per rules.

This clearance will Ly valid subject to clearance issued by other concerned agencies as per rules.

(Dawa Z**ānepò**) Offity, Chief Forestry Officer

CC to:

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- 1) Dasho Dzougdag, Dzongkhag Administration, Trongsa for kind information
- 2) Managing Director, DGPC, Thimphu for kind information
- 3) Gup, Tangsibiji Gewog Administration, Trongsa form kind information
- 4) Range Officer, Trongsa Range for information and necessary action

Zhenegang, Post Box 394: Tele No. 00 975 - 05 -741205 / 741323 Fax No. 741271/ e-mail dl/ozbere@ineaf.gov.bt



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TANAN



OFFICE OF THE CHIEF FORESTRY OFFICER ZHEMGANG FOREST DIVISION DEPARTMENT OF FORESTS AND PARK SERVICES

ZFD/TECH/22-2/2013-14/1003

Date: 25/02/2014

FOREST CLEARENCE

The Zhemgang Division, Department of Forest and Park Services, Ministry of Agriculture & Forest is pleased to issue Forest Clearance for construction of permanent & temporary Colonies at Danisite measuring 11,210m², establishment of Batching plant measuring 12,141m², Crushing plant measuring 16,187m², development of Muck disposal area measuring 138,630m², at Lorim and access road construction to Adit I measuring 2600mX8.5m in SF land, in favor of Nikachhu Hydro Power Project with the following terms and conditions:

The clearance is issued as per the approval from the Department vide No.DoFPS/Ka-6/2014/1220 dated 31/08/2013.

- 1. This clearance is limited to forestry perpestive as per the detailed field report;
- 2. This clearance is not transferable;
- 3. The validation of this clearance shall subject to obtaining other relevant clearance;
- 4. Additional clearance should be sought piror to any deviation of the activity/area;
- 5. This clearance shall not be liable for any dispute arising during the implementation of activity;
- 6. This clearance is limited within the proposed area for specific time acitivity;
- 7. Any damage cause to Public/Private property shall be borne by holder of this clearance;
- 8. Any waste generated from the activity should be properly dispose as per the Waste Prevention and Management Regulation, 2012;
- 9. The existing Forest produce shall be disposed as per the existing rules and regulation;
- 10. The legal status of the land shall remain unchanged and on any occasion the land shall not be converted to private ownership;
- 11. The GRF land shall shall be released only after proper hand in taking note signed by the parties;
- 12. This clearance shall not restrict easement;
- 13. This clearance shall be revoke without any liability on any part of Government if the holder of the clearance violates any of the above terms and conditions;
- 14. The trees and poles generated should be handed over to NRDCL for extraction and disposal as per the F&NCAR, 2008;
- 15. This clearance shall be veiled till **one year** from the date of issue and subjected to the periodic review and changes.

Zhemgang, Post Box 394; Tele No. 00 975 - 03 -741205 / 741323 Fax No. 741221/ e-mail dfozhem@moaf.gov.bt



Non-compliance of any of the above mentioned conditions is a violation of the Forest and Nature Conservation Act 1995 and its Rules 2006 and amended Rules 2008 and any other relevant laws. This shall result in revocation/suspension of the Forestry Clearance, in part or in whole and the penalties enforced as per the Act without any liability on the part of the government;

The clearance is issued as per the field report submitted by Unit In-Charge, Chendebji PMU vide Ref.No.CFMU/DoF/22/2013-2014/38 dated 25/12/2013.

(Ugyen Tenz Chief Forestry Officer

Copy to:

1. The Dasho Dzongda, Trongsa Dzongkhag Adiministration for kind information

2. The Project Manager, Nikachhu Hydropower Project, Trongsa for information.

- 3. The Unit In- Charge, Chendenbji Forest Management unit for information
- Office copy

Cory to 1) Dor IP) 120 21 Head, control

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Zhemgang, Post Box 394; Tele No. 00 975 - 03 -741205 / 741323 Fax No. 741221/ e-mail dfozhem@moaf.gov.bt

במי יצד תביו וופרי לי באי בר במידי שמי צד ועמו במומישטי בר אבר יחי פעמי למי מש נערמו



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Royal Government of Bhutan Ministry of Agriculture and Forests Department of Forests and Park Services THIMPHU



No. DoFPS/Ka-6/2014/ 1220

The Chief Forest Officer Zhemgang Division

February 12, 2014

2600 22-2 Tech

Sub: Approval for issuance of Forestry Clearance

As recommended by your letter no. 912 dated 04/02/2014, approval is hereby accorded for proposed construction of permanent & temporary Colonies at Damsite measuring 11,210m², establishment of Batching plant measuring 12,141 m², Crushing plant measuring 16,187m², development of Muck disposal area measuring 138,630m², at Lorim and access road construction to Adit I measuring 2600mX8.5m in SF land, in favour of Nikachu Hydro Power Project, Trongsa Dzongkhag.

You may therefore; take further necessary action from your end accordingly and the trees and poles should be handed over to NRDCL for extraction & disposal as per the F&NCAR, 2008.

(Chenche Norbu)

Director General

Copy to:

PA to Director General, DoFPS for record.

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अन्त्रसे दगश्च केवाधीम केना



OFFICE OF THE CHIEF FORESTRY OFFICER ZHEMGANG FOREST DIVISION DEPARTMENT OF FORESTS AND PARK SERVICES

ZFD/JECD/22-2/2013-2014/CDL-

Dated: 04/02/2014

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The Hon'ble Director General. Department of Forest and Park Services, Ill replic

Sub: Sevicion approval for issuance of forestry cleanance in favor of NHPP, Trongsa. Dasho:

Hits division would like to forward the application in favor of Nikachu Hydro Power Project for issuance of borestry Clearance for the following works at different places.

SLau	Activities to be carried out	Area (m2) & name of place	Remarks
1	Coastruction of permanent&	11.210m ² at Lorini	880 nos of trees need to be removed
	temporary colority at Latinistic		
	E. G. F. John T Bay, oug Plant af	144m ara mu	230 nos of trees need to be removed
	Enno sile	· .	
ì	Establishment of Crushing Plant as Dam site	16. 187m ² at Loriu below national highway	250 nos of trees need to remove.
+	Development of Mack disposal area 3N at Dam site	45.270m ² at Lorin	390 nos of trees need to be removed
•	 dapment of daposal news site a 	* 93.36ian?	600 nos of trees need to be removed
9	Construction of	- 2autan X 8.5 m	1200 nos of trees need to be
	access foul to Adit I	1	rendwett

Zhentgang, Post Box 394; Tele No. 00 975 - 03 -741205 / 741323 Fax No. 741221/ e-mail diozbent@moaf.gov bt



Therefore, this is being submitted for your honor's approval and further directives please.

Enclosed: Detail field report & sketch map for your honor's ready reference.

Yours Faithfully.

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Chief Furestry Officer

Copy to:

- The Projects Department, Planning and Design Division, Druk Green Power Corporation, Thimphu for kind information.
- 2. The Unit In charge, CFMU for information and necessary action.
- Thee copy.

Zucangang, Post Box 394, Tele No. 00 975 - 03 -741205 * 741323 Fax No. 741221 / e-mail dfuzhem // muaf.gov.br



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अन्तरक्षेत्रगष्य केंपाध्येग केना

দ্বিশ্বসম্বাদ্য



OFFICE OF THE CHIEF FORESTRY OFFICER ZHEMGANG FOREST DIVISION DEPARTMENT OF FORESTS AND PARK SERVICES

/10/11/11/12-2/2013-14/1005

Date: 26/02/2013

FOREST CLEARENCE

The Zhengang Division, Department of Forest and Park Services, Ministry of Agriculture & Forest is pleased to issue Forest Clearance for the construction of following activities in favor of Nakacha Hydro Power Project with the following terms and conditions:

SLas	Particular	Corridors(Name of place)	Area in meters	Remarks
I	Batching plants in Surge shaft	Norboudi	6070m2	The acquisition shall be temporary
	Colonies at provide house	(Norhoudi), above MHPA Dan avis(Right bank)	10643m2	-do-
	"Cristing plant al 1945 and 1975 1	 A abordo, Iownstean (of MEPA dan axis(0) ph bank) 	16.187/07	-do-
	Mack dumping (site-VII	(Norboudi).downstream of MHPA dam axis(Right bank	71.000m2	-do-
13	Muck dumping	Chipchippokto	62,030m2	-do-
6	Barching plant for Adir IV	Gongkhorehhu	6070m2	-do-
i Ji	nachting piancht powernouw site '	a Sectoord) any marcain of a META dam as as Right bank	12141m.	·
18	Common Much diamping house sile	Phybo Gyaenn Tshangkhar)	73,116m2	-do-
9	Access road to	Agay chocho(Tshangkha)	Length Breadth	The access road to

/ boundary de la deva Mar, l'ele Nacifié V15 - e N. 94100 (1974) 323 Faix No. 3010001 e-mát di orbemér austrepre tr

सन्दर्भु वृग्ध केंवर्भ्य मार्कना



Tariar Str.



OFFICE OF THE CHIEF FORESTRY OFFICER ZHEMGANG FOREST DIVISION DEPARTMENT OF FORESTS AND PÅRK SÉRVICES

1	Contaion Muck	1.750m 7.5m	common muck disposal
,	disturing site		site has been along
			Tshangkha Power tiller
		100 - 0	i track

The clearance is issued as per the approval from the Department vide no.DoPPS/Ka-6/2014/1162 dated 03/02/2014.

- 1. This clearance is limited to forestry perspective as per-the detailed field report;
- 2. This clearance is not transferable:
- 3. The validation of this clearance shall subject to obtaining other relevant clearance;
- 4. Additional clearance should be sought prior to any deviation of the activity/area:
- 5 The elearative shall not be liable for any dispute arising during the implementation of accuring.
- this clear me is directed within the proposed area for specific time activity;
- 7. Atty fail are ratise to Public Private property shall be borne by holder of this clearance.
- M. wait cuerated from the activity should be property dispose as per the Waste Prevention and Management Regulation, 2012;
- The existing Forest produce shall be disposed/removed only after land registration in thram and demarcation as per the existing rules and regulation;
- 10. This clearance shall not restrict easement;
- 11. The GRF land shall be released only after proper hand in taking note signed by the parties
- (2) This clearance shall be revoke without any liability on any part of Government if the boller of the clearance violates any of the above terms and conditions.
- In free, and poles generated should be handed over to the NRDCL for extraction and the stal as per the F&NCAR, 2008;
- 14. This clearance shall valid till *one* year from the date of issue and subject to the periodic changes and review.

Zheingang, Post Box 394, Tele No. 00 975 - 03 -741205 - 741323 Fax No. 7412217 e-mail dfazhein a muailigov.bt



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OFFICE OF THE CHIEF FORESTRY OFFICER ZHEMGANG FOREST DIVISION DUPARTMENT OF FORUSTS AND PARK SERVICES

Non-compliance of any of the above mentioned conditions is a violation of the Forest and Nature Conservation Act 1995 and its Rules 2006 and amended Rules 2008 and any other relevant laws. This shall result in revocation/suspension of the Forestry Clearance, in part or in whole and the penalties enforced as per-the Act without any liability on the part of the government;

This is issued as per field inspection report submitted Range Officer. Trongsa Range vide letter no. 1 R. ADAU2-4 (b) 2013-14/319 dated 06/01 2014

(gi en CHIEF FORESTRY OFFICER

Copy to:

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- 1) The Dasho Dzongda, Dzongkhag Administration. Trongsa for kind information.
- 2) The Gup, Tashileng Gewog Administration, Trongsa for information,
- 3) The Range Officer, Trongsa Range for information and necessary action.
- 4) The Project Manager, NHPP for information.

Zhenigmig, Pass Hox 394-1 ele No. (103075 - 103 -7613205 - 761323 Fax No. 24937 Ce-mail diozhem & monigov.br

PAGE 8./01

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Royal Government of Bhutan Ministry of Agriculture and Forests Department of Forests and Park Services THIMPHU



22 35

05/02/14

No. DOFPS/Ka-6/2014 1162

The Chief Forest Officer Zhemgang Division February 3, 2014

Sub: Approval for issuance of Forestry Clearance

As recommended by your letter no. 761 dated 08/01/2014, approval is hereby accorded for proposed establishment of Batching plant, Crushing plant, Muck dumping, Colonies and access toad construction in SF land at Norboundi, Chipchippokto, Gongkhorchhu, and Tsahangkha measuring 270,382m² (67.59 acres) in favour of Nikachu Hydro Power Project, Trongsa Dzongkhag.

You may therefore; take further necessary action from your end accordingly and the trees and poles should be banded over to NRDCL for extraction & disposal as per the F&NCAR, 2008.

(Chenche Norbu) **Director** General

Copy to:

PA to Director General, DoFPS for record.

Sendent / Tehing

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OFFICE OF THE CHIEF FORESTRY OFFICER ZHEMGANG FOREST DIVISION DEPARTMENT OF FORESTS AND PARK SERVICES

ZFD/TEC11/22-2/2013-2014/%)

Dated: 08/01/2014

Lo.

The Hon'hle Director General, Department of Forest and Park Services, Lhimphu,

Sub: Approval for issuance of Forestry clearance in favor of Nikachu Hydro Power Project.

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Dasho.

has division would like to forward an application for issuing forestry clearance in favor of Nikachu Liydor Proyeer Projeer in the following places

51.00	Particular	Corridors(Name of place)	Area in meters	Remarks
	Batching plants of Surge shaft	Norboudi	6070ni2	The proposed area falls inside GRF land
1	Colonies at power house	(Norboudi), above MHPA Dam axis(Right bank)	10643m2	-do-
3	Crushing plant at power bouse	(Norboudi).downstream of MHPA dam axis(Right Donter	16,187m2	-do-
-1	Muck duapping site-VII	iNorboudt).downstream of MHPA dam asistRight bank	71.000m2	-do-
;	Muck dumping site-VI at Adit V	Chipchippokio	62.030m2	-do-
h	Batching plant for Adit IV	Ciongkhorehhu	6070m2	-do-
7	Batching plant at powerhouse site	(Norboudi).downstream of MHPA dom axis(Right bank	12141m2	-do-

O/ Themgang, Past Hox 394; Tele No. 01 975 - 0.5 -741295 - 741323 Lax No. 74122 Dje-mail dfozheim@moaf.gov.bi



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OFFICE OF THE CHIEF FORESTRY OFFICER ZHEMGANG FOREST DIVISION DEPARTMENT OF FORESTS AND PARK SERVICES

. N	Comann Much dumping lanne site	Phylio Gynem(Tshangkha)	73,1160	12	-do-
	Access road to Common Muck	Agay chocho(Tshangkha)	Length Breadth		The take off point &
	dumping site		1,750m	7.5m	inside pyr land of
					Tshangkha

Therefore, dais is submitted for Dasho's kind approval please,

Yours Faithfully.

(Ugyen Tenzin) Y Chief Forestry Officer

Copy to:

1. The Project Manager, DGPC, Trongsa for information.

The Range Officer. Trongsa Range for information and necessary action.
 Toffice copy.

Zhenagang, Piez Box 304, Tele Sig 19/075 - 03 -743205, 741323 Fax No. 741221, esmail dfozhem@moaf.gov.bi



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OFFICE OF THE CHIEF FORESTRY OFFICER ZHEMGANG FOREST DIVISION DEPARTMENT OF FORESTS AND PARK SERVICES

ZFD/TECH/22-2/2013-14/100M

Date: 25/02/2014

FOREST CLEARENCE

The Zhemgang Division, Department of Forest and Park Services, Ministry of Agriculture & Forest is pleased to issue Forest Clearance of drift work (underground) measuring length of 350m and 30m in favor of Nikachbu Hydropower Project with the following terms and

The clearance is issued as per the approval from the Department vide No.DoFPS/Ka-3-2/2013/594 dated 31/08/2013

- 1. This clearance is limited to forestry perpestive as per the detailed field report;
- 2. This clearance is not transferable;
- 3. The validation of this clearance shall subject to obtaining other relevant clearance;
- 4. Additional clearance should be sought piror to any deviation of the activity/area;
- 5. This clearance shall not be liable for any dispute arising during the implementation of activity;
- 6. This clearance is limited within the proposed area for specific time acitivity;
- 7. Any damage cause to Public/Private property shall be borne by holder of this clearance;
- 8. Any waste generated from the activity should be properly dispose as per the Waste Prevention and Management Regulation, 2012;
- 9. The existing Forest produce shall be disposed as per the existing rules and regulation;
- 10. The legal status of the land shall remain unchanged and on any occasion the land shall not be converted to private ownership;
- 11. The GRF land shall shall be released only after proper hand in taking note signed by the parties ;
- 12. This clearance shall not restrict easement;
- 13. This clearance shall be revoke without any liability on any part of Government if the holder of the clearance violates any of the above terms and conditions;
- 14. The trees and poles generated should be handed over to NRDCL for extraction and disposal as per the F&NCAR, 2008;
- 15. This clearance shall be veiled till one year from the date of issue and subjected to the periodic review and changes.

Zhemgang, Post Box 394; Tele No. 00 975 - 03 -741205 / 741323 Fax No. 741221/ e-mail dfozhem@moaf.gov.bt



Non-compliance of any of the above mentioned conditions is a violation of the Forest and Nature Conservation Act 1995 and its Rules 2006 and amended Rules 2008 and any other relevant laws. This shall result in revocation/suspension of the Forestry Clearance, in part or in whole and the penalties enforced as per the Act without any liability on the part of the government;

The clearance is issued as per the field report submitted by Unit In-Charge, Chendebj#FMU vide Ref.No.CFMU/DoF/22/2013-2014/25 dated 22/10/2013.

(Ugyen Tenz

Chief Forestry Officer

Copy to:

- 1. The Dasho Dzongda, Trongsa Dzongkhag Adiministration for kind information
- 2. The Project Manager, Nikachhu Hydropower Project, Trongsa for information.
- 3. The Unit In- Charge, Chendenbji Forest Management unit for information
- Office copy

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Zhemgang, Post Box 394; Tele No. 00 975 - 03 -741205 / 741323 Fax No. 741221/ e-mail dfozhem@moaf.gov.bt

ברומי ביצר ובביח יחפרין מיקטי בריק ממי שמי שמי שמיום מחמישמי ברי אבי זי ומיזמי אחימט ערבי



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Royal Government of Bhutan Ministry of Agriculture and Forests Department of Forests and Park Services THIMPHU



No. DoFPS/Ka-3-2/2013/ 594

October 31, 2013

The Chief Forest Officer Zhemgang Forest Division.

Sub: Approval for issuance of Forestry Clearance

As recommended by your Office letter No. 453 dtd 28/10/2013, approval is hereby accorded as per the annexure 18(d),(6) for proposed clearance of drift work (underground) measuring 350 metres length and 30metres in favour of NHPP, DGPCL.

Therefore, you are asked to issue the forest clearance for above activity from your end as per the existing guidelines. The trees and poles within the transmission alignment should be handed over to NRDCL for extraction & disposal as per the F&NCAR, 2008.

25/02/14

Julical Trahing

(Chencho Norbu)

(Chengho Norbu) Director General

Copy to:

- 1. The CFO, FRMD information.
- 2. PA to Director General, DoFPS for record.

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RED/TECH/22/2013-14/4/53

Date: 28/10/2013

. The Hon'ble Director General Department of Forest and Park Services Thimphie Bhutan.

Subject: Forwading Clearence in favor of NHPP, DGPCL

Dasho,

We have an honor to forward an application in favor of Nikachhu Hydropower Project under Tangsbiji Gewog, Trongsa Dzongkhag. The applicant has proposed for clearence to carry out drift work measuring length of 350m and 30 m. As per the information, the work shall be carried one exclusively underground. The field report shows that no massive damage is forseen in mutureregarding the drift work.

therefore, necessary approval may be accorded in favour of the applicant.

inclosed: Field report

ours haithfully,

Wogven Tenzh

Whilef Forest Officer

- 8. Project Manager, Nikachhu Hydropower Project, Tangsibiji Gewog, for kind information
- the Unit Incharge. Chendebjee for information and necessary action.

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angang, Post Box 394; Tele No. 00 975 - 03 -741205 | 741323 Fax No. 741221/ e-mail dfozhem@moaf.gov.bt



No.2FD/Tech/03/2013-2014/1001

26th Febuary2014

FOREST CLEARANCE FOR DEVELOPMENTAL ACTIVITY

In exercise of authority granded by the Forest and Nature Conservation Amended Rules 2008, the Zhemgang Forest Division is please to issue Forestry Clearance for submergence of Nikachu at Dam site covering 22,800sq.m in favour of Nikachu Hydropower Project under Trongsa Dzongkhag. This has been issued with following terms and conditions.

- 1. This clearance is limited to forestry perpestive as per the detailed field report;
- 2. This clearance is not transferable;
- 3. The validation of this clearance shall subject to obtaining other relevant clearance;
- 4. Additional clearance should be sought piror to any deviation of the activity/area;
- 5. This clearance shall not be liable for any dispute arising during the implementation of activity;
- 6. This clearance is limited within the proposed area for specific time acitivity;
- 7. Any damage cause to Public/Private property shall be borne by holder of this clearance;
- Any waste generated from the activity should be properly dispose as per the Waste Prevention and Management Regulation, 2012;
- 9. The existing Forest produce shall be disposed as per the existing rules and regulation;
- The legal status of the land shall remain unchanged and on any occasion the land shall not be converted to private ownership;
- 11. The GRF land shall shall be released only after proper hand in taking note signed by the parties;
- 12. This clearance shall not restrict easement;

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- 13. This clearance shall be revoke without any liability on any part of Government if the holder of the clearance violates any of the above terms and conditions;
- 14. This clearance is valid upto <u>one year</u> from the date of issue and subject to the periodic changes.

Non-compliance of any of the above mentioned conditions is a violation of the Porest and Nature Conservation Act 1995 and its Rules 2006 and amended Rules 2008 and any other relevant laws. This shall result in revocation/suspension of the Forestry Clearance, in part or in whole and the penalties enforced as per the Act without any liability on the part of the government.

Zhemgang Post Box 394/Tel no. 00 975 3 741205/741323/Fax no. 741221/c mail: dfozhem@moaf.gov.bt



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This is issued based on field report submitted the Unit Incharge, Chendepji vide letter no.CFMU/DoF/22/2013-14/52 dated 31st January 2014

(Ugyen Chief Fore

CC to:

- 1. The Dasho Dzongdag, Dzongkhag Administration, Trongsa for kind information.
- 2. The Gup, Tangsbi Gewog Administration for information.
- 3. The Unit Incharge, FMU-Chendepji for information and necessary action.
- 4. The Project Manager, Nikachu Hydropower project for information.
 - 5. Office copy,

Corry (P) Propa

Zhemgang Post Box 394/Tel no. 00 975 3 741205/741323/Fax no. 741221/e mail: dfozhem@moaf.gov.bt



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No.ZFD/Tech/03/2013-2014/1002_

26th Febuary2014

FOREST CLEARANCE FOR DEVELOPMENTAL ACTIVITY

In exercise of authority granded by the Forest and Nature Conservation Amended Rules 2008, the Zhemgang Forest Division is please to issue Forestry Clearance for Muck Disposal site covering 24,600sq.m in favour of Nikachu Hydropower Project under Trongsa Dzongkhag. This has been issued with following terms and conditions.

1. This clearance is limited to forestry perpestive as per the detailed field report;

2. This clearance is not transferable;

3. The validation of this clearance shall subject to obtaining other relevant clearance;

Additional clearance should be sought piror to any deviation of the activity/area;

5. This clearance shall not be liable for any dispute arising during the implementation of activity;

6. This clearance is limited within the proposed area for specific time acitivity;

7. Any damage cause to Public/Private property shall be borne by holder of this clearance;

8. Any waste generated from the activity should be properly disposed as per the Waste Prevention and Management Regulation, 2012;

9. The existing Forest produce shall be disposed as per the existing rules and regulation;

10. The legal status of the land shall remain unchanged and on any occasion the land shall not be converted to private ownership;

11. The GRF land shall be released only after proper hand in taking note signed by the parties;

12. This clearance shall not restrict casement;

13. This clearance shall be revoke without any liability on any part of Government if the holder of the clearance violates any of the above terms and conditions;

14. This clearance is valid upto one year from the date of issue and subject to the periodic changes.

Non-compliance of any of the above mentioned conditions is a violation of the Forest and Nature Conservation Act 1995 and its Rules 2006 and amended Rules 2008 and any other relevant laws. This shall result in revocation/suspension of the Forestry Clearance, in part or in whole and the penalties enforced as per the Act without any liability on the part of the government.

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This is issued based on field report submitted the Unit Incharge, Chendepji vide letter no. CFMU/DoF/22/2013-14/52 dated 31st January 2014

(Ugyen ChiefForester Cet

CC to:

- 1. The Dasho Dzongdag, Dzongkhag Administration, Trongsa for kind information,
- 2. The Gup, Tangsbi Gewog Administration for information.
- 3. The Unit Incharge, FMU-Chendepji for information and necessary action.
- 4. The Project Manager, Nikachu Hydropower project for information.
 - 5. Office copy.

21 Head. (P) (P)

Zhemgang Post Box 394/Te) no. 00 975 3 741205 /741323/Fax no. 741221/e mail: dfozhem a moaf.gov.bt





ZFD/TECH/03/2013-14/1626

Date: 30/06/2014

FOREST CLEARENCE (Developmental Activity)

The Zhemgang Division, Department of Forest and Park Services, Ministry of Agriculture & Forest is pleased to issue Forest Clearance for proposed access road construction in following areas of Nikachu Hydropower Project in favor of Director(Project), Druk Green Power Corporation, Thimphu.

Sl.no	Purpose	Location	Length	Remarks
1	Access road to Adit- V	Near Thumendra	500X8.5 metres	Take off point from Thimphu-Trongsa High Way
2	Access road to Power House	Norboudi	3900X8.5metres	Only alignment passess through GRF Land
3	Access road to Adit III	Namgeycholing School along Tangsibji farm road	2500x8.5 metres	Through GRF land

The clearance is issued as per the approval of the Department vide approval No.DoFPS/Ka-3-1/2014/2047 dated June 19,2014 on following terms and conditions:

- 1. This clearance is limited to forestry perpestive as per the detailed field report;
- 2. This clearance is not transferable;
- 3. The validation of this clearance shall subject to obtaining other relevant clearance;
- 4. Additional clearance should be sought piror to any deviation of the activity/area;
- 5. This clearance shall not be liable for any dispute arising during the implementation of activity;
- 6. This clearance is limited within the proposed area for specific time acitivity;
- 7. Any damage cause to Public/Private property shall be borne by holder of this clearance;
- 8. Any waste generated from the activity should be properly dispose as per the Waste Prevention and Management Regulation, 2012;
- 9. The existing Forest produce shall be disposed as per the existing rules and regulation;

- The legal status of the land shall remain unchanged and on any occasion the land shall not be converted to private ownership;
- 11. The GRF land shall shall be released only after proper hand in taking note signed by the parties ;
- 12. This clearance shall not restrict easement;
- 13. This clearance shall be revoke without any liability on any part of Government if the holder of the clearance violates any of the above terms and conditions;
- 14. This clearance is valid upto <u>one year</u> from the date of issue and subject to the periodic changes.

Non-compliance of any of the above mentioned conditions is a violation of the Forest and Nature Conservation Act 1995 and its Rules 2006 and amended Rules 2008 and any other relevant laws. This shall result in revocation/suspension of the Forestry Clearance, in part or in whole and the penalties enforced as per the Act without any liability on the part of the government;

This is issued as per field inspection report submitted by Range Officer, Panbang Range vide no.PBR/3-1/2013-2014/148 dated 21/04/2014.

(Ugye Lett2 Chief Forestry Officer

CC to:

- 1. The Dasho Dzongdag, Trongsa for kind information.
- 2. The Project Manager, Nikachu Hydro Power Project for information.
- 3. The Gup Gewog Administration, Tangsibji for information.
- 4. The Range Officer, Trongsa Range for information and necessary action.
- 5. Office copy.



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Royal Government of Bhutan Ministry of Agriculture and Forests Department of Forests and Park Services THIMPHU



June 19, 2014

No. DoFPS/Ka-3-1/2014/ 2-047

The Chief Forestry Officer, Zhemgang Forest Division.

Received No. 3217. File No...03 ech

Sub: Approval for issuance of Forestry Clearance

On the strength of field report submitted by your office, vide letter No.1540 on dated 06/06/2014, the approval is hereby accorded as per the annexure 37 for issuance of Forest Clearance for proposed access road construction in the following areas of Nikachu Hydropower Project in favour of Director (Projects), Druk Green Power Corporation, Thimphu.

SLNo.	Purpose	Location	Length	Remarks
01	Access road to Adit-V	Near Thumendra	500x8.3meler	Take off point, from Thimphu-Trongsa high way.
02	Access road to power	Norboudi	3900x8.5ineter	Only #lignment passes through GRF land.
03	Access road to Adit III	Namgeycholing school along Tangbji farm road.	2500x8.5meter	Through GRF land,

Therefore, you are instructed to issue the forest clearance for above activity from your end as per the existing guidelines. The trees and poles within the proposed road alignment should be handed over to NRDCL for extraction & disposal as per the F&NCAR, 2008.

(Chenche Norbu) Director General

Copy to:

Julieal Julieal

The PA to Director General, DoFPS for record.



No.ZFD/Tech/03/2013-2014/10444

5th March, 2014

FOREST CLEARANCE FOR DEVELOPMENTAL ACTIVITY

The Department of Forest and Park Services has kindly accorded Forest Clearance Approval for Development of Muck Disposal area near Badelachu and access road construction to Adit II in favor of Nikachu Hydro Power Project, Trongsa Dzongkhag. This has been issued with following terms and conditions.

- 1. This clearance is limited to forestry perpestive as per the detailed field report;
- 2. This clearance is not transferable;
- 3. The validation of this clearance shall subject to obtaining other relevant clearance;
- 4. Additional clearance should be sought piror to any deviation of the activity/area;
- 5. This clearance shall not be liable for any dispute arising during the implementation of activity;
- 6. This clearance is limited within the proposed area for specific time acitivity;
- 7. Any damage cause to Public/Private property shall be borne by holder of this clearance;
- 8. Any waste generated from the activity should be properly dispose as per the Waste Prevention and Management Regulation, 2012;
- 9. The existing Forest produce shall be disposed as per the existing rules and regulation;
- 10. The legal status of the land shall remain unchanged and on any occasion the land shall not be converted to private ownership;
- 11. The GRF land shall be released only after proper hand in taking note signed by the parties;
- 12. This clearance shall not restrict easement;
- 13. This clearance shall be revoke without any liability on any part of Government if the holder of the clearance violates any of the above terms and conditions;
- 14. This clearance is valid upto <u>one year</u> from the date of issue and subject to the periodic changes.

Non-compliance of any of the above mentioned conditions is a violation of the Forest and Nature Conservation Act 1995 and its Rules 2006 and amended Rules 2008 and any other relevant laws. This shall result in revocation/suspension of the Forestry Clearance, in part or in whole and the penalties enforced as per the Act without any liability on the part of the government.

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TANAM



OFFICE OF THE CHIEF FORESTRY OFFICER ZHEMGANG FOREST DIVISION DEPARTMENT OF FORESTS AND PARK SERVICES

This has approval vide no.DoFPS/Ka-6/2014/1353 dated 4th March 2014 of the Offtg.Director General, Department of Forests and Park Services, Thimphu.

(Ugyen Tenzin)

Chief Forestry Officer

CC to:

- 1. The Dasho Dzongdag, Dzongkhag Administration, Trongsa for kind information.
- 2. The Gup, Tangsibi Geog for information.
- 3. The Unit Inchrage, Chendepji for necessary action.

4. Office copy. 5. Nikadu Hydro Power hoject

Zhemgang Post Box 394/Tel no. 00 975 3 741205/741323/Fax no. 741221/c meil? dfozhem@moaf.gov.bt

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Royal Government of Bhutan Ministry of Agriculture and Foresis Department of Forests and Park Services THIMPHU



No. DoFPS/Ka-6/2014/ \ 353

March 4, 2014

The Chief Forest Officer Zhemgang Division

Sub: Approval for issuance of Forestry Clearance

As recommended by your letter no.1045 dated 27/02/2014, approval is hereby accorded for proposed development of Muck disposal area measuring 72,996m², at Badelachu and access road construction to Adit II measuring 1,716mX8.5m in SF land, in favour of Nikachu Hydro Power Project, Trongsa Dzongkhag.

You may therefore; take further necessary action from your end accordingly and the trees and poles should be handed over to NRDCL for extraction & disposal as per the F&NCAR, 2008.

(Shacha Do

Offtg. Director General

Copy to:

PA to Director General, DoFPS for record,



ZFD/TECH/03/2013-14/1521

Date: 5/06/2014

FOREST CLEARENCE (Developmental Activity)

The Zhemgang Forest Division, Department of Forest and Park Services, Ministry of Agriculture & Forest is pleased to issue Forestry Clearance for construction of transmission line from NHPC till Yurmo, under Langthel Gewog

The clearance is issued as per the approval of the ministry/ Department/ as per FNCR, 2006 rule no. Chapter XIII, section 9(3) on following terms and conditions:

- 1. This clearance is limited to forestry perpestive as per the detailed field report;
- 2. This clearance is not transferable;
- 3. The validation of this clearance shall subject to obtaining other relevant clearance;
- 4. Additional clearance should be sought piror to any deviation of the activity/area;
- 5. This clearance shall not be liable for any dispute arising during the implementation of activity;
- 6. This clearance is limited within the proposed area for specific time acitivity;
- 7. Any damage cause to Public/Private property shall be borne by holder of this clearance;
- 8. Any waste generated from the activity should be properly dispose as per the Waste Prevention and Management Regulation, 2012;
- 9. The existing Forest produce shall be disposed as per the existing rules and regulation;
- 10. The legal status of the land shall remain unchanged and on any occasion the land shall not be converted to private ownership;
- 11. The GRF land shall shall be released only after proper hand in taking note signed by the parties ;
- 12. This clearance shall not restrict easement;
- 13. No trees should be felled in the area.
- 14. This clearance shall be revoke without any liability on any part of Government if the holder of the clearance violates any of the above terms and conditions;
- 15. This clearance is valid upto <u>one year</u> from the date of issue and subject to the periodic changes.

Non-compliance of any of the above mentioned conditions is a violation of the Forest and Nature Conservation Act 1995 and its Rules 2006 and amended Rules 2008 and any other relevant laws. This shall result in revocation/suspension of the Forestry Clearance, in part or in whole and the penalties enforced as per the Act without any liability on the part of the government;

Zhemgang, Post Box 394; Tele No. 00 975 - 03 -741205 / 741323 Fax No. 741221/ e-mail cfozhem@druknet.bt



This is issued as per field inspection report submitted by Range Officer, Trongsa Range vide no.TR/ADM/2-4(a)/2013-2014/474 dated 03/06/2014.

(Sonam

Offt. Chief Forestry Officer

-3

CC to:

- 1. Nikkachhu Hydro Power Authority for information.
- 2. The Gup, Langthel Gewog Administration for information.
- 3. The Range Officer, Trongsa Range for information and necessary action.
- 4. Office copy.

Zhemgang, Post Box 394; Tele No. 00 975 - 03 -741205 / 741323 Fax No. 741221/ e-mail cfozhem@druknet.bt

FFOR NO. :

3 Jun. 2014 4:02AM Pi



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KARRAMA



Ternor ageroant at a war the Office of the Forest Range Officer Trongsa Forest Range Zhemgang Forest Division



Date: 03/06/2012 No.TR/ADM/2-4(8)/2013-2014/ 47-14 Τ0, The Chief Forest Officer. Divisional Forest Office, Zhomgang.

Subject: Forestry Clearance for Transsimision line of Nikkachhu Project from NHPC till Yarmo, Langthel.

Sir

2

As the DGPC is carrying out the study on Transmission line from NHPC Power House till Yurmo, Langthel They are approaching for clearances to study and for loan from Asian Development Bank (ADB).

In this regard you may kindly issue the clearances as they have no tree to fall.

Therefore, necessary Forest Clearance may kindly be issued from your good office for the above stated purpose

Thanking you, Yours Faithfully,

Trongsa

Copy tog-

- i. The Gup, Nubi, Drektang and Langthei, Beat Office for information.
- 2. The Beat In-Charge, Nubi, Drektang and Langthel, Beat Office for information & necessary monitoring.
- 3. Office Copy.

Phone: 03521125

Fac: 025214.5

Clearances for Construction Power (33 kV, 5 km from Banglapokto to Intake)



न्युग्रिय मुग्रेय के राष्ट्र के राष्

ROYAL GOVERNMENT OF BHUTAN DISTRICT ADMINISTRATION Chhoetse-dzong: Trongsa

DAT/DEC-17/2014/ 3543

January 24, 2014

00000 0 201001

DZONGKIIAG ADMINISTRATIVE APPROVAL

In exercise of the powers delegated under the National Environment Protection Act 2007, of the National Environment Commission Secretariat, Section 47, which mandates the Dzongkhag Environment Committee (DEC) as one of the Competent Authorities in Making recommendations to the concerned Ministries, Local Governments, and /or to the Secretariat concerning any measures that need to be taken to protect the quality of the Environment. Also, Dzongkhag Administration is mandated to issue the Dzongkhag Administrative Approval as per the Section 3.10 of Application for Environmental Clearance Guideline; the Dzongkhag Administrative Approval is hereby accorded in favor of Nikachhu Hydropower Project as per the 5th Dzongkhag Environment Committee meeting held on January 23, 2014 for Construction of 5 km, 33kV Transmission line for 118MW Nikachhu Hydropower Project with following terms and conditions:

- 1. Applicant to execute the wok as per The Land Act 2007.
- 2. Applicant to execute the work as per Waste Prevention and Management Regulation 2012.
- Applicant to carry out the transmission line construction along the National Highway RoW, along the edges of the Royal Tsamdro as recommended by the DEC during the field visit.
- The Applicant to maintain the Zhunglam (Footpath) and maintain 5meters RoW for the Existing Zhunglam (footpath) for the construction of the transmission line.
- 5. Applicant to ensure that restoration works are carried out after the completion of the construction.
- 6. The said transmission line construction to benefit the community of Sephuchen (Ngala and Dangla)
- The Dzongkhag Administrative Approval is accorded only for obtaining Environmental Clearance and does not include Social Clearance, Forestry Clearance, if required thereof;
- The Dzongkhag Administrative Approval for the said activity is within the jurisdiction of Trongsa Dzongkhag.

Further, this Dzongkhag Administrative Approval will stand valid till obtaining the Environment Clearance from the Competent Authority.

(Tshewang Rinzin) Chairman

Dzongkhag Environment Committee Copy to:

- 1. The Director (Projects), Druk Green Power Corporation Limited, Thimphu for kind perusal.
- 2. The Chief Environment Officer, ESD, NECS, Thimphu for kind information.
- 3. The Range Officer, Range Office, Tshangkha for kind information.
- 4. The Gup, Tangsibji gewog Administration for kind information.
- 5. The Environment Officer, Nikachhu Hydropower Project, Trongsa for kind information and necessary action please.
- 6. Office Copy.

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GEOG ADMINISTRATION OFFICE, TANGSIBI GEOG

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OFFICE OF THE CHIEF FORESTRY OFFICER ZHEMGANG FOREST DIVISION DEPARTMENT OF FORESTS AND PARK SERVICES



ZFD/TECH/22-2/2013-14/906

Date: 04/02/2014

FORESTRY CLEARANCE

The Zhemgang Division, Department of Forests & Park services, Ministry of Agriculture & Forests is pleased to issue Forest Clearance for Construction of Transmission Line measuring 5km length and 12m wide from Banglapokto to Dam site of NHPP via biological corridor of JSWNP & JSWNP in favor of Nikachu Hydro Power Project, Trongsa

This clearance is issued as per the approval from the Department vide letter no.DoFPS/ka-3-2/2014/1038 dated 9th January 2014.

This clearance is limited to forestry perspective as per the detail field report;

- 1. This clearance id not transferable;
- 2. The validation of this clearance shall subject to obtaining other clearances;
- 3. Additional clearances should be sought prior to any deviation of the activity area;
- This clearance shall not be liable for any dispute arising during the implementation of activity;
- 5. This clearance is limited within the proposed area for specific one time activity;
- 6. Any damage caused to public /Private property shall be borne by the holder of this clearance;
- 7. Any waste generated from the activity should be properly dispose as per the Waste Preventation and Management regulation.2012;
- 8. The existing Forest produce shall be disposed as per the existing rules and regulation;
- Upon approval of GRF land on lease, the proponent and concerned authority should execute lease agreement for the intended activity. A copy of leased agreement should be forwarded to concerned Forest Division;
- 10. The legal status of the land on lease shall remain unchanged and shall not be converted to private ownership/mortgaged/sub lease /sold:
- 11. This clearance shall not restrict easement;
- Upon expiry/annulment of the GRF land on lease, the GRF land should be restored to original and handover to DoFPS as per F&NCR;
- 13. The renewal of the clearance is subject to performance of the activity;
- 14. The ORF land shall be released only after the proper handing taking note signed by the both the parties.
- 15. This clearance shall be revoke without any liability on part of Government if the holder of this clearance violates any of the above terms & conditions;
- 16. This shall valid till one year from the date of issue and subject to the periodic review and changes.

Zheingang, Post Box 394; Tele No. 00 975 - 03 -741205 / 741323 Fax No. 741221/ e-mail dfozbern@moaf.gov.bt





Non-compliance of any of the above mentioned conditions is a violation of the Forest and Nature Conservation Act 1995 and its Rules 2006 and amended Rules 2008 and any other relevant laws. This shall result in revocation/suspension of the Forestry Clearance, in part or in whole and the penalties enforced as per the Act without any liability on the part of the government;

This is issued as per field inspection report submitted by Unit In charge, CFMU vide no.CFMU/DoF/22/ 2013-14/37 dated 25/12/2013.

(Ugyen Ter Chief Forestry Daticer

Copy to:

- 1. The Dasho Dzongdhag, Dzongkhag Administration, Trongsa for kind information.
- 2. The Gup, Geog Administration, Tangsibgi Gewog for kind information.
- 3. The Project Manager, NHPP, Trongsa for information.
- 4. The Unit In charge, CFMU for information.
- 5. Office copy.

Zhemgang, Post Box 394; Tele No. 00 975 - 03 -741205 / 741323 Fax No. 741221/ e-mail dfozhem@moaf.gov.bt

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Royal Government of Bhutan Ministry of Agriculture and Forests Department of Forests and Park Services THIMPHU



No. DoFPS/Ka-3-2/2014/ 1038

The Chief Forest Officer Zhemgang Forests Division.

Sub: Approval for issuance of Forestry Clearance



As recommended by your office letter no. 727 dated 31/12/2013, the approval is hereby accorded as per the annexure 18(d),(6)for issuance of Forest Clearance for proposed re-alignment of 33kv transmission line passing through the SRF land measuring 5km length & 12metres wide, from Banglapokto to Damsite of NHPP via biological corridor of JSWNP & JDWNP in favour of NHPP, Trongsa.

Therefore, you are asked to issue the forest clearance for above activity from your end as per the existing guidelines. The trees and poles within the transmission alignment should be handed over to NRDCL for extraction & disposal as per the F&NCAR, 2008.

(Chencho Norbu) **Director General**

Copy to:

1. The CFO, WCD information.

2. PA to Director General, DoFPS for record.

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Annex Q – Critical Habitat Assessment

Distribution and Habitat Requirements of Endangered and Bhutan Schedule 1 Wildlife, Birds, and Plants.

Critical habitat assessment is an important part of the environmental impact assessment process for the Nikachhu project, given the presence of a small part of the Jigme Singye Wangchuck National Park (JSWNP), an IUCN category II protected area, and a biological corridor in the project area (the ADB SPS notes that critical habitats include legally protected areas such as the JSWNP¹). Bhutan supports a number of threatened (protected/endangered) species of plants and animals, including those in the JSWNP and other protected areas that are connected together by the biological corridors. It is therefore necessary to determine if the project area itself (the project footprints and immediately adjacent areas) is critical for the survival of these threatened species.

This assessment is based on the latest IUCN data and maps for the key species of concern, as well as recent research reports and surveys for specific animals. It has also been supported by habitat and wildlife surveys in the proposed project footprint areas (twice under the project), opinions of species experts (including WWF and the Royal Society for the Protection of Nature in the early phase of the EIA and again as this critical habitat assessment was developed), as well as review of JSW National Park staff and local community scientific and anecdotal information on wildlife in the area. All the information in this critical habitat assessment has been reviewed on a species basis by the National Park office, and found to be up-to date and accurate. Independent expert opinions regarding several protected species in the JSWNP and their range and habitat requirements were also sought, to corroborate the project conclusions regarding critical habitat.

The detailed analysis and species-specific data are noted below.

Criteria that the analysis responds to:

The objective of this critical habitat assessment is to: (i) determine if critical habitat is present in the project area; and, (ii) determine if there will be any measurable adverse impacts, following the definitions and requirements within ADB's Safeguard Policy Statement (SPS, 2009).

Specifically, the SPS defines critical habitat as:

Critical habitat is an area that has high biodiversity value. It includes (ADB Sourcebook, 2012):

- habitat required for the survival of critically endangered or endangered species;
- areas having special significance for endemic or restricted-range species;
- sites that are critical for the survival of migratory species;
- areas supporting globally significant concentrations or numbers of individuals of congregatory species;
- areas with unique assemblages of species or that are associated with key evolutionary processes or provide key ecosystem services; and
- areas having biodiversity of significant social, economic, or cultural importance to local communities.

¹ Areas of high biodiversity value that are designated National Park (under IUCN Category II protected area criteria) are likely to qualify as critical habitat, and so the JSWNP has been treated as such. In Bhutan, biological corridors link the National Parks together at a landscape scale ensuring species migration and meta-population conservation. Being contiguous with the JSWNP, the biological corridor has therefore also been treated as a critical habitat, although it is not subject to the same level of legal protection given to a National Park.

Furthermore, Appendix 1, para 28 of the SPS sets out specific requirements for projects that may affect critical habitat, such that, no project activity will be implemented in areas of critical habitat unless the following requirements have been met:

- There are no measurable adverse impacts, or likelihood of such, on the critical habitat which could impair its high biodiversity value or the ability to function.
- The project is not anticipated to lead to a reduction in the population of any recognized endangered or critically endangered species or a loss in area of the habitat concerned such that the persistence of a viable and representative host ecosystem be compromised.

In order to identify if the project area is critical for the survival of threatened species, quantitative thresholds for critical habitat determination described in the International Finance Corporation (IFC) Performance Standard 6, Guidance Note 2012 have also been used as guidance (see below). Specifically, the IFC describes critical habitat in two tiers.

Tier one states:

- Habitat required to sustain >10 percent of the global population of a CR or EN species/subspecies where there are known, regular occurrences of the species and where that habitat could be considered a discrete management unit for that species.
- Habitat with known, regular occurrences of CR or EN species where that habitat is one of 10 or fewer discrete management sites globally for that species.

Tier two states:

- Habitat that supports the regular occurrence of a single individual of a CR species and/or habitat containing regionally-important concentrations of a Red listed EN species where that habitat could be considered a discrete management unit for that species/subspecies.
- Habitat of significant importance to CR or EN species that are wide-ranging and/or whose population distribution is not well understood and where the loss of such a habitat could potentially impact the long-term survivability of the species.
- As appropriate, habitat containing nationally/regionally important concentrations of an EN, CR or equivalent national/regional listing.

IFC Guidance (Performance Standard 6) regarding endemic species was also considered (for Golden Langur). An endemic species is defined as one that has greater than or equal to 95% of its global range inside the country or region of analysis. The Tier 1 and Tier 2 sub-criteria for Criterion 2 are defined as follows:

Tier 1: Habitat known to sustain \geq 95 percent of the global population of an endemic or restricted-range species where that habitat could be considered a discrete management unit for that species (e.g., a single-site endemic).

Tier 2: Habitat known to sustain \geq 1 percent but < 95 percent of the global population of an endemic or restricted-range species where that habitat could be considered a discrete management unit for that species, where adequate data are available and/or based on expert judgment.

Relevant aspects of the IFC Guidance Note 6 - Biodiversity Conservation and Sustainable Management of Living Nature Resources (January 2012) are highlighted below:

HCV Type	Performance Standards	
HCV 1: Areas containing globally, regionally or nationally significant concentrations of biodiversity values	Critical habitat in most cases. See paragraphs GN55– GN112 for further guidance.	
HCV 1.1: Protected areas		
HCV 1.2: Rare, threatened or endangered species		
HCV 1.3: Endemic species		
HCV 1.4: Seasonal concentrations of species		
HCV 2: Globally, regionally or nationally significant large landscape-level areas where viable populations of most if not all naturally occurring species exist in natural patterns of distribution and abundance.	Natural habitat, and may be critical habitat if areas contain high biodiversity values as identified in paragraph 16 of Performance Standard 6.	
HCV 3: Areas that are in or contain rare threatened or endangered ecosystems	Critical habitat	
HCV 4: Areas that provide basic ecosystem services in critical situations	ADDA DESCRIPTION RECEIPTON	
HCV 4.1: Areas critical to water catchments	Phonity ecosystem services as defined by paragraph	
HCV 4.2: Areas critical to erosion control	24 of Performance Standard 6, See paragraphs	
HCV 4.3: Areas providing critical barriers to destructive fire	GN 120-GN 142 for further guidance.	
HCV 5: Areas fundamental to meeting basic needs of local communities	Priority ecosystem services as defined by paragraph 24 of Performance Standard 6. Client requirements defined in Performance Standard 5 are also applicable. See paragraphs GN126–GN142 for further guidance.	
HCV 6: Areas critical to local communities' traditional cultural identify (areas of cultural, ecological, economic	Priority ecosystem services as defined by paragraph 24 of Performance Standard 6. Client requirements	

High Conservation Value Types and Performance Standard 6

GN65. For Criteria 1 through 3, the project should determine a sensible boundary (ecological or political which defines the area of habitat to be considered for the Critical Habitat Assessment. This is called the 'discrete management unit," an area with a definable boundary within which the biological communities and/or management issues have more in common with each other than they do with those in adjacent areas (adapted from the definition of discreteness by the Alliance for Zero Extinction). A discrete management unit may or may not have an actual management boundary (e.g., legally protected areas, World Heritage sites, KBAs, IBAs, community reserves) but could also be defined by some other sensible ecologically definable boundary (e.g., watershed, interfluvial zone, intact forest patch within patchy modified habitat, seagrass habitat, coral reef, concentrated upwelling area, etc.). The delineation of the management unit will depend on the species (and, at times, subspecies) of concern.

Identification of the DMU:

Critical habitat assessment requires the definition of a discrete management unit (DMU) that can guide the analysis of whether or not the project area will impinge on critical habitat for endangered or Bhutan protected species. A DMU is an area with a clearly demarcated boundary within which the biological communities and/or management issues have more in common with each other than they do with those in adjacent areas. While different species may have different habitat requirements and ranges, which would dictate different discrete management units, in reality, for central Bhutan, the declaration of Jigme Singye Wangchuck

National Park (JSWNP) has already recognized the habitat requirements and ranges of the important and endangered species that occur in this part of the country (the JSWNP is dominated by pristine broadleaf forest in the lower altitude areas of the park and undisturbed coniferous forest at higher altitudes). Furthermore, as it is defined by a mountain range (the Black Mountains), bordered by the Nikachhu in the north and the Mangdechhu in the east, and surrounded by national highway on the northeast, east, and southeast sides, it has both a natural, functional, and legal boundary that clearly defines and facilitates management of important habitats for a large number of species. Therefore, for the purpose of the critical habitat assessment for the Nikachhu project, the discrete management unit is defined as the JSWNP and part of the eastern biological corridor (which extends to the Wangchuk Centennial Park) immediately to the north of the JSWNP (see map), as well as the immediate adjacent area of about 5 km, which includes all project footprints for the hydropower project construction sites, as well as the transmission line alignment. The project footprints (these include work sites where there will be temporary or permanent loss of forest habitat and construction activity, not areas where there will be **no** human presence associated with the project) and immediate zone of influence (within 5 km of the project footprints) are located at the extreme northern edge of this discrete management unit. The habitat type in the project area is characterized mostly by degraded forest (previously harvested in places and re-growing, and patches now used for cattle grazing), barren areas, the national highway, and various houses (mostly scattered along the right of way of the national highway and in adjacent areas). More specifically, the project interaction with the project area will be as follows:

- inundation of the Nikachhu above the project dam will flood 2.4 hectares of very steep slope (about 20-30 m width x 800 m length along the northern edge of the JSWNP, in its multi-purpose buffer zone);the very steep slopes in the Nikachhu gorge at the proposed dam site and upstream and downstream for 3-4 km (especially on the right bank, which is the Park side) are not easily used by land-based wildlife (being about 70-90° slopes, damp, and slippery);
- the rest of the JSWNP (more than 99.99% of the Park area) will remain completely undisturbed and still accessible to wildlife;
- all the project footprints (dam site, adits, powerhouse works) are on the north side (left bank) of the Nikachhu, which as noted previously, is characterized as a disturbed habitat, with a national highway running along the high ground next to the Nikachhu river, some houses, dry land, secondary forest, and cattle grazing areas; and,
- there will be a muck disposal site near the national highway in one of three biological corridors that connect JSWNP to the north; this temporary work site (which will be fully rehabilitated after 1.5 2 years) takes up only 15% of the width of the biological corridor, and being within 100-200 m of the national highway, is not likely to be heavily used by animals; animals will still have access to undisturbed habitat within the biological corridor on either side of the muck disposal site.

Species assessed:

For the critical habitat assessment, the range and habitat requirements of each of the protected/endangered animals in Bhutan were addressed. Those species which have been observed in and near JSWNP (in the DMU) were considered in more detail on a species-specific basis. These details are provided below. For each species, a conclusion regarding whether or not Tier 1 and 2 criteria (under the IFC Guidance Note 6) are triggered by the project area (i.e., whether or not the project area is habitat critical to the survival of endangered species) is provided.



Wildlife (endangered species in Bhutan):

Common Name	Scientific Name	IUCN and National Threat Category	Present in Project Area**
1.Asian Elephant	Elephas maximus	Endangered Schedule I*	No
2. Indian Water Buffalo	Bubalus arnee	Endangered Schedule I*	No
3. Tiger	Panthera tigris	Endangered Schedule I*	Not sighted, but reported by locals and Park staff, 4 km away to the northwest.
4. Chinese Pangolin	Manis pentadactyla	Critically Endangered Schedule 1*	No
5. Clouded Leopard	Neofelis nebulosa	Vulnerable Schedule I*	No
6. Dhole/ Wild Dog	Cuon alpines	Endangered	Not sighted, but reported by locals and Park staff
7. Fishing Cat	Prionailurus viverrinus	Endangered	No
8. Ganges River Dolphin	Platanista gangetica	Endangered	No
9. Gaur	Bos gaurus	Vulnerable	In camera trap,

Common Name	Scientific Name	IUCN and National Threat Category	Present in Project Area**
		Schedule I*	according to Park staff (at the lower Mangdechhu- Nikachhu confluence)
10. Golden Langur	Trachypithecus geei	Endangered (endemic) Schedule I*	Not sighted in the project area; reported by locals and Park staff on two occasions more than 5 km from project footprints
11. Asiatic Black Bear	Ursus thibetanus	Vulnerable Schedule I*	Not sighted, but reported by locals and Park staff
12. Himalayan Musk Deer	Moschus Ieucogaster	Endangered Schedule I*	No
13. Hispid Hare	Caprolagus hispidus	Endangered	No
14. Leopard	Panthera pardus	Near threatened Schedule I*	Not sighted, but reported by locals and Park staff
15. Leopard Cat	Prionailurus bengalensis	Least Concern Schedule I*	Yes
16. Pygmy Hog	Porcula salvania	Critically Endangered Schedule I*	No
17. Red Panda	Ailurus fulgens	Vulnerable Schedule I*	Yes (reported in the Park by forestry staff; they are mostly located above 2,400 meters asl, which is above the elevation of the project sites)
18. Serow	Capricornis sumatraensis (thar)	Near Threatened Schedule I*	Not sighted, but reported by locals and Park staff
19. Snow Leopard	Panthera uncia	Endangered Schedule I*	No
20. Takin	Budorcas taxicolor	Vulnerable Schedule I*	No

Schedule I* means that the species is included in the Schedule I of the Species and Nature Conservation Act of Bhutan.

** The project area is taken to mean within about 5 km of the specific project component footprints, including the JSWNP, even though the project will only encroach about 20-30 meters into the Park buffer zone at the inundation area above the diversion dam, and about 5 km north, up the eastern biological corridor (one of three connecting JSWNP to areas in the north). See below for detailed explanations of species distributions (whether in the project area or not).

IUCN Critically Endangered (Bhutan Schedule 1) birds that have been recorded in JSW National Park (but not observed during the animal surveys at the project footprint areas): White-bellied heron (*Ardea insignis*); this is further considered below (animal #21).

Vulnerable Schedule 1 bird observed along parts of the proposed transmission line RoW: Rufous-necked hornbill (*Aceros nipalensis*); this is further considered below (animal #22).

Endemic and Schedule 1 plants that have been recorded in JSW National Park (but not observed in the survey plots at the project footprint areas):

Cryptocarya bhutanica (endemic); *Corylopsis himalayana* (endemic), *Allium rhabdotum* (endemic), *Viola bhutanica* (endemic), *Taxus baccata* (Schedule 1), and *Panax psedo-ginseng* (Schedule 1). These are not further considered as they have not been observed during surveys in the project area.

Tree fern (*Cyathea spinulosa*) which is protected in Bhutan, was observed at the project site. It occurs throughout Asia (but, it does not have any IUCN classification). It is not further considered here, due to its widespread distribution. Furthermore, it is not considered endangered according to IUCN.

Migratory birds that have been recorded in JSW National Park (but not observed during the animal surveys at the project footprint areas):

Anas strepera, Cuculus canorus, Hierococcyx sparverioides, Cuculus saturatus, Niltava sandara, Aethopyga ignicauda, Phalacrocorax carbo. As these all occur throughout Bhutan and elsewhere in Asia, or beyond, they do not have endangered status, and they were not observed in the project area, they are not further considered.

Species-specific distribution and habitat requirement data (from the IUCN database, Bhutan wildlife research papers, and JSWNP survey data).

† indicates the project area:

Common Name	Scientific Name	IUCN and National Threat Category	Present in Project Area
1. Asian Elephant	Elephas maximus	Endangered Schedule I	No



IFC Criteria: The Asian elephant occurs only at lower altitudes in southern Bhutan and in other countries in South and Southeast Asia, as indicated by the IUCN database (see map). It has never been seen in the northern part of JSWNP. The project area has no habitat importance for Asian elephants, so does not trigger Tier 1 or 2 criteria.

Conclusion Regarding Project Interactions with Critical Habitat:There is no concern for elephants, as they do not occur in the project area (restricted to southern Bhutan and elsewhere).

Common Name	Scientific Name	IUCN and National Threat Category	Present in Project Area
2. Indian Water Buffalo	Bubalus arnee	Endangered Schedule I	No



IFC Criteria: The Indian water buffalo only occurs in a small area along the Bhutan-India border (and a few other locations in India). It is not present in the project area, as it prefers low-lying alluvial grasslands, pools, and marsh areas (evident further to the south), so Tier 1 and 2 criteria are not triggered.

Conclusion Regarding Project Interactions with Critical Habitat: There is no concern for Indian water buffalo, as they do not occur in the project area (restricted to southern Bhutan and elsewhere).
Common Name	Scientific Name	IUCN and National Threat Category	Present in Project Area
3. Tiger	Panthera tigris	Endangered Schedule I	Not sighted, but reported by locals and Park staff, 4 km away to the northwest.





IUCN Status: Listed as endangered, as a precautionary approach finds that the population of breeding adult Tigers is likely fewer than 2,500 mature individuals (in 42 protected source sites, there is evidence of a breeding total of 2,154 Tigers).

Range: The Tiger once ranged widely across Asia, from Turkey in the west to the eastern coast of Russia (Nowell and Jackson 1996). Over the past 100 years Tigers have disappeared from southwest and central Asia, from two Indonesian islands (Java and Bali) and from large areas of Southeast and Eastern Asia. Tigers have lost over 93% of their historic range (Sanderson *et al.* 2006, Walston *et al.* 2010b). Tigers are currently found in thirteen Asian range states: Bangladesh, Bhutan, Cambodia, China, India, Indonesia, Lao PDR, Malaysia, Myanmar, Nepal, Russia, Thailand and Viet Nam. They may still persist in North Korea, although there has been no recent confirmed evidence.

In 1994, the first comprehensive assessment to delineate Tiger range was carried out (Dinerstein *et al.* 1997). Priority areas for Tiger conservation were estimated to total 1.64 million km² in 159 Tiger Conservation Units (TCUs), roughly equivalent to discrete meta-populations, not including Russia (later estimated at 270,0000 km²: Sanderson *et al.* 2006) and China. While this was generally considered representative of current distribution, Tiger presence was confirmed in just 47% of the TCUs, and 89% were scored as undergoing medium to high levels of poaching of Tigers and their prey.

This exercise was revised and updated ten years later, and in delineating Tiger Conservation Landscapes (TCLs), greater emphasis was placed on actual records of Tiger presence and breeding (Sanderson *et al.* 2006). TCLs were defined as areas where there is sufficient habitat to conserve at least five Tigers, and Tigers have been confirmed to occur in the past decade. Tiger range was estimated at 1.1 million km² in 76 TCLs (again, roughly equivalent to discrete meta-populations). This represented a 41% decline from the range described a decade earlier (in South and Southeast Asia, a drop from 1.55 million km² to 914,000 km²: Sanderson *et al.* 2006: 63), attributed primarily to poaching pressure (Dinerstein *et al.* 2007). Habitat loss due to deforestation was also to blame, notable particularly in Sumatra and Myanmar (Wikramanayake *et al.* 2010). In India, landscapes with Tigers found to be much smaller and more fragmented than in the original assessment (Sanderson *et al.* 2006: 63 and Figure 4.12).

Source Sites have been defined as areas with confirmed current presence of Tigers and evidence of breeding, population estimates of >25 breeding females, legal protection, and embedded in a larger habitat landscape with the potential to hold >50 breeding females. An extensive review of scientific literature as well as correspondence with Tiger scientists and protected area managers resulted in the identification of just 42 source sites totaling approximately 90,000 km².

Native to: Bangladesh; Bhutan; Cambodia; China (Anhui - Regionally Extinct, Beijing - Regionally Extinct, Chongqing - Regionally Extinct, Fujian - Possibly Extinct, Guangdong - Possibly Extinct, Guangxi - Regionally Extinct, Guizhou - Regionally Extinct, Hebei - Regionally Extinct, Heilongjiang, Henan - Regionally Extinct, Hubei - Regionally Extinct, Hunan - Possibly Extinct, Jiangsu - Regionally Extinct, Jiangxi - Possibly Extinct, Jilin, Liaoning - Regionally Extinct, Shaanxi - Possibly Extinct, Shandong - Regionally Extinct, Shanaxi - Regionally Extinct, Sichuan - Regionally Extinct, Tianjin - Regionally Extinct, Tibet [or Xizang], Xinjiang - Regionally Extinct, Java - Regionally Extinct, Sumatera); Lao People's Democratic Republic; Malaysia (Peninsular Malaysia); Myanmar; Nepal; Russian Federation; Thailand; Viet Nam.

Bhutan-specific data: Bhutan forms the northwest portion of Tiger Conservation Landscape (TCL37), a global priority ITCL that includes prime tiger habitat all the way to Namdapha in India and the Hukawng Valley in Myanmar. Tigers in Bhutan range from 100 masl in the south to as high as 4,500 m in the north. There are more tigers in the south (subtropical forest) compared to the central Himalayan region (temperate forest).

WWF Bhutan and Wildlife Conservation Division, Ministry of Agriculture and Forests have been implementing the Tiger Action Plan since 2006. Tiger conservation programs were first evident in 1996, but over the years a more comprehensive approach has been explored. Based on the surveys, approximately 115-150 tigers are estimated to exist in Bhutan (67 to 81 are said to be adults) and these range over much of the country covering at least 10,714 km2, mainly in three clusters northwest of the project area, east, and south of the project area. The average density of tigers in Bhutan is one per 70 km2. The recent JSWNP tiger survey indicates one tiger per 50 km² in prime habitat. The prime habitat has been determined to be within the temperate forests of Langthel, Nabji-Korphu, and Tingtibi, which are 70-135 km away from the project area, down the Mangdechhu. JSWNP links the tiger habitats of Royal Manas National Park and Northern Protected Areas on the eastern side of the Black Mountains. The general observation is that tigers are mostly observed in camera traps set on hill tops and game trails. Dr. Sonam Wangyel's camera trap surveys in JSWNP (in 2006-2007) have indicated that tigers prefer less disturbed areas further away from human settlements. Only two tigers have been detected in camera traps in the northern part of JSWNP, more than 5 km from the project area.

Recent tiger camera trap surveys near Trongsa indicate that tigers are evident in a range northeast outside the project area (east of the Mangdechhu) and northwest outside the project area (Pela Pass), and that tiger movements are more likely to be west-east, about 10 km north of the project area, rather than in other directions.

Dr. Sonam Wangyel mentioned that the nearest breeding areas for tigers are located at Dorji Goenpa and Pelela, which are away from the project area. Furthermore, according to Dr. Sonam Wangyel (external tiger expert), Bhutan has about twice as many tigers as the area can actually support. He advised (during this CHA) that there should be no measurable adverse impacts on the Tiger population and their movement since most of project structures are underground. He also considers that the project area is not a critical habitat for Tigers.

Source for data above: Chundawat, R.S., Habib, B., Karanth, U., Kawanishi, K., Ahmad Khan, J., Lynam, T., Miquelle, D., Nyhus, P., Sunarto, S., Tilson, R. &Sonam Wang 2011. *Pantheratigris.* The IUCN Red List of Threatened Species. Version 2014.2. <<u>www.iucnredlist.org</u>>. Downloaded on **02 September 2014**.

http://www.wwfbhutan.org/projects /species/wwf bhutan/

Tharchen, L. 2013. Report on Ecological Survey and Monitoring of Tigers at Trongsa Forest Range, Zhemgang Forest Division, Bhutan.

Tiger Action Plan for the Kingdom of Bhutan 2006-2015. 2005. Wildlife Conservation Division, Ministry of Agriculture and Forestry, in collaboration with WWF Bhutan Program.

Ministry of Agriculture and Forestry. 2014. Preliminary Report of the National Tiger Survey of Bhutan 2014 (Updates from the Southern Belt).

Sonam Wangyel Wanga and David W. Macdonald. 2009. The use of camera traps for estimating tiger and leopard populations in the high altitude mountains of Bhutan.

S. W. Wang & D. W. Macdonald. 2011. Feeding habits and niche partitioning in a predator guild composed of tigers, leopards and dholes in a temperate ecosystem in central Bhutan.

IFC Criteria: There has been only one tiger sighting 4 km away from the project footprints (to the northwest), and only 3 tigers in total sighted in an area 10 km out of the project footprints. This represents less than 3% of the tiger population in Bhutan and <0.1% of the global tiger population. There are at least 42 protected sites globally that support tiger populations. JSWNP, and the immediate adjacent area, therefore represents only 2% of the global management sites for tigers. Tier 1 criteria for tigers are therefore not triggered by the project. As the project footprints are located in disturbed and degraded forest habitat very close to the national highway and settlements (habitat that is avoided by tigers; they have never been seen there), the project work sites are not considered to be critical habitat for tigers. All data for the area indicate that tigers prefer the less disturbed forest habitat northwest and northeast of the project area, and while tigers may range over large areas, in the area north of the JSWNP, they have not ranged into the project area near the national highway and the Nikachhu, which is a much more disturbed habitat than areas to the north and south. As such, the project area does not support regionally important concentrations of tigers. Therefore, Tier 2 criteria for tigers are not triggered by the temporary project work sites.

Conclusion Regarding Project Interactions with Critical Habitat: The project area is on the edge of one of three main tiger sighting clusters in Bhutan. However, most of the Tiger population in JSWNP occurs much further to the south on the Mangdechhu, and there are other more dense Tiger sighting areas to the northwest and east of the project. Less than 3% of the tiger population in Bhutan may use habitat northwest and northeast of the project area. They have never been sighted in the vicinity of the national highway along the Nikachhu (where the project work sites will be). 85% of the biological corridor width at a muck disposal site and all of the biological corridor north of the national highway will remain undisturbed. Camera trap data indicate that tigers prefer hill tops and prey runs, rather than the river gorge and slopes that characterize the Nikachhu project area. The very steep slopes in the Nikachhu gorge at the proposed dam site and upstream and downstream for 3 - 4 km (especially on the right bank, which is the Park side) cannot be used by tigers (being about 70-90° slopes, damp, and slippery). As such, this particular area is not expected to be an important tiger movement corridor (the recent survey data indicate an east-west movement corridor about 10 km north away from the project area. In any case, at night time, all construction activities will be disallowed, to avoid disrupting wildlife movements. It is therefore considered that the temporary project disturbance at work sites in degraded forest habitat near the national highway will not negatively impact Tiger critical habitat nor reduce the Tiger population, and no further mitigation measures or habitat offsets are required. However, it is still proposed that wildlife monitoring be conducted to determine possible interactions between the project and Tigers, and their use of the biological corridors. The external expert (Dr. Sonam Wangyel) has indicated that because the project area is not a critical habitat for tigers, the project will not have measurable adverse impacts and affect their population.

Common Name	Scientific Name	IUCN and National Threat Category	Present in Project Area
4. Chinese Pangolin	Manis pentadactyla	Critically endangered Schedule 1	No



IUCN Status: Critically endangered. However, little is known of this species. It is listed as a protected species in national or sub-national legislation in all range states, except Bhutan.

Range: This species occurs in the Himalayan foothills of Nepal, southern Bhutan and north and northeastern India, possibly northeastern Bangladesh, northern and western Myanmar, to northern and Annamite regions of Lao PDR and northern Viet Nam, northwest Thailand, and through southern China (south of the Chiangjiang - the Yangtze River) to Hainan, Taiwan (P.R. China) and Hong Kong SAR. However, it has likely been extirpated from parts of its current range, the limits of which are poorly known and may never be elucidated, due to high levels of exploitation historically. It exists at high altitudes, especially in the southern and western parts of its range, though also occurs at much lower altitudes, for example in Hong Kong and likely in the northeast of its range. Its latitudinal range is thought to overlap considerably with that of *Manis javanica*, with *Manis pentadactyla* tending to occur in hills and mountains and the former more generally found at lower altitudes. However, recent interviews with hunters in Viet Nam suggest that the two species can be found in the same areas of forest, and that the differences between them are ecological, relating to diet and habitat use, rather than altitude (P. Newton pers. comm. 2008).

The species is marginally present in northern India (Bihar) and has been recorded in northeastern India (Arunachal Pradesh, Assam, Meghalaya, Nagaland, Manipur, Tripura, Mizoram, Sikkim and the northern part of West Bengal) (Srinivasulu and Srinivasulu 2012, Tikader 1983, Zoological Society of India 2002).

The species occurs in southern Bhutan (though potentially central and western areas only) and Nepal, where it is confined to elevations below approximately 2,000 m asl (Baral and Shah 2008, Mitchell 1975, Srinivasulu and Srinivasulu 2012). It has been recorded as present in the Suklaphanta wildlife reserve in southwest Nepal within the last four years and in Jajarkot district in mid-west Nepal (H.S. Baral pers. comm. 2013).

This species has been recorded in north and central Lao PDR, however, there are too few locality records to determine the geographic and altitudinal range of the species in the country with any accuracy (Duckworth et al. 1999; Timmins and Evans 1996).

Source for data above: Challender, D., Baillie, J., Ades, G., Kaspal, P., Chan, B., Khatiwada, A., Xu, L., Chin, S., KC, R., Nash, H. & Hsieh, H. 2014. *Manis pentadactyla*. The IUCN Red List of Threatened Species. Version 2014.2. <<u>www.iucnredlist.org</u>>. Downloaded on 02 September 2014.

IFC Criteria: This animal is restricted to lower altitudes (below 2,000 m; the project area is at about 2,300 m asl) and in Bhutan is limited to the southern areas. It has not been recorded from the northern section of JSWNP. The project area has no habitat importance for Chinese Pangolin. As such, the project area does not trigger Tier 1 and 2 criteria for Chinese Pangolin.

Conclusion Regarding Project Interactions with Critical Habitat: The project site is beyond the distribution range of the Chinese Pangolin. As the project area has no habitat value for Chinese Pangolin, no interactions are expected.

Common Name	Scientific Name	IUCN and National Threat Category	Present in Project Area
5. Clouded Leopard	Neofelis nebulosa	Vulnerable Schedule I	No



IUCN Status: Vulnerable.

Range: The clouded leopard is found from the Himalayan foothills in Nepal through mainland Southeast Asia into China (Nowell and Jackson 1996). The clouded leopard historically had a wide distribution in China, south of the Yangtze, but recent records are few, habitat is fast disappearing, illegal hunting of this species has been prolific and its current distribution in China is poorly known (Wozencraft *et al.* 2008). The clouded leopard is extinct on the island of Taiwan (Anon. 1996). It still occurs marginally in Bangladesh: Khan (2004) reported that local people still see clouded leopards in the mixed-evergreen forests of the northeastern and southeastern parts of the country.

The map shows range within forest cover (European Commission, Joint Research Centre, 2003) to reflect patchiness caused by deforestation upon recommendation of the assessors (IUCN Cats Red List workshop 2007).

Native: Bangladesh; Bhutan; Cambodia; China; India; Lao People's Democratic Republic; Malaysia (Peninsular Malaysia); Myanmar; Nepal; Thailand; Viet Nam Regionally extinct: Taiwan, Province of China

They are strongly associated with forest habitat, particularly primary evergreen tropical rainforest, but there are also records from dry and deciduous forest, as well as secondary and logged forests. They have been recorded in the Himalayas up to 2,500 m and possibly as high as 3,000 m. Less frequently, they have been found in grassland and scrub, dry tropical forests and mangrove swamps (Nowell and Jackson 1996).

Source for data above: Sanderson, J., Khan, J.A., Grassman, L. & Mallon, D.P. 2008. *Neofelis nebulosa*. The IUCN Red List of Threatened Species. Version 2014.2. <<u>www.iucnredlist.org</u>>. Downloaded on **02 September 2014**.

IFC Criteria: Clouded leopards have never been recorded in the northern part of the JSWNP (recent camera trap surveys also confirmed that clouded leopards are not present in the Trongsa area, which is nearby). The animal is not IUCN critical or endangered, so does not trigger Tier 1 criteria. Also, because this animal is only IUCN "vulnerable" and Schedule 1, the project area does not trigger Tier 2 criteria, since there are no nationally or regionally important concentrations of clouded leopards in this region of the country.

Conclusion Regarding Project Interactions with Critical Habitat: While clouded leopards may occur in JSWNP and the project area, they have not been recorded for this region. Therefore, it is suggested that the project area, as degraded forest habitat adjacent to human settlements and a national highway, is not important for this animal. Project interactions with the clouded leopard are not expected (even if this animal were to occur there), as they will continue to have undisturbed access to the large area of JSWNP, through forested areas between project work sites.

Common Name	Scientific Name	IUCN and National Threat Category	Present in Project Area
6. Dhole/ Wild Dog	Cuon alpines	Endangered Not Schedule 1	Not sighted, but reported by locals and Park staff



Status: Endangered. It is estimated that fewer than 2,500 mature individuals remain in the wild and the declining population trend is expected to continue. Main threats to the species include ongoing habitat loss, depletion of prey base, interspecific competition, persecution and possibly disease transfer from domestic and feral dogs.

Range: In Central and eastern Asia, there have been no confirmed, recent reports of dholes from Russia, Mongolia, Kazakhstan, Kyrgyzstan (where they were found formerly in the Tian-Shan area) or Tajikistan (where they were found formerly in the eastern Pamir area) (A. Poyarkov and N. Ovsyanikov in litt. D. Miquelle pers. comm.). There is a recent report of a dhole that was captured in Jiangxi district, south China (C. Bellamy pers. comm.). Dholes were once present in parts of western China in the Tian-Shan Range, but the species' current status in this area is unclear; they do at least still persist, perhaps in low numbers, in parts of the Qilian Shan in north-western Gansu Province (Harris 2006). The species is still found in Tibet today, particularly in areas bordering the Ladakh region of India (R. Wangchuk pers. comm.), and the Tibet Forestry Bureau has reported that dholes are still "common" in parts of southeast Tibet (S. Chan, in litt.). Dholes occurred in northern Korea (Won Chang Man and Smith 1999) and a few small populations may still exist. There have been no records from Pakistan, but the species occurred on the alpine steppes of Ladakh, Kashmir, and India (Johnsingh 1985) that extend into the region termed Pakistan-occupied Kashmir by India.

Dholes are still found throughout much of India south of the river Ganges, and especially in the Central Indian Highlands and the Western and Eastern Ghats of the southern states. They are also found throughout north-east India, in the states of Arunachal Pradesh, Assam, Meghalaya, and West Bengal (A. Venkataraman, A.J.T. Johnsingh and L. Durbin pers. comm.). In the

Himalaya and north-western India, the status of dholes seems more precarious with a much more fragmented distribution. Dholes reportedly still occur in the Ladakh area of Kashmir, which is contiguous with the Tibetan highlands in China (R. Wangchuk, pers. comm.).

The species formerly was recorded in the Terai region of the Indo-gangetic plain, including the Royal Chitawan National Park in Nepal, but there have been few recent reports. There is an unconfirmed report of dholes in Dhorpatan Hunting Reserve in the late 1990s (R.C. Kandel, pers. comm.).

In Bhutan, there have been recent press reports that dholes have recovered from a government-initiated mass poisoning campaign in the 1970s and there have apparently been numerous recent incidents of dholes killing livestock in the lower Kheng region. Two recent, independent, eye-witness reports identify dholes in six protected areas in Bhutan (S. Wangchuk, pers. comm., T. Wangchuk pers. comm.). In some regions, dhole predation on wild boar (Susscrofa) may be viewed in a positive light by local people (T. Wangchuk, pers. comm.). The Dhole is recorded throughout the JSWNP, but sightings are not very common. Recent camera trap surveys near Trongsa (to the east of the project area) did not detect any Dhole. According to Park staff, the degraded forests in the project area cannot be considered prime habitat for the Dhole.

Native: Bangladesh; Bhutan; Cambodia; China; India; Indonesia; Kazakhstan; Kyrgyzstan; Lao People's Democratic Republic; Malaysia; Mongolia; Myanmar; Nepal; Russian Federation; Tajikistan; Thailand; Viet Nam.

Source for data above: Durbin, L.S., Hedges, S., Duckworth, J.W., Tyson, M., Lyenga, A. & Venkataraman, A. (IUCN SSC Canid Specialist Group - Dhole Working Group) 2008. *Cuon alpinus*. The IUCN Red List of Threatened Species. Version 2014.2. <<u>www.iucnredlist.org</u>>. Downloaded on 02 September 2014.

Phuntsho Thinleya, Jan F. Kamlerb, Sonam W. Wanga, KinzangLhama, Ute Stenkewitzb, David W. Macdonald. 2011. Seasonal diet of dholes (*Cuon alpinus*) in northwestern Bhutan

S. W. Wang & D. W. Macdonald. 2011. Feeding habits and niche partitioning in a predator guild composed of tigers, leopards and dholes in a temperate ecosystem in central Bhutan.

IFC Criteria: The Dhole has a widespread and contiguous range throughout the eastern Himalayas, East Asia, and Southeast Asia. Given the low frequency of sightings in JSWNP, lack of any recent sightings or camera trap photographs of this animal in the area, and the widespread distribution of this animal throughout other parts of Asia, it is extremely unlikely that the project area provides critical habitat to the Dhole (this is the opinion of wildlife experts in the Park). Tier 1 criteria are not triggered, as there is no possibility of 250 mature dholes (10% of the global population) living in this area, and there are numerous other locations and management sites throughout the protected areas of Bhutan, India, Myanmar, Vietnam, and Laos. Also, Tier 2 criteria are not triggered, since the project area does not support nationally or regionally important concentrations of Dholes; the lack of sightings confirms that the dhole, while wide-ranging within its distribution area in search of prey, has not been using the project area as habitat critical to its survival, or they would be consistently seen there.

Conclusion Regarding Project Interactions with Critical Habitat: Since the project area is not in the main contiguous range of the dhole, and sightings are not frequent or regular, interactions between the project construction activities and dholes are not expected (in any case, dholes would avoid any sites with significant human activity). Furthermore, the Nikachhu in the

vicinity of the project area is a gorge and has very steep slippery slopes, which would not be conducive to dhole movements. Dholes will continue to have undisturbed access to JSWNP, where habitat and dhole populations will remain undisturbed.

Dr. Sonam Wangyel has indicated that wild dogs are adaptable and have a wide range of distribution. Because the project area is not a critical habitat for this species, the project will not have measurable impact on the habitat and population of dholes.



IFC Criteria: The IUCN data indicate that fishing cats do not occur in the project area (see map). They are typically found in swamps and marshy areas, oxbow lakes, reed beds, tidal creeks and mangrove areas and are more scarce around smaller, fast-moving watercourses. Along watercourses, they have been recorded at elevations up to 1,525 m, but most records are from lowland areas. There is no possibility of Tier 1 and 2 criteria being triggered.

Conclusion Regarding Project Interactions with Critical Habitat: There is no concern for fishing cats, as they do not occur in the project area (they are restricted to other locations in South and Southeast Asia).

Common Name	Scientific Name	IUCN and National Threat Category	Present in Project Area
8. Ganges River Dolphin	Platanista gangetica	Endangered	No



IFC Criteria: The Ganges River Dolphin is restricted to the larger, deeper, and wider rivers of India, Bangladesh, and Pakistan. The closest they might come in Bhutan is the lower reach of the Manas River. The dolphin has never been observed in the Mangdechhu or higher up any river system in Bhutan. As the Nikachhu is run-of-river and will discharge with the Mangdechhu project into the upper Mangdechhu, the project will not affect water discharge and depth in the Manas River, which is around 100 km away from the project area and receiving contributions from a large number of major and minor tributaries. As the project has no linkage with dolphin habitat, Tier 1 and 2 criteria are not triggered.

Conclusion Regarding Project Interactions with Critical Habitat: There is no concern for Ganges River dolphins, as they do not occur in the project area (restricted to more southern rivers), and will not be affected by the Nikachhu and Mangechhu project discharge patterns.

Common Name	Scientific Name	IUCN and National Threat Category	Present in Project Area
9. Gaur	Bos gaurus	Vulnerable Schedule I	In camera trap, according to Park staff (at the lower Mangdechhu-Nikachhu confluence)



IUCN Status: Vulnerable.

Range: Gaur historically occurred throughout mainland south and southeast Asia and Sri Lanka. It currently occurs in scattered areas in the following range states: Bhutan, Cambodia, China, India, Lao PDR, Malaysia (Peninsular Malaysia only), Myanmar, Nepal, Thailand, and Viet Nam, but is extinct in Sri Lanka and also, as a resident, apparently in Bangladesh (Grubb 2005; MdAnwarul Islam in litt. 2008; Hedges in prep.). The species is now seriously fragmented within its range, and the mapped distribution is generalized, especially in India, Myanmar, China and Malaysia.

The domesticated form of Gaur, considered by IUCN a separate species (*Bos frontalis*; Mythun, Mithan or Gayal), occurs in parts of India, China, and Myanmar as feral, semi-feral, and domestic animals. This animal is excluded from the red-listing considerations for Gaur.

Native: Bangladesh; Bhutan; Cambodia; China; India; Lao People's Democratic Republic; Malaysia (Peninsular Malaysia); Myanmar; Nepal; Thailand; Viet Nam Regionally extinct: Sri Lanka

The global population is estimated to lie within 13,000–30,000 animals. Field data suggest that the proportion of mature individuals in the population is likely to be 0.4–0.6, indicating a total of 5,200–18,000 mature individuals, with no population known to have over 1,000 individuals (S. Hedges pers. comm. 2000).

In Bhutan, Gaur apparently persists all over the southern foot-hill zone, notably in Royal Manas National Park, Phipsoo Wildlife Sanctuary and Khaling Wildlife Sanctuary (Choudhury 2002). Being more confined to warmer areas, gaur sightings have been recorded in the JSWNP in the past in the warmer forests of Nabji, Langthel and Tingtibi (quite far south from the project area; 70-135 km). One has been recorded in the Chendebji area, west and outside the project area. The nearest to the project area that a gaur has been seen is at the Nikachhu-Mangdechhu confluence (outside the project area).

The Gaur occurs from sea level up to at least 2,800 m asl (Wood 1937; Wharton 1968; Choudhury 2002). Despite the many reports that call it an animal of hill-country, low-lying areas seem to comprise optimal habitat (Choudhury 2002): in Conry's (1989) study area, elevations ranged from 46 to 1,079 m asl but the three radio-tracked Gaur only used areas below 381 m. Elevations below 61 m were used most intensively and all three animals selected these low-lying areas; elevations above 61 m were selected against or used in proportion to availability (Conry 1989). Similarly, in the Tenasserim–Dawna mountains, Thailand, signs of Gaur were more abundant in the lowlands than in the hills, noting that this was the opposite of the patterns that would be predicted if hunting (itself concentrated heavily in the lowlands) was the chief determinant of population densities, although solitary animals were found mainly in the hills (Steinmetz *et al.* 2008).

Gaur habitat to be "characterized by (1) large, relatively undisturbed forest tracts, (2) hilly terrain below an altitude of 5,000 to 6,000 ft (1,500–1,800 m asl), (3) availability of water, and (4) an abundance of forage in the form of coarse grasses (including bamboo), shrubs, and trees".

Source for data above: Duckworth, J.W., Steinmetz, R., Timmins, R.J., Pattanavibool, A., Than Zaw, Do Tuoc& Hedges, S. 2008. *Bos gaurus*. The IUCN Red List of Threatened Species. Version 2014.2. <<u>www.iucnredlist.org</u>>. Downloaded on **02 September 2014**.

IFC Criteria: Gaur have never been recorded in the project area (the nearest sightings were 8-10 km southeast outside the project area, and 6-7 km to the west). As such, the project area is not serving as critical habitat for gaur. Gaur are not IUCN critically endangered or endangered, so Tier 1 criteria are not triggered. In any case, it is impossible that more than 10% of the global population (which would be 1,300 to 3,000 animals) occurs in the project vicinity. Also, there are many gaur habitat locations throughout south and southeast Asia. The project area is not considered a Gaur management site. Also, Tier 2 criteria are not triggered, since the project area does not support nationally or regionally important concentrations of gaur.

Conclusion Regarding Project Interactions with Critical Habitat: The project area is not in the prime habitat and range of the gaur. Most of the gaur population is at lower altitudes in the southern ranges of the Bhutan protected areas such as Royal Manas National Park, Phipsoo Wildlife Sanctuary, and Khaling Wildlife Sanctuary. It is therefore concluded that the proposed project clearing areas and work sites are not critically important to gaur, as most of the Bhutan population occurs further south, and they are not expected to occur at any project work sites.

Common Name	Scientific Name	IUCN and National Threat Category	Present in Project Area
10.Golden Langur	Trachypithecus geei	Endangered (endemic) Schedule I	Not sighted in the project area; reported by locals and Park staff on two occasions only, more than 5 km from project footprints



IUCN Status: Listed as Endangered because of a perceived serious population decline, inferred from an observed reduction in the extent of its habitat (notably in India, rather than Bhutan). However, recent data (see below) suggest the population numbers may be higher than estimated earlier, in both India and Bhutan, and the population may be stabilizing or increasing, especially with increased forest protection in India.

General Information on Range, Population, and Habitat: This species occurs only in Bhutan and north-eastern India (Assam); it is therefore considered to be endemic to the sub-region. It is confined to a forest belt in western Assam between the Manas River in the east, Sankosh in the west and Brahmaputra in the south along the Indo-Bhutan border (Medhi*et al.* 2004). Its distribution in Bhutan is limited to the foothills of the Black Mountains, where JSWNP's core zone is located (Srivastava *et al.* 2001). The total known range of this species in both India and Bhutan is less than 30,000 km², and much of it is not suitable habitat (Srivastava *et al.* 2001). The population in India is highly fragmented, with the southern population completely separated from the northern population due to the effects of human activities.

Native: Bhutan; India (Assam)

Recent censuses conducted under the Golden Langur Conservation Project (GLCP) in India have recorded over 5,600 langurs in that country in 2008–2012 (Horwich*et al.* 2013, cited in Nigam, Nilofer, Srivastav, and Tyagi, 2014). Now, the Golden Langur population in India and Bhutan is estimated at over 12,000individuals (Horwich*et al.* 2013), which is more than double the earlier estimate of 5,500 individual langurs (cited in the IUCN database).

93% of the population is found in contiguous forest, while the remaining 7% is found in several small isolated reserves (Srivastava et al. 2001). This species is found in moist evergreen,

dipterocarp, riverine, and moist deciduous forests, and occasionally in degraded habitats with secondary growth (Srivastava *et al.* 2001). This species experiences a considerable range in elevation of near sea-level in the south to about 2,600 m in the north (Wangchuk *et al.* 2003). One isolated population is found in the Abhaya Rubber Plantation, Nayakgaon, in the Kokrajhar district of Assam (Medhi *et al.* 2004). Study of this population has shown that the animals can withstand the effects of habitat change to some extent and survive in altered habitats (Medhi *et al.* 2004). The diet consists of young and mature leaves, ripe and unripe fruits, and seeds, with most feeding spent on young leaves (Gupta 1998, 2002). Subba (1989) and Subba and Santiapillai (1989), however, found that this species prefers fruits and buds to leaves. In forest fragments they may depend on cultivated crops such as tapioca, betel, and guava. It is diurnal and arboreal (Khajuria 1977).

Bhutan-specific Information on Golden Langurs: There has been considerable research undertaken on Golden Langurs in Bhutan, much of it summarized by Wangchuk (2005; updated in recent personal communications with Tashi Wangchuk in 2014). In Bhutan this species is found in at least JSWNP (Srivastava *et al.* 2001), Phipsoo Wildlife Sanctuary, and Royal Manas National Park (Molur *et al.* 2003; cited in the IUCN database). The core habitat of Golden Langurs consists of forests classified as warm broad-leaved forests, between 1,000 m to 2,400 m altitude, and subtropical forests between 200 m and 1,000 m altitude (Grierson and Long, 1983) between the Punatsangchhu (Sunkosh river) and the Mangdechhu and Manas rivers. The furthest north and west Golden Langurs have been recorded is from Chendebji (west, about 8 km from the dam site, outside the project area) at 2,600 m in the summer (just 2-3 weeks; Wangchuk, pers. comm.) in mixed broadleaf forest (but this has only been observed once). The next most northern location is below the Trongsa Dzong at 2,353 m; just one record (on the east bank of the Mangdechhu, near the Mangdechhu dam worksite and several kilometers north of the existing transmission line, the alignment of which the Nikachhu project line will use). The southern-most sighting records in Bhutan are from Manas in the east at 199 m.

In general, Golden Langurs are resident in broadleaf forests below 2,400 m in summer; occasionally some groups forage at higher altitudes for brief periods of time before returning to lower elevations. Beyond the rivers in the west and east, other langur populations occur (grey langur in the west and capped langur in the east). The estimated available habitat is 3,089 km², with an estimated population of about 6,637 individuals (an average density of 2.1 Golden Langurs/km² was estimated from the census in 1994 and 2003).

Of the 22 langur observations that have been made during the recent survey (Wangchuk, 2005), 91% were at elevations less than 1,800 m; only 9% were at elevations greater than 2,300 m (the project construction activities are mostly at 2,300 - 2,400 m above sea level). Golden langurs live in troops of 3 to 15 individuals, mostly as single male/multi-female or two-male/multi-female groups and sometimes in all male groups (Chetry et al., 2010). Even if all troops have a maximum size of 15 animals, the population structure data suggest that Bhutan may be supporting more than 440 troops (these are somewhat independent population sub-units), to make the population estimate of 6,637. The survey data indicate that about 55% of the Golden Langur population in Bhutan is living along the southern reaches of the Mangdechhu (particularly on the east bank mostly outside JSWNP, more than 20 km from the project area) and 36% is living in the southern part of the country near the Indian border (more than 50 km from the project area). The protected areas (including the eastern to southern part of JSWNP and the Royal Manas National Park and biological corridor) and surrounding areas in southern border of Bhutan, being undisturbed forest, make up the majority of the Golden Langur habitat. In the 2013-14 Golden Langur survey undertaken by the JSWNP, almost all of the sightings were 70-135 km away from the project area, down the Mangdechhu. No Golden Langur troops

were observed in the vicinity of the project (these animals are diurnal, and if present in the area, would be easily seen during surveys; they were not).

Dr. Tashi Wangchuk (external expert) has confirmed that: (i) the Nikachhu project area is not located in the Golden Langur's critical habitat; (ii) the project, located in relatively degraded habitat, should have no measurable adverse impacts on the critical habitat of Golden Langur, which would impair its high biodiversity value or the ability to function for Golden Langurs; and, (iii) the project is not anticipated to lead to a reduction in the langur's population in the long run (due to lack of proximity to the Golden Langur population and the fact that Golden Langur habitat in the National Park system in Bhutan will continue to be protected and undisturbed.

Source for data above: Das, J., Medhi, R. & Molur, S. 2008. *Trachypithecus geei*. The IUCN Red List of Threatened Species. Version 2014.2. <<u>www.iucnredlist.org</u>>. Downloaded on **02 September 2014**.

Nigam P., Nilofer B., Srivastav A. & Tyagi P.C. 2014. National Studbook of Golden Langur (*Trachypithecus geei*), Wildlife Institute of India, Dehradun and Central Zoo Authority, New Delhi.

Wangchuk, Tashi.2005. The evolution, phylogeography, and conservation of the golden langur (*Trachypithecus geei*) in Bhutan. PhD Thesis. Faculty of the Graduate School of the University of Maryland, College Park.

IFC Criteria: Tier 1 criteria are not triggered for Golden Langurs. The habitat in the project area (the left bank of the Nikachhu) is not protected undisturbed forest (it is a degraded habitat with a national highway running along the high ground next to the Nikachhu, some houses, dry land, secondary forest, and cattle grazing areas). As such, Golden Langurs have never been observed on the Nikachhu near the project area or within 5 km of the project footprint. The nearest sightings (Chendebji and Trongsa, and only occasionally) were more than 5 km from the proposed project footprints. The occasional sightings of one or two langur troops at the northern limit of the Golden Langur habitat would account for about 30 animals at most (maximum observed troop size is 15 animals). This is only 0.25% of the global population of Golden Langurs (which is 12,000, spread between Bhutan and India). As noted above, 99.75% of the global population of Golden Langurs lives at least 20-200 km further south at lower altitudes, in areas that will not be affected at all by the project. There are at least 11 defined management sites for Golden Langurs in Bhutan, including eight forest management units that provide habitat for Golden Langurs in 483 km² and three national parks (there are also more Golden Langur management sites in India). However, the project footprint does not fall directly in a Langur management site (just a slight incursion up the steep slope of the northern edge of the JSWNP, where langurs have never been observed). Therefore, the project area does not trigger the other sub-criterion for Tier 1 (affecting an area that is one of 10 or less Golden Langur management sites in the world).

Also, the marginal importance of the northern limit of Golden Langur habitat (it is not critical habitat, as it supports only occasional use, by <0.25% of the global population) does not trigger Tier 2 criteria; there are no regionally or nationally important concentrations of Golden Langurs in the project area. While it is plausible that Golden Langurs could again visit the Chendebji area west of the project, such animals would have access to this area via JSWNP, which will remain continuously accessible and protected for Golden Langurs.

With regard to endemic-specific criteria, given that the project area has not supported Golden Langurs in the past, it cannot be considered a discrete management unit; furthermore, the adjacent areas that are used only occasionally by Golden Langurs support no more than 0.25%

of the global population. Neither Tier 1 nor Tier 2 sub-criteria for Criterion 2 (endemic species) are triggered by the project area (it is not critical habitat for the endemic Golden Langur).

Conclusion Regarding Project Interactions with Critical Habitat: It is concluded that the project, with temporary construction activity in degraded habitat outside the JSWNP, will not create irreversible habitat loss, habitat fragmentation, or reduction of the Bhutan or global Golden Langur population, as this area has never been observed to support Golden Langurs. As such, no special mitigation measures or habitat offsets are required for this animal. However, ongoing wildlife monitoring (including Golden Langur observations) during construction and during the initial project operation is proposed as part of the EMP.

Common Name	Scientific Name	IUCN and National Threat Category	Present in Project Area
11. Asiatic Black Bear	Ursus thibetanus	Vulnerable Schedule I	Not sighted, but reported by locals and Park staff



IUCN Status: Vulnerable. Although actual data on population sizes or trends are lacking, it seems likely, given the rate of habitat loss and uncontrolled exploitation that the world population has declined by 30–49% over the past 30 years (3 bear generations).

Range: (red areas in the map above indicate locations where the Asiatic Black Bear no longer occurs) Fossil remains of the Asiatic black bear have been found as far west as Germany and France, but in historic times the species has been limited to Asia. This species occupies a narrow band from southeastern Iran (Gutleb and Ziaie 1999) eastward through Afghanistan and Pakistan, across the foothills of the Himalayas, to Myanmar. It occupies all countries in mainland Southeast Asia except Malaysia. It has a patchy distribution in southern China, and is absent in much of east-central China. Another population cluster exists in northeastern China, the southern Russian Far East, and into North Korea. A small remnant population exists in South Korea. They also live on the southern islands of Japan (Honshu and Shikoku) and on Taiwan and Hainan. Sport hunting of Asiatic black bears is legal in Japan and Russia. The species now occurs very patchily through much of its former range, especially in Iran, Afghanistan, Pakistan, mainland southeast Asia and China. Its distribution in parts of China and Myanmar remains very poorly known.

The distribution of the Asiatic black bear roughly coincides with forest distribution in southern and eastern Asia (FAO 2006), except that in central and southern India this species is replaced by the sloth bear (*Melursus ursinus*), in southern Thailand and into Malaysia it is replaced by the sun bear (*Helarctos malayanus*) and north and west of the Russian Far East it is replaced by the brown bear (*Ursus arctos*). However, the Asiatic black bear overlaps the ranges of each of these species, especially the sun bear in a large portion of Southeast Asia.

Native: Afghanistan; Bangladesh; Bhutan; Cambodia; China; India; Iran, Islamic Republic of; Japan; Korea, Democratic People's Republic of; Korea, Republic of; Lao People's Democratic Republic; Myanmar; Nepal; Pakistan; Russian Federation; Taiwan, Province of China; Thailand; Viet Nam.

Within JSWNP, sighting of Black bears is very common and based on these observations, it appears that the population of Black bears is thriving. Further to the south and northwest, there have been instances of Black bears entering villages of Chendebji and Nabji, outside the project area. In general, in Bhutan, authorities believe that there is no immediate threat to the Asiatic Black Bear due to habitat disturbance, as they have access to a large area in the National Parks.

Source for data above: Garshelis, D.L. & Steinmetz, R. (IUCN SSC Bear Specialist Group) 2008. *Ursus thibetanus*. The IUCN Red List of Threatened Species. Version 2014.2. <<u>www.iucnredlist.org</u>>. Downloaded on **02 September 2014**.

S.W. Wang, D.W. Macdonald. 2009. Livestock predation by carnivores in Jigme Singye Wangchuck National Park, Bhutan

IFC Criteria: This animal is not IUCN critically endangered or endangered, so does not trigger Tier 1 criteria. Tier 2 criteria are not triggered, since the project area does not support nationally or regionally important concentrations of Asiatic Black Bears (they occur through Bhutan and other countries to the west and east).

Conclusion Regarding Project Interactions with Critical Habitat: The Asiatic Black Bear prefers contiguous forest habitat such as that provided by JSWNP and other protected areas in Bhutan. It is unlikely to come into the project area (which is characterized as disturbed habitat, due to the highway, cattle grazing, human habitation and degraded forest), and they are unlikely to be prevalent in the gorge area of the Nikachhu, which has very steep slippery slopes which would not support movement of bears. Crossing from the Park into the project area is extremely unlikely for this reason. Furthermore, the National Highway, crossing through the eastern biological corridor, presents a barrier to animal movements, and bears are unlikely to preferentially access the corridor in this area for this reason. In any case, the biological corridor north of the project area will still be accessible to any bears that may be on that side of the national highway. The project is not expected to cause any habitat fragmentation in this area (JSWNP will remain undisturbed and accessible). It is therefore considered that there will be no project impact on bear habitat or the bear population in Bhutan.

The external expert (Dr. Sonam Wangyel) has confirmed that the Asiatic Black Bear is widely distributed and abundant in Bhutan, and the project area is not serving as critical habitat for this animal. The project is therefore not expected to have any adverse impacts on bear habitat or the overall population.

Common Name	Scientific Name	IUCN and National Threat Category	Present in Project Area
12. Himalayan Musk Deer	Moschus leucogaster	Endangered Schedule I	No



IUCN Status: Listed as Endangered because of a probable serious population decline, estimated to be more than 50% over the last three generations (approximately 21 years), inferred from over-exploitation, which is characteristic of this genus.

Range: This species occurs in the Himalayas of Bhutan, northern India (including Sikkim), Nepal, and China (southwest Xizang) (Groves *et al.* 1995; Grubb 2005). Its occurrence in China is almost marginal (Yang *et al.* 2003, where treated as *M. chrysogaster*).

Native: Bhutan; China; India; Nepal

Little is known of the species' current status. There are very few in China, reflecting the small range there (Yang *et al.* 2003). It is believed to be declining throughout its range because of over-harvesting. This species inhabits high alpine environments, with Groves *et al.* (1995) recording a lowest altitude of 2,500 m asl. It is poorly known, but its natural history is likely to be similar to that of *M. chrysogaster. M. chrysogaster* is found on barren plateaus at high altitudes, where it occupies meadows, fell-fields, shrublands or fir forests. It feeds mainly on grasses, shrubs, leaves, moss, lichens, shoots, and twigs (Green 1987). It is generally solitary and crepuscular (Harris and Cai 1993).

A recent camera trap survey in the Trongsa area, on the east side of the Mangdechhu, indicated the presence of musk deer there. Musk deer have not been observed in the project area.

Source for data above: Timmins, R.J. & Duckworth, J.W. 2008. *Moschus leucogaster*. The IUCN Red List of Threatened Species. Version 2014.2. <<u>www.iucnredlist.org</u>>. Downloaded on **02** September 2014.

IFC Criteria: While this animal has been listed as endangered, there are no data on population numbers and there are no defined management sites for this animal, except that protected areas in Bhutan and to the west may serve as such. The musk deer has not been recorded for the project area (at 2,200 - 2,300 masl); this species inhabits high alpine environments, with Groves *et al.* (1995) recording a lowest altitude of 2,500 m asl. It therefore appears that the project area is not critical habitat for the musk deer and would not support more than 10% of the global population of this animal; nor would it serve as a management site. Tier 1 criteria are therefore not triggered. For the same reasons, Tier 2 criteria are not triggered, since the project area has never recorded presence of musk deer; it does not support nationally or regionally important concentrations of Himalayan musk deer.

Conclusion Regarding Project Interactions with Critical Habitat: The project area is at the extreme eastern edge of the range of Himalayan musk deer, and just below the lowest altitude recording for this species (2,500 meters asl), which would explain the lack of sightings in the project area (all of its range is a contiguous stretch of the Himalayas to the west into India). It is concluded that the project area is not important or critical to the survival of the Himalayan musk deer, and that the project will not impact on its habitat or population numbers.

Common Name	Scientific Name	IUCN and National Threat Category	Present in Project Area
13. Hispid Hare	Caprolagus hispidus	Endangered	No



IUCN Status: Caprolagus hispidus exists in an area of occupancy of less than 500 km², in highly fragmented habitats. The species is experiencing continuing decline in suitable habitat area due to increasing agriculture, flood control, and human development (Bell *et al.* 1990, Maheswaran 2002, Jordan *et al.* 2005).

Range: Knowledge of the distribution of *C. hispidus* has always been limited. The historic range of the species extended along the foothill region of the southern Himalayas from Uttar Pradesh through southern Nepal, the northern region of West Bengal to Assam, and into Bangladesh as far south as Dacca (Bell *et al.* 1990). The current distribution in South Asia is sporadic, including the countries of Bangladesh, India, Nepal, and possibly Bhutan (Jordan *et al.* 2005). The extent of occurrence of *C. hispidus* is estimated to be between 5,000 and 20,000 km², and the area of occupancy is estimated to be between 11 and 500 km², in highly fragmented populations (Jordan *et al.* 2005). It occurs at elevations ranging from 100-250 m (Jordan *et al.* 2005); far below the project area elevation of 2,200-2,300 m asl.

Native: Bangladesh; India (Assam, Bihar, Uttar Pradesh, West Bengal); Nepal

Source for data above: Maheswaran, G. & Smith, A.T. 2008. Caprolagus hispidus. The IUCN Red List of Threatened Species. Version 2014.2. <<u>www.iucnredlist.org</u>>. Downloaded on **02** September 2014.

IFC Criteria: The hispid hare does not occur in the project area or JSWNP. No Tier 1 or 2 criteria are triggered.

Conclusion Regarding Project Interactions with Critical Habitat: There is no concern for the hispid hare, as the project site is well outside the range of this animal.

Common Name	Scientific Name	IUCN and National Threat Category	Present in Project Area
14. Leopard	Panthera pardus	Near threatened Schedule I	Not sighted, but reported by locals and Park staff



IUCN Status: Near threatened. The leopard is an adaptable, widespread species that nonetheless has many threatened subpopulations. While still numerous and even thriving in some marginal habitats from which other big cats have disappeared in many parts of sub-Saharan Africa, in North Africa leopards are on the verge of extinction.

Range: The leopard occurs across most of sub-Saharan Africa, as remnant populations in North Africa, and then in the Arabian peninsula and Sinai/Judean Desert (Egypt/Israel/Jordan), south-western and eastern Turkey, and through Southwest Asia and the Caucasus into the Himalayan foothills, India, China and the Russian Far East, as well as on the islands of Java and Sri Lanka (Nowell and Jackson 1996; Sunquist and Sunquist 2002; Hunter *et al.* in press).

The leopard is commonly encountered in camera traps throughout Bhutan and has been commonly seen in the Trongsa area, east of the Mangdechhu.

Source for data above: Henschel, P., Hunter, L., Breitenmoser, U., Purchase, N., Packer, C., Khorozyan, I., Bauer, H., Marker, L., Sogbohossou, E. & Breitenmoser-Wursten, C. 2008. *Panthera pardus*. The IUCN Red List of Threatened Species. Version 2014.2. <<u>www.iucnredlist.org</u>>. Downloaded on **02 September 2014**.

IFC Criteria: The leopard is not IUCN critically endangered or endangered, so Tier 1 criteria are not triggered. The leopard is very widely distributed throughout Asia, but has not been observed in the project area, Therefore, the project area is not critical habitat for the leopard and is not supporting nationally or regionally important concentrations of the animal; Tier 2 criteria are not triggered.

Conclusion Regarding Project Interactions with Critical Habitat: The project area is not critically important to the leopard (it has not been seen there), and in any case the leopard is widely distributed throughout Bhutan, and other locations in Africa and Asia. The temporary project construction activities are unlikely to disturb this animal, which will continue to have undisturbed access to JSWNP and other forest areas.

Common Name	Scientific Name	IUCN and National Threat Category	Present in Project Area
15. Leopard Cat	Prionailurus bengalensis	Least Concern Schedule I	Yes



IUCN Status: Least concern. The Leopard Cat is a widespread and relatively common species (Nowell and Jackson 1996, Sunquist and Sunquist 2002), although some island subspecies are included in the Red List. Although there is a declining population trend in parts of its range due to habitat loss and hunting, the species is stable in many areas, even thriving in some altered habitats including oil palm and sugar cane plantations (IUCN Cats Red List Workshop 2007).

Range: The leopard cat is a widespread species in Asia. It is found throughout most of India west into Pakistan and Afghanistan (Habibi 2004), through the Himalayan foothills, across most of China, and north to the Korean peninsula and into the Russian Far East (Nowell and Jackson 1996). It is found throughout Southeast Asia, and on the islands of Sumatra, Java, Borneo and Taiwan. It is found on numerous small offshore islands of mainland Asia (Nowell and Jackson 1996, Sunquist and Sunquist 2002). The leopard cat is the only wild felid found in the Japan, where it occurs on the small islands Tsushima and Iriomote, and the Philippines, where it occurs on the islands of Palawan, Panay, Negros and Cebu. In the Philippines, there are recent (2007) unconfirmed reports from the island of Masbate. It should be present in Guimaras due to proximity to Negros and Panay, but no presence was reported, and is therefore presumed to be extinct (R. Lorica and W. Oliver, unpub.).

Native: Afghanistan; Bangladesh; Bhutan; Brunei Darussalam; Cambodia; China; Hong Kong; India; Indonesia (Java, Kalimantan, Sumatera); Japan (Nansei-shoto); Korea, Democratic People's Republic of; Korea, Republic of; Lao People's Democratic Republic; Malaysia; Myanmar; Nepal; Pakistan; Philippines; Russian Federation; Singapore; Taiwan, Province of China; Thailand; Viet Nam

The leopard cat is the most frequently recorded small cat across most of its wide range, in comparison with sympatric species (Nowell and Jackson 1996, Duckworth *et al.* 1999, Holden

2001, Duckworth *et al.* 2005, Lynam*et al.* 2006, Yasuda *et al.* 2007), and with its broad distribution has an abundant population.

Source for data above: Sanderson, J., Sunarto, S., Wilting, A., Driscoll, C., Lorica, R., Ross, J., Hearn, A., Mujkherjee, S., Khan, J.A., Habib, B. & Grassman, L. 2008. *Prionailurus bengalensis*. The IUCN Red List of Threatened Species. Version 2014.2. <<u>www.iucnredlist.org</u>>. Downloaded on **02 September 2014**.

IFC Criteria: Tier 1 criteria are not triggered as this animal is IUCN "least concern". While leopard cats may occur in the project area, they are also frequently observed in JSWNP and areas to the east of the project area (in Trongsa district; 20 recent camera sightings there). Given the frequent observations of leopard cats in other parts of Bhutan (inside and outside the park) and the lack of sightings in the project area, it is concluded that the project area is not supporting nationally or regionally important concentrations of leopard cats, so Tier 2 criteria are not triggered.

Conclusion Regarding Project Interactions with Critical Habitat: Given the large population and widespread distribution of this animal, the project area is not deemed to be critically important to this species. Any animals in the vicinity of the project will continue to have access to forested areas in JSWNP and elsewhere.

Common Name	Scientific Name	IUCN and National Threat Category	Present in Project Area
16. Pygmy Hog	Porcula salvania	Critically Endangered Schedule I	No



IFC Criteria: This animal does not occur in the project area (see map). This species is dependent on early successional riverine communities, typically comprising dense tall grasslands, and therefore has favoured the tall, wet alluvial grasslands extending in a narrow belt south of the Himalayan foothills from north-western Uttar Pradesh and southern Nepal to Assam, possibly extending at intervals into contiguous habitats in southern Bhutan No Tier 1 or 2 criteria are triggered.

Conclusion Regarding Project Interactions with Critical Habitat: There is no concern for the pygmy hog, as the project site is well outside the range of this animal.

Common Name	Scientific Name	IUCN and National Threat Category	Present in Project Area
17. Red Panda	Ailurus fulgens	Vulnerable Schedule I	Yes (reported in the Park by forestry staff; they are mostly located above 2,400 meters asl, which is above the elevation of the project sites)



IUCN Status: Vulnerable.

Range: The distribution of *Ailurus fulgens* in the wild is poorly known, but its range is known to include Nepal, India, Bhutan, Myanmar, and southern China, with a disjunct population on the Meghalaya Plateau of northeastern India (Choudhury 2001). The westernmost limit of this species is from the Annapurana Range in Nepal, and the easternmost is from the Qing Ling Mountains of the Shaanxi Province in China. The distribution range of this species should be considered disjunct, rather than continuous (Roberts and Gittleman 1984). It is found from the southern part of the Gaoligong Shan on the Myanmar-China border (25°N), to Minshan Mountains and upper Min Valley, Sichuan (33°N) (Ellerman and Morrison-Scott 1966, Macdonald 1984, Corbet and Hill 1992, Choudhury 1997). Although Roberts and Gittleman (1984) record it as occurring only above 2,200 m, it can be found from 1,500 to 4,800 m, and on the Meghalaya Plateau it is found from 700 to 1,400 m (Choudhury 1997), sometimes as low as 200 m (Surajit Roy pers. comm.). Pradhan *et al.* (2001) found that this species' preferred altitudinal range in Singhalila National Park in eastern Himalayas was 2,800 to 3,100 m, and it was relatively more abundant between 2,800 to 3,600 m.

Native: Bhutan; China; India; Myanmar; Nepal

The global population of this species is about 10,000 individuals (Choudhury and Yonzon pers. comm.).Observation of this species is difficult due to its shy and secretive nature, and its largely nocturnal habits (Choudhury 2001).

The Red Panda is found closely associated with temperate forest having bamboo-thicket understories (Roberts and Gittleman 1984).

The Red Panda is threatened by habitat loss and fragmentation, poaching, and inbreeding depression (Wei *et al.* 1998). Habitat loss is considered to be the biggest threat to this species, while poaching is the next biggest threat in the Indian portion of its range and some localized areas (Choudhury 2001).

In Bhutan, the red panda is hunted for making fur caps or hats (Yonten, 2004). Based on past studies and information from other national parks in Bhutan, the Red Panda is found in many of the temperate forests where bamboo is present. Red Panda studies have been undertaken in Sakteng Wildlife Sanctuary and Jigme Dorji National Park. Red panda presence has also been confirmed in Wangchuck Centenial Park and Thrumshingla National Park. In 2013, a similar study was conducted in JSWNP and many of the signs of Red Panda were observed in elevations higher than 2,400 masl, where Bamboo forests are in good health. The Bamboo forests (which suffered natural die back are flowering) were found luxuriant at much higher altitude than the project site. In comparison, on the left (north) bank of the Nikachhu, bamboo was found only at one project worksite location (Adit 1, east of the dam site).

Outside of India, China has 35 protected areas (Wei *et al.* 1998) covering about 42.4% of this species habitat in China, Nepal has eight, and Bhutan has five that support known or reported populations of this species (Choudhury 2001). The red panda has been recorded from Singalila National Park (Bahuguna *et al.* 1998), and Langtang National Park in Nepal (Yonzon and Hunter 1991).

Source for data above: Wang, X., Choudhury, A., Yonzon, P., Wozencraft, C. & Than Zaw 2008. *Ailurus fulgens*. The IUCN Red List of Threatened Species. Version 2014.2. <<u>www.iucnredlist.org</u>>. Downloaded on **02 September 2014**.

S.W. Wang, D.W. Macdonald. 2009. Livestock predation by carnivores in Jigme Singye Wangchuck National Park, Bhutan

Sangay Dorji, Rajanathan Rajaratnam and Karl Vernes. 2012. The Vulnerable red panda *Ailurus fulgens* in Bhutan: distribution, conservation status and management recommendations.

IFC Criteria: Tier 1 criteria are not triggered as this animal is IUCN "vulnerable". Given that red pandas favor higher altitudes and occur in other parks in Bhutan, the project area therefore does not support nationally or regionally important concentrations of red pandas, so Tier 2 criteria are not triggered.

Conclusion Regarding Project Interactions with Critical Habitat: While the red panda has been sighted in the vicinity of the proposed project sites, it favors higher altitudes, and is expected to be more frequent and widely distributed (compared to the project area) in the higher altitude habitats in the five protected areas in Bhutan where it is known to occur (including JSWNP). Given these data, the project area (in inferior forest habitat outside the Park, at lower altitudes, near the national highway, and in a river gorge area with very steep, slippery slopes that are not conducive to animal movements) is not expected to be important for the survival of this species. It is therefore considered that the project impacts on the habitat and population of red pandas will be negligible.

The external expert for this species (Dr. Sonam Wangyel) has confirmed that red pandas prefer higher altitudes than the project area, and therefore the project area is not their critical habitat and the project is not expected to adversely impact red panda habitat or the overall population.

Common Name	Scientific Name	IUCN and National Threat Category	Present in Project Area
18. Serow	Capricornis sumatraensis (thar)	Near Threatened Schedule I	Not sighted, but reported by locals and Park staff



IUCN Status: Near threatened. Listed as Near Threatened because this species is believed to be in significant decline (but probably at a rate of less than 30% over three generations, taken at 21 years) due to hunting for food and habitat loss, making the species close to qualifying for Vulnerable under criteria A2cd.

Range: This species is known to occur in east and southeast Bangladesh, Himalayas (Bhutan, northern India including Sikkim and Nepal), China (Tibet only), northeast India (provinces east of Bangladesh), and probably into western Myanmar (Grubb, 2005).

Native: Bangladesh; Bhutan; China; India; Nepal

Accounts from throughout the species' range report that it inhabits rugged steep hills and rocky places, especially limestone regions up to 3,000 m asl, and also in hill and mountain forest areas with gentler terrain.

It is listed in Schedule I of Bhutan's Forest and Nature Conservation Act, 1995. Himalayan serow is reported in Royal Manas National Park on the southern border with Assam (Jackson 1981). It also lives in the vast Jigme Dorji National Park (Blower, 1989; Wollenhaupt, 1988d), which extends across all of northern Bhutan, and in JSWNP (Blower, 1989). The serow was recently caught in camera trap surveys in the Trongsa area, east of the Mangdechhu, and is widespread throughout JSWNP. The external expert (Dr. SonamWangyel) indicates that the serow does not have specific habitat and is widely adaptable.

Source for data above: Duckworth, J.W. & MacKinnon, J. 2008. *Capricornis thar*. The IUCN Red List of Threatened Species. Version 2014.2. <<u>www.iucnredlist.org</u>>. Downloaded on **02** September 2014.

IFC Criteria: The serow has only IUCN "Near threatened" status, so does not trigger Tier 1 criteria. The serow occurs throughout the parks of Bhutan where there is undisturbed habitat. The project area (in degraded habitat outside the park, near the national highway, and in a steep, slippery slope area adjacent to the Nikachhu), does not support nationally or regionally important concentrations of serow, and therefore Tier 2 criteria are not triggered.

Conclusion Regarding Project Interactions with Critical Habitat: While serow have been reported in the project area, the project area is a very small part of a much wider range in Bhutan which covers most of the southern protected areas, including JSWNP. Furthermore, the project area is characterized by degraded forest, the national highway which crosses through the eastern biological corridor, and steep, slippery slopes adjacent to the Nikachhu which are not conducive to animal movements. All these features present obstacles to serow and make the project area unsuitable habitat for serow. The JSWNP will continue to provide secure and undisturbed habitat for the serow. It is considered that the project impacts on the habitat and population of serow will be negligible.

The external expert (Dr. Sonam Wangyel) has indicated that because the serow is more commonly found much further away from the project area, the project area is not considered critical habitat for this animal, and therefore the project is not expected to have any adverse effects on serow habitat or the population.

Common Name	Scientific Name	IUCN and National Threat Category	Present in Project Area
19. Snow Leopard	Panthera uncia	Endangered Schedule I	No



IFC Criteria: Snow Leopards are closely associated with the alpine and sub-alpine ecological zones, favoring steep terrain well broken by cliffs, ridges, gullies, and rocky outcrops. This habitat is not present in the central part of Bhutan, including the project area, therefore snow leopards have never been observed there. As the snow leopard does not occur in the project area (see map), no Tier 1 or 2 criteria are triggered.

Conclusion Regarding Project Interactions with Critical Habitat: There is no concern for snow leopards, as they do not occur in the project area (restricted to northern Bhutan and throughout higher altitudes elsewhere in the Himalayas).

Common Name	Scientific Name	IUCN and National Threat Category	Present in Project Area
20. Takin	Budorcas taxicolor	Vulnerable Schedule I	No



IUCN Status: Vulnerable.

Range: This species occurs in Bhutan, China (southeastern Gansu, Sichuan, Shaanxi, southeast Tibet, and northwestern Yunnan), and northeast India (Arunachal Pradesh and Sikkim; Singh 2002) and northern Myanmar (Salter 1997).

Native: Bhutan; China; India; Myanmar

There is no known estimate of population size or trend for *B. taxicolor whitei* within China, Bhutan, or India. In Bhutan, threats include competition and disease transmission from domestic livestock, habitat loss (pasture burning), and loss or disruption of migration routes. In Bhutan, the species is known to inhabit Jigme Dorji National Park.

Source for data above: Song, Y.-L., Smith, A.T. & MacKinnon, J. 2008. *Budorcas taxicolor*. The IUCN Red List of Threatened Species. Version 2014.2. <<u>www.iucnredlist.org</u>>. Downloaded on **02 September 2014**.

IFC Criteria: The takin has not been recorded in the project area. In any case, as it is IUCN "vulnerable", it does not trigger Tier 1 criteria. Also, because it has not been observed in the project area, Tier 2 criteria are not triggered.

Conclusion Regarding Project Interactions with Critical Habitat: The takin has not been recorded in the project area, which is consistent with the available range data; this animal prefers more northern and higher altitude areas (such as Jigme Dorji National Park). The project area is not critically important to the takin; no project impacts are expected.
21. White-bellied Heron (*Ardea insignis*): (IUCN listed as Critically Endangered; Bhutan Schedule 1); these birds have been recorded in JSW National Park (but not observed during the surveys at the project footprint areas).



IUCN Status: Critically endangered.

Range and Habitat: Ardea insignis is known from the eastern Himalayan foothills in Bhutan and north-east India to the hills of Bangladesh, north Myanmar and, historically at least, across west and central Myanmar (BirdLife International 2001). It may also occur in south-east Tibet, China, but is now extinct in Nepal. Birds visit the Brahmaputra lowlands in winter. Although historical reports suggest it was previously common in Myanmar, it has evidently declined throughout its range given the paucity of recent records. Most of the few recent records come from five or six sites in Assam and Arunachal Pradesh, India, one or two sites in Bhutan, and parts of Myanmar.

In Bhutan, white-bellied heron surveys have been carried out by RSPN since 2003. There is a small population of 30 known individuals (with six juveniles) as of July 2007 (Pradhan 2007), with the total national population unlikely to exceed 50 individuals (Pradhan *et al.* 2007). In the 2007 survey, 26 birds were observed along the Punatsangchhu river basin (from Panaka through Wangdue Phodrang to Tsirang districts in the western part of Bhutan), including rivers of the Phochhu, confluence of Phochhu-Mochhu, Punatsangchhu, Kamechhu (Digchhu), Zawa, and Ngagshina (Pradhan 2007). Four birds were observed year-round in the Bertichhu river area, at 645 m elevation (on a tributary of the Mangdechhu in Zhemgang district). Only one bird has been recorded on the lower reaches of the Mangdechhu, at about 570 m elevation, evident in the autumn, winter, and spring, but not the summer (RSPN, 2011). The species has also been reported from the Thimchhu, Lungtenphu (C. Feijen *in litt.* 2009). White-bellied herons have never been recorded in the Nikachhu area or upper Mangdechhu. Based on surveys to date, the Punatsangchu appears to be the most important habitat for white-bellied herons.

Six active nests were recorded in Bhutan in 2007, two from a new site, and by 26 July 2007 they held six chicks in total. Due to natural forest fires, three nests were abandoned. A further three active nests with five chicks were recorded in 2009, although only three chicks remained on a subsequent visit (Anon, 2009). The six breeding sites recorded to date are only on two rivers in the western and southern-central regions of Bhutan; the eastern part of the country has not been thoroughly surveyed (Pradhan 2007).

The nesting areas of the birds are generally at 620 m to 1,368 m elevation, within 100-500 m distance of feeding areas. Their roosting areas are at 651 m to 1,375 m elevation, within about

1,000 m distance of feeding areas. The Rufford Foundation suggests that the available habitat for white-bellied herons in Bhutan is 345.95 km² (J. Dorji, 2013). As noted above, white-bellied herons have never been recorded in Trongsa district in which the project area is located, and this probably reflects the relatively high elevation and low productivity of mountain rivers and streams (for example, the main project area is at 2,300 m elevation, almost 1,000 meters higher than the observed elevation range of these birds). The nearest habitat for white-bellied herons is the Bertichhu, which is approximately 50 km away from the proposed dam site and 35 km away from the proposed transmission line.

The heron is known to feed on snow trout and brown trout, but only in areas that have relatively high productivity of fish and where there is access to shallow water (this precludes most steep mountain rivers, such as the Nikachhu and upper Mangdechhu, especially during the monsoon, when discharges are very high). Sandbars and cobble bars within rivers are a key characteristic of suitable habitat that allows herons to feed in shallow water and roost and feed safely. The formation of bars depends on sediment deposition during high flows (RSPN, 2011). Hydropower projects (e.g., Punatsangchhu hydropower projects under construction) are considered a threat to the heron, due to potential effects on fish populations, construction effects including collision with power lines, and degradation of foraging habitat due to changes in flow and sediment load. Recognizing the importance of the riverbed in the Punakha-Wangdue (quite far west of the project area) as a primary feeding ground for this species, the Royal Government of Bhutan has declared the area as protected habitat for White-bellied Herons.

Native: Bhutan; India; Myanmar; Possibly extinct: Bangladesh; Regionally extinct: Nepal.

Although a complete population census is yet to be conducted, the current population size is thought to be best placed in the band 50-249 mature individuals (D. Wilson and J. Eames *in litt.* 2006). This equates to 75-374 individuals in total, rounded here to 70-400 individuals.

Source for data above: various RSPN publications on white-bellied herons (as well as pers. comm. R. Pradhan and the RSPN website: <u>www.rspnbhutan.org</u>) and Birdlife International and IUCN, as follows:

BirdLife International. 2013. *Ardea insignis*. The IUCN Red List of Threatened Species. Version 2014.2. <<u>www.iucnredlist.org</u>>. Downloaded on **30 October 2014**.

Dorji, J. 2013. Population and Distribution of White-bellied Heron in Bhutan. The Rufford Foundation. Presentation to the College of Natural Resources, Lobesa.

Pradhan, R. 2007. White-bellied Heron Project 2005-2007: Annual Report December 2005-December 2006.

Pradhan, R., Norbu, T., Frederick, P. 2007. Reproduction and ecology of the world's rarest Ardeid: the White-bellied Heron (*Ardea insignis*) in Bhutan. *31st Annual Meeting of the Waterbird Society, 30 October - 3 November 2007, Universitat de Barcelona*, pp. 97.

Royal Society for Protection of Nature (Bhutan). 2007. Project Areas. Royal Society for Protection of Nature (Bhutan).

Royal Society for Protection of Nature. 2011. The Critically-Endangered White-bellied Heron.

IFC Criteria: The white-bellied heron has not been recorded within 35 km of the project area, most likely as it does not favour the higher altitudes and fast-running streams and rivers that

characterize the area (these herons prefer lower altitudes and wider, slower-moving rivers with sand/cobble bars). As such, even though white-bellied herons are critically endangered, neither Tier 1 nor Tier 2 criteria are triggered, due to the absence of these herons within the Nikachhu river stretch and the upper Mangdechhu.

Conclusion Regarding Project Interactions with Critical Habitat: As the project area (the dam site, immediate downstream, and the transmission line alignment) provides no habitat (critical or otherwise) for white-bellied herons, the project will not have any direct interaction with these birds or their habitat. In the watershed of concern, it is only the lower reaches of the Mangdechhu, at the confluence with the Bertichhu (about 35-50 km south of the project area) that can provide some habitat for white-bellied herons, reflecting lower altitudes and a wider river with seasonal sand/cobble bars. The prevailing hydrology and riverbed morphology in this area is defined by the seasonal discharges in the Mangdechhu and its many tributaries. These prevailing features will not be altered by the Nikachhu project, since the Nikachhu discharge will go to the Mangdechhu dam and then be released back into the Mangdechhu about 35 km above the white-bellied heron habitat. Since the Bertichhu is a tributary of the Mangdechhu, it will not be affected at all by the project. Therefore, the Nikachhu project will not have any measureable impact on the white-bellied heron habitat and population.

22. **Rufous-necked Hornbill** (*Aceros nipalensis*) (IUCN listed as Vulnerable): 3 birds seen at one location along the transmission line alignment, on the left bank of the Mangdechhu.



IUCN Status: Vulnerable.

Range and Habitat: Aceros nipalensis is currently known from Bhutan, north-east India, Myanmar, southern Yunnan and south-east Tibet, China, Thailand, Laos and Vietnam. It has declined dramatically and is now very rare across much of its historical range. It is thought to be extinct in Nepal, and to be close to extinction in Vietnam (J. C. Eames *in litt.* 2007); it has also disappeared from many areas in Thailand. While still widespread and fairly common in Bhutan (K. D. Bishop *in litt.* 2007), healthy populations elsewhere survive only in Namdapha National Park, India, Nakai-Nam Theun National Biodiversity Conservation Area, central Laos and perhaps also HuaiKhaKhaeng, west Thailand, and Xishuangbanna Nature Reserve, China. Population densities in these strongholds have led some to suppose that the species is more widespread and common than field surveys suggest (Kinnaird and O'Brien 2007). It is perhaps locally common in north Myanmar, and there are recent records from West Bengal (D. Ghose *inlitt.* 2005) and Eaglenest Wildlife Sanctuary, Arunachal Pradesh, India (Choudhury 2003, Datta 2009).

Native: Bhutan; China; India; Lao People's Democratic Republic; Myanmar; Thailand; Viet Nam

A population estimate of 2,500-9,999 individuals has been derived from analyses of records and surveys by BirdLife International (2001). This equates to 1,667-6,666 mature individuals, rounded here to 1,500-7,000 mature individuals.

It inhabits mature broadleaved forests, generally between 600-1,800 m (maximum altitude 2,200 m), but locally down to 150 m. It has also been recorded in dry woodland (K. D. Bishop *in litt.* 2007). It nests (usually March-June) in tall, wide-girthed trees. Evidence suggests that some populations make seasonal movements between forested areas in response to variations in the abundance of fruiting trees.

The following protected areas support important populations: Xishuangbanna Nature Reserve (China), Thrumshingla National Park (Bhutan, east of the project area), Namdapha National Park (Arunachal Pradesh, India), Nakai-Nam Theun National Biodiversity Conservation Area (Laos), and Um Phang and Maewong National Parks and HuaiKhaKhaeng and ThungYai Wildlife Sanctuaries (Thailand).

During the transmission line survey, two male and one female rufous-necked hornbills were observed at one location near Kuengarabten (about two-thirds of the way down the alignment, going south).

In Bhutan, apart from Thrumshingla National Park and Kuengarabten, it is found in Gonphu, Buli and Tshaidang in Zhemgang, and Mongar, Lhuentse, Trashigang and Samdrupjongkhar in eastern Bhutan.

Source for data above: BirdLife International 2012. Aceros nipalensis. The IUCN Red List of Threatened Species. Version 2014.2.< www.iucnredlist.org >. Downloaded on **02 September 2014**; Rinchen Drakpa; cited in <u>http://www.raonline.ch/pages/bt/nat/bt hornbill01.html</u>.

IFC Criteria: No Tier 1 criteria are triggered, since the hornbill is not CR and EN. Also, since the hornbill occurs throughout other parts of Bhutan (especially in Thrumshingla National Park, about 20 km east of the proposed transmission line, where there were 48 sightings; also in Gonphu, Buli and Tshaidang in Zhemgang, and Mongar, Lhuentse, Trashigang and Samdrupjongkhar in eastern Bhutan) and Asia, Tier 2 criteria are not triggered. With only three birds sighted at one location along an approximate 18.6 km line (only about 19% of which is at the preferred altitudes for hornbills), the proposed transmission line alignment cannot be considered to be supporting nationally or regionally important concentrations of hornbills.

Conclusion Regarding Project Interactions with Critical Habitat: While the rufous-necked hornbill was observed at one location along the transmission line alignment (at Kuengarabten), the species is normally found in mature, dense, evergreen and broadleaved forest, mainly in the hills up to altitudes of 1,800 m, which is lower than most of the proposed alignment (81% of the transmission alignment, all in the northern section, is higher than 1,800 m asl; and the 19% (about 3.5 km) that is at lower altitudes generally has degraded forest). There are few areas of pristine forest with the large trees required for hornbill nesting along the transmission line Most important is the fact that in the area where the hornbills were sighted alignment. (Kuengarabten), there is already a transmission line (the Yurmoo-Trongsa 66 kV line), so the Nikachhu transmission line can be routed along the existing right-of-way to preclude cutting of any large trees that would be preferred by hornbills in this area. It is concluded that the proposed transmission line alignment is not critical to the survival of this species, and with the measures proposed above, the project impacts on the habitat and population of this species will be negligible. In any case, the compensatory afforestation program (described in the EMP) can include frugivorous trees (mostly berry trees, such as Ficus spp.), which would be attractive to rufous-necked hornbills, if planted at lower altitudes preferred by hornbills.

Overall Conclusions Regarding the Project and Critical Habitat: The conclusion of the National Park office review and species expert opinions in this critical habitat assessment is that the project will not present any concerns with regard to habitat functionality and species persistence. The Park and the species experts have indicated that the project area does not fall in the critical habitat of the species assessed, and that it is not expected that there will be any measurable adverse impacts on the species populations and habitat values.

Regarding the six definitions of critical habitat (ADB SPS) and the IFC Tier 1 and 2 definitions, none of these definitions has been found to apply to the project area. While the JSWNP and the biological corridor have been assessed as critical habitat (for management purposes; see footnote 1 above), the project area does not impinge on any specific area within these two land management categories that is critically important to the populations of threatened species in Bhutan. Regardless of this conclusion, the project is still taking a precautionary approach and will be implementing a biodiversity conservation plan that includes monitoring and development of a wildlife database, as well as field conservation measures to protect wildlife. Furthermore, at night time, all construction activities will be disallowed, to avoid disrupting wildlife movements.