NEPAL ELECTRICITY AUTHORITY

ENVIRONMENTAL AND SOCIALMANAGEMENT PLAN
OF
GRID TIED SOLAR POWER PROJECT, BLOCK NO. 2, NUWAKOT (8.3MW)


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ABBREVIATIONS AND ACRONYMS

BS	:	BikramSambat (Nepali Era)
CSR	:	Corporate Social Responsibility
DADO	:	District Agriculture Development Office
DCC	:	District Coordination Committee
DFO	:	District Forest Office
DoED	:	Department of Electricity Development
ESMF	:	Environment and Social Management Framework
ESMP	:	Environment and Social Management Plan
EPR	:	Environment Protection Rules, 1997
ESSD	:	Environment and Social Studies Department
GoN	:	Government of Nepal
GSEEP	:	Grid Tied and Solar Energy Efficiency Project
GRC	:	Grievance Redress Cell
GRM	:	Grievance Redress Mechanism
HHs	:	Households
IEE	:	Initial Environmental Examination
MoEn	:	Ministry of Energy
MoEST	:	Ministry of Environment, Science and Technology
NEA	:	Nepal Electricity Authority
PAS	:	Project Affected Settlement
PH	:	Power house
PV	:	Photovoltaic
PMO	:	Project Management Office
WB	:	World Bank

Units

ha	:	Hectare
km	:	Kilometer
kV	:	Kilo Volt
m^2	:	Square meter
MW	:	Megawatt

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1 INTRODUCTION

1.1 Background

Nepal with the installed capacity of 900MW power generation connected to the national grid vis a vis a much higher level of peak demand which stood at 1559.7MW in 2016/17 suffers from serious power shortage every year (source: Annual Report, NEA). In response to the constantly growing power shortage, the Government has emphasized on the development of other potential resources particularly of Renewable Energies such as biomass, biogas, solar and wind along with hydropower for the production of electricity and meet the growing energy demand of the country in short term as well as long-term basis. To solve the present energy crisis, and enhance the energy network system of the country, Government of Nepal (GoN) has allocated budget under the title of "Renewable Energy and Capacity Expansion Project" under the soft loan of the World Bank (WB) and co-financing of the GoN in the fiscal year 2071/72. So, Nepal Electricity Authority (NEA), government owned institution has initiated the exploration of sites for the solar power development under project **Grid Tied Solar Power Project (GTSPP). According to survey license obtained from Department of Electricity (DoED), project is entitled as Grid Tied Solar Power Project, Block No 2, Nuwakot.It will be under Grid solar and energy Efficiency Project (GSEEP).** This is one of the major projects to produce electricity through solar energy (renewable energy) and thus strengthen and meet growing electricity demand of Nepal. The project produces clean and pollution free energy and thus is environment friendly.

1.2 Project Site Description

The project site Block No 2; Staff Quarter and Forebay area of Devighat powerhouse (PH), is selected for installation of PV solar farmhouse with a capacity of 8.3MW.The project site is located at Devighat Colony area of Bidur Municipality-6(the then Charghare VDC) of Nuwakot district. The name of the settlement around the project area is Mandredhunga settlement.The project site consists of two areas i.e. Forebay area (6.28ha) and Staff Quarter area (6.24ha). The total area required for this subproject is 12.52ha land which is already owned by NEAduring r the construction of Devighat Hydro power project in FY 2036/37 (1984 AD).

The project site has sub-tropical climate, influenced by monsoon rains (June-September) and has summer months from March to May. The site has easy access to road as well as water resource. It is an open terraced land sloping due south at an angle of about 30^0. The site is located above the bank of Trishuli River with no obstructions of trees, buildings, hills at Forebay area but there is a TL tower of 66kV inside this area; Staff Quarter area has majority of the area covered by trees, staff blocks of Devighat PH (majority of which are damaged due to earthquake of Baishakh 12, 2072 BS and are in dilapidated state).Devighat PH NEA, will demolish all these damaged buildings and relocate it (the staff quarters) to the upper section of staff quarter area which is out of the boundary of the proposed project area (60m above). And these new structures will not be affected by project works and project components. The major tree species found in the staff quarter area are Sisau (*Dalbergiasisoo*), Kapur (*Cinnamomumcamphora)* andAanp (*Magniferaindica).*The project will have to take permission from District Forest Office, Nuwakot to cut these trees for site clearance and this will be done after the approval of Initial Environment Examination (IEE) report from the Ministry of Energy (MoEn) through Department of Electricity Development

(DoED).There is no any monuments of historical nature of that of religious importance within the project site.

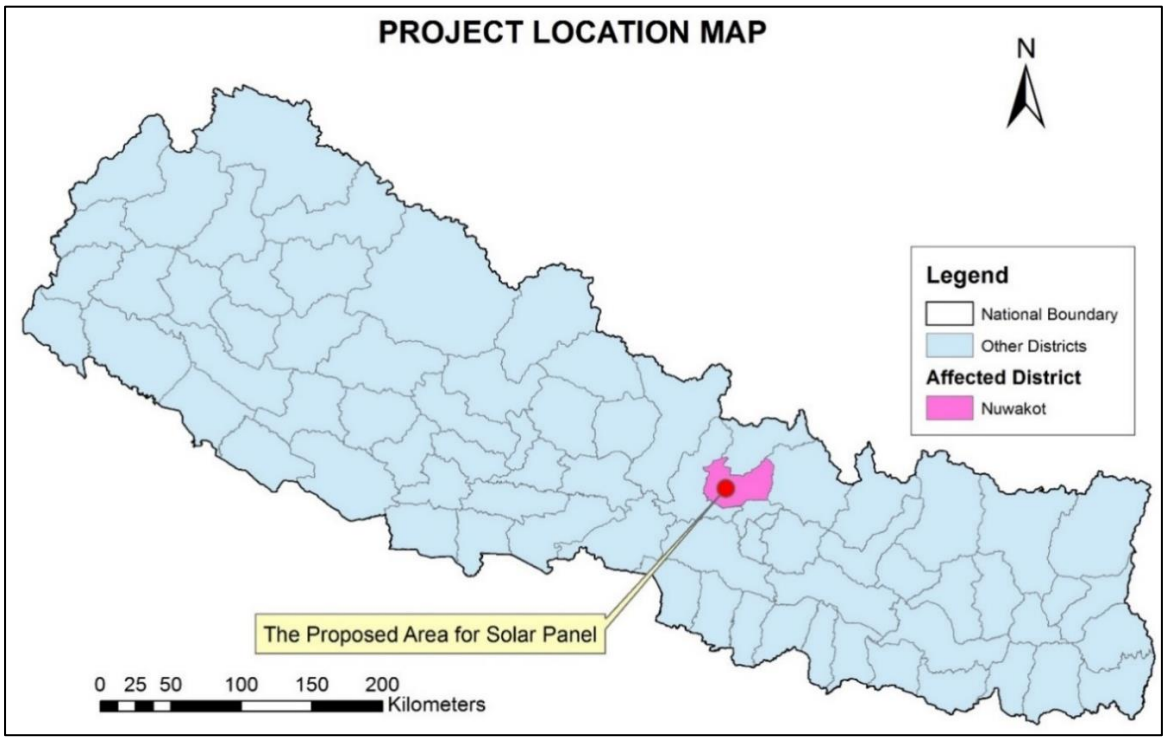

Figure 1-1: Project Location Map

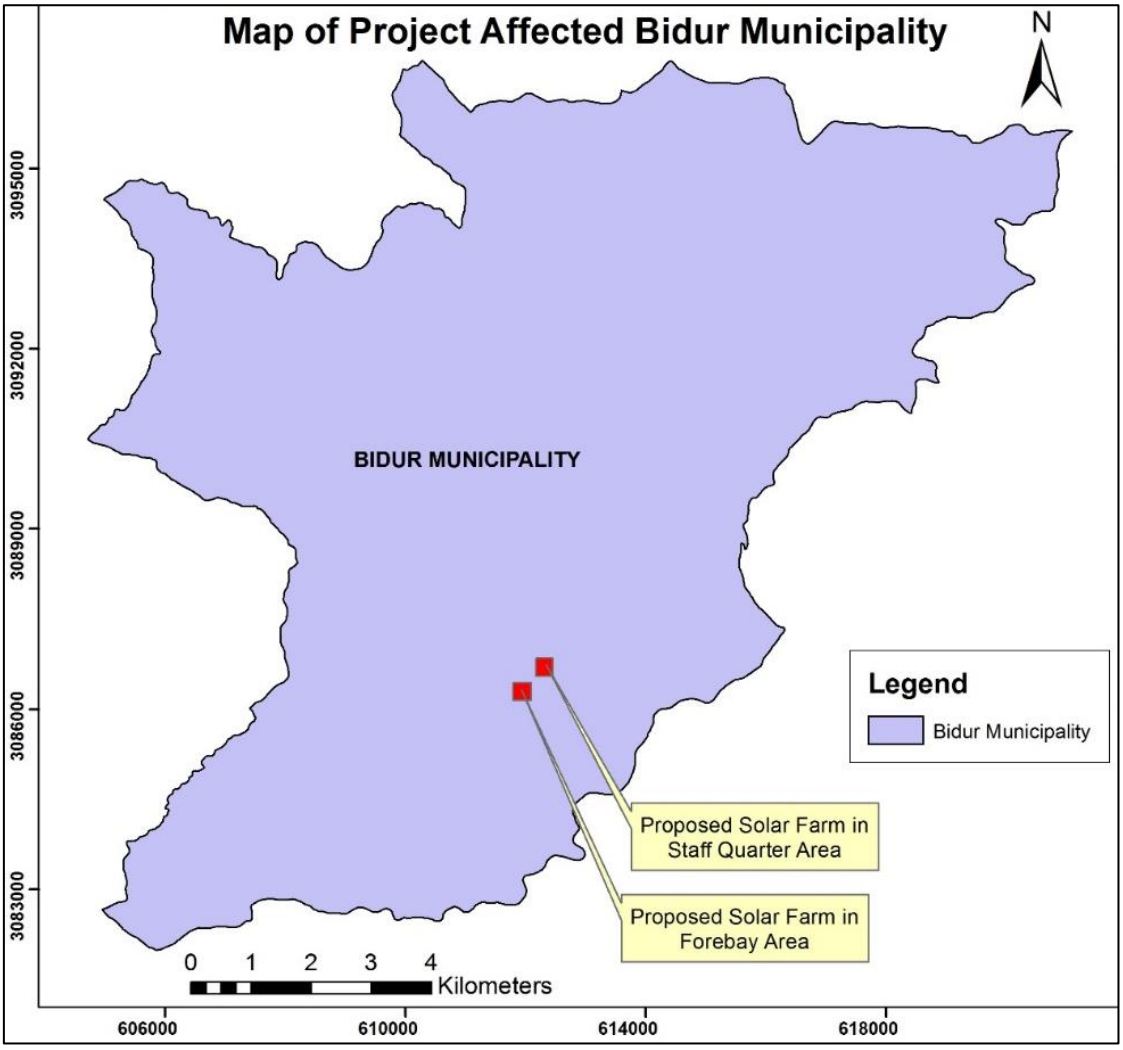

Figure 1-2: Project Affected Bidur Municipality showing the Project Site

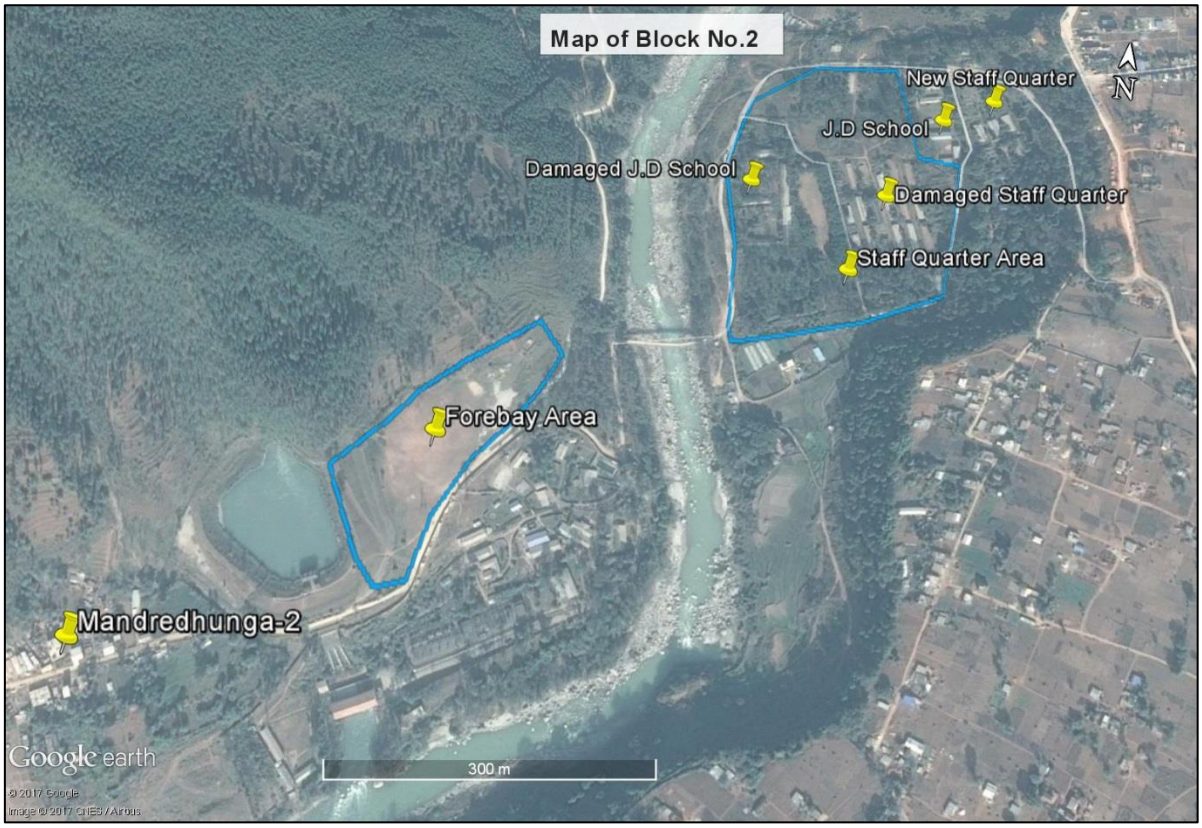

Figure 1-3: Google image of Forebay and Staff Quarter Areas for Solar Plant

1.3 Construction Planning

The implementation of the proposed project comprises installation, erection, testing and commissioning works of solar panels. The estimated years of project completion is one years starting from March, 2018.

1.3.1 Preliminary Works

Preliminary works for the proposed project consists of contract award, the detail design study and mobilization of the contractors. The detail design study will carry out the spotting of solar panels, preparation of longitudinal profiles, geological field test and laboratory testing, etc.

1.3.2 Land

The project will permanently require approximately 12.52ha of land for solar panels erection and other physical facilities. For the erection of solar panels, approximately 11.27ha land will be needed and the remaining 1.25ha land will be used for other physical facilities such as construction of guard buildings, water control mechanism and so on. Since the area is under the ownership of NEA, there is no need to acquire private land from the people. In the same way, there is enough land within NEA around the area which will be used for other purposes.

1.3.3 Requirement of Workforce

During the stages of the construction period of the project, altogether approximately 140 people will be employed including 100 unskilled, 15 semi-skilled and 25 skilled human reosurces. Most of the unskilled manpower will be hired locally as per available skill and

experiences; approximately 80-85 manpower are hired locally whereas only 10-15 manpower will be migrant workers.The workforce will be used for a maximum of 8 months during construction period.

1.3.4 Materials

The main materials required for construction works related with the solar farm project will be as follows;

- Solar modules; Polycrystalline (pc-Si)
- Inverters (String/Central)
- Power supply
- Mounting Structures
- Aggregate
- Cement
- Sand
- Water

The requirement of the project materials are presented in the following table.

Table 1-1: Requirement of the Project Materials to the Project

S.N.	Description	Number	Model
1	Solar modules; Polycrystalline (pc-Si)	153,812	RSM60-6-270p
2	Inverters (String/Central)	23	SG125/SG2500
3	Mounting Structures	6409	Steel Structure

Source: GSEEP

The power supply needed for construction activities will be tapped from the existing 11kV/66kV TL which is within the boundary of project site.Aggregate, cement and sand is needed in very minimal amount for the construction of controlled building, guard room and toilet. The required amount of cement will be acquired from local manufacturers. Likewise, sand will be purchased from local market. Coarse aggregates will be produced at site from excavated materials or purchased from the nearby market. The excavated foundation material can be used as a backfill required for the foundation of mounting structure.The water required to clean solar panels is approximately 7000-20000lt. per MW plans. On the basis of this, total water requirement for this project is 60,000-166,000lt. The panels is planned to clean once a week.The project will arrange these quantity of water by deep boring in staff quarter area and through tapping from Forebayin Forebayarea.

1.3.5 Construction Method

Simple land labeling works to be done, not so major land excavation and cutting filling will be done for this project. There is no use of concrete batching plant for this project. Backhoe Loaders, Ramming Machine and Excavator are used during construction. There is no blasting only drilling for piling works will be done.

1.4 Objectives, rationale and Methodologies for Preparing ESMP

Objectives

The objective of the Environment and Social Management Plan (ESMP) is to identify the potentially significant environmental issues and risks of the proposed project and to suggest appropriate mitigation measures to mitigate and/or minimize the adverse impacts so that the

project is implemented in an environmentally sound manner. The other general objectives of the study are to:

- Identify, predict and describe/ assess potential environmental and social impacts from the installation of the Solar farm
- Definethe roles and responsibilities of all parties involved in project environmental and social management (including monitoring mechanism which should be consistent with the provisions in the project's ESMF);
- Identify and describe measures for impact avoidance, minimization, and mitigation and their costs;
- Define environment and social management mechanismto ensure the implementation of mitigation measures and monitoring programs; and establish a supervision, monitoring and reporting as well as grievance handling mechanism.
- Consult with potentially affected people, community and stakeholders and help to identify/ understand people's concerns and suggestionsand address them, if relevant.

Rationale

Based on the recommendation identified from screening report, the ESMP is prepared to address the impacts on the particular aspects and describe different measures to mitigate those impacts.

Methodology

This ESMP report is prepared in accordance with the screening report of the project, field study, consultation with local people/stakeholders and officials. Various methodologies are used to prepare the ESMP; they are:

- Field Investigation
  - ❖ Identification of settlements nearby project area.
  - ❖ Meetings/Consultations/Public Participation
  - ❖ Verification of secondary data/ information and collection of data/ information from the field.

The project team visited the site in 2074/09/11 to 2074/09/14. During site visit, two consultation meetings were conducted at project sites (J. D secondary school, Devighat Colony and Mandredhungasettlement). Altogether, 32 local people participated in the meeting, with 16 males and 16 females. The detail of the meeting is given in Annex I.The team also visited to district level line offices such as Ward No 6, Bidur Municipality, Bidur Municipality office, District Coordination Committee (DCC), District Forest Office (DFO) and District Agriculture Development Office (DADO).

2 EXISTING ENVIRONMENTAL AND SOCIAL SETTINGS

The proposed project area is located at Devighat Colony area of Bidur Municipality-6(the then Charghare VDC) of Nuwakot district. For the study of existing environmental and social settings, the study area is defined as the area for the erection of the solar panels and other physical facilities. The settlement area, forests or other vegetation and places having built up infrastructures or facilities that falls within the boundary of project site is also under the study area.

2.1 Physical Environment

The topography, land use, climatic condition, geomorphology and geology, seismology, air, water and noise condition, watershed and drainage pattern, solar potential and air traffic that shall be influenced due to the construction of this project has been discussed in each topic ahead.

2.1.1 Topography

The proposed solar sites are located in the mid-hills of Nepal. Staff Quarter area has flat terrain as well medium sloped terrain whereas,Forebay area has flat terrain.The altitudinal variation of the Staff Quarter area is between 500masl and 520masl whereasForebay area is between 515masl and 520masl at Bidur municipality of Nuwakot.

2.1.2 Landuse

A total of 12.52ha land will be covered by the solar farm. The land is owned by NEA and consists mostly the tree speciesplanted by NEA itself and the damaged staff blocksin Staff Quarter site whereas Forebay site consists of barren land. There is 66kV TL tower within theForebay area.

2.1.3 Air Quality

The project area is accessible via Battar-Charghare-Khadgabhanjyang road which connects the project area with PasangLhamo highway. The transportation density and frequency of the vehicles along the road is very low, so the noise pollution levels are very low and can be considered as fairly good. The construction and improvement works for the road are undergoing. The main source of air pollution is due to vehicular movement along the road. Therefore, the overall status of air quality at the solar site can be considered to be good and within the range of acceptable limits.

2.1.4 Noise Quality

Noise pollution is very less in the area. Only the vehicular movement is causing noise pollution in and around the solar site. The noise level near Mandredhunga settlement is found to be 44dB which is within the range determined by Ministry of Environment, Science and Technology (MoEST) in National Standard of Sound Quality, 2069.

2.1.5 Water sources and Drainage Patterns

The main river which drains the project area is Trishuli River which is about 60m west from the boundary of staff quarter area and 200m east from Forebay area. There are no any rivulets near the project site. The project site is located in hilly area so the chances of water logging is minimal.

2.1.6 Soil Erosion and Land Stability

During field visit, there was no any evident of landslide within the boundary of project site. Both Forebay and Staff Quarter areas are stable. Staff quarter area is located about 60meast from the inner bank of Trishuli River so bank cutting is minimal.

2.2 Biological Environment

Vegetation and forest resources, ethno botany, mammals and birds and rare and protected species of flora and fauna found in the project area are studied in biological environment.

2.2.1 Vegetation and Forest Resources

Among the two sites under block 2 of the project, Forebayarea is devoid of any infrastructure or other flora (trees/vegetation). There is no natural forest found in the Forebay area during site visit. The area is occupied by grass, predominantly - dubo (*Cynodondactylon)*which is distributed throughout the project area.

In the Staff Quarter area, major tree species like Bhogate (*Citrus maxima*), Nibuwa(*Citrus limon*), Kimbu (*Morusaustralis*), Kutmero (*Litseamonopetala*). Kharreto (*Hypericumuralum*), Sisau (*Dalbergiasissoo*), Pipal (*Ficusreligiosa*), Kapur (*Cinnamomumcamphora*), Amba (*Psidiumguajava*), Tooni (*Toona ciliate*), Aanp (*Mangiferaindica*), Bar (*Ficusbenghalensis*), Sami (*Ficusbenjamina*), Simal (*Bombaxceiba*), Khirro (*Sapium insigne*), Salla (*Pinusroxburghii*), Naspati (*Pyruscommunis*), GobreSalla (*Pinuswallichiana*), Dumrighans (*Ficusracemosa*), Litchi (*Litchi chinensis*), Sirish (*Albiziajulibrissin*) Bakaino (*Meliaazedarach)* are found during site visit which are commonly used by locals in the project area.These plant resources are utilized for various purposes like fodder, animal bedding, as fruits and nuts etc. by the local around the project area.A total of 677 trees (DBH >10cm) are found in the staff quarter area which need to be cleared during project construction. The details of the potential loss of such tress is presented in the Table 2.2.

Common shrubs foundin and around the project area (Staff quarter area)are Sajiwon (*Jatropacurcas sp.)*, Dhurseli (*Colebrokiaoppositiofolia*), Banmara (*Eupatorium sp.*), Titepati (*Artemisia vulgaris*), Hade Unyu (*Dicranopteruslinearis*), Aiselu (*Rubuspaniculatus*), Argeli (*Daphne sureil*) etc. Similarly common herbs occurring in the project area are Dubo (*Cynodondactylon*), Khar/Siroghans (*Imperata cylindrical*), Kans (*Saccharumspontaneum)* etc.

2.2.2 Ethnobotany/ Plant Resources Use Pattern

There is not much significant major timber yielding plant around the project area. Common plant resources use pattern in Staff quarter area is presented as below:

Table 2-1: List of Common plant resources found in Project area

S.N.	Common name	Scientific name	Usage
1	Bhogate	*Citrus maxima*	Fruit and nuts, support for climber
2	Nibuwa	*Citrus limon*	Fruit and nuts, insecticide
3	Kimbu	*Morusaustralis*	Fruit, fiber, fodder
4	Kutmero	*Litseamonopetala*	Fodder, medicinal plant
5	Kharreto	*Hypericumuralum*	Utensils, handicrafts
6	Sisso	*Dalbergiasissoo*	Animal bedding, Fiber and fiber yielding, Fodder, Medicinal plants, Seeds, Vegetables
7	Pipal	*Ficusreligiosa*	Exudates, Fodder, Fruit and nuts
8	Kapur	*Cinnamomumcamphora*	-
9	Amba	*Psidiumguajava*	Fruit and nuts, Fodder
10	Tooni	*Toonaciliata*	Animal bedding, Utensils, handicrafts, Fodder, Insecticides and herbicides
11	Aap	*Mangiferaindica*	Fruits and nuts
12	Bar	*Ficusbenghalensis*	Religious
13	Sami	*Ficusbenjamina*	Religious
14	Simal	*Bombaxceiba*	Animal bedding, Exudates, Fibre and fiber yielding, Fodder
15	Khirro	*Sapium insigne*	Animal bedding, Exudates, Fodder, Fruit and nuts
16	Salla	*Pinusroxburghii*	Animal bedding, Exudates, Fibre and fiber yielding, Fodder, Fruit and nuts
17	Naspati	*Pyruscommunis*	Fruit
18	GobreSalla	*Pinuswallichiana*	Animal bedding, Exudates, Fibre and fiber yielding, Fodder
19	Dumrighans	*Ficusracemosa*	Animal bedding, Drying/tanning, Exudates, Fodder
20	Litchi	*Litchi chinensis*	Fruit
21	Sirish	*Albiziajulibrissin*	Fodder
22	Bakaino	*Meliaazedarach*	Fodder

Source: Field Visit, 2017

2.2.3 Wildlife (Mammals and Birds)

Common mammals spotted in the project area (Staff quarter area) are RatuwaMriga (*Muntiacusmuntjak)*, Rabbit (*Lepusnigricollis*), Squirrel (*Funanbulus sp*.), Chituwa (*Pantherapardus*), Ban biralo (*Felischaus*), Bat (*Pteropusgiganteus*), Dumsi (*Hystrixindica*), Mal sapro (*Martin flavigula*) etc. Common bird species are Cuckoo (*Plantative cuckoo*), Kalij (*Lephuraleucomelanos*), Dhukur (*Streptopeliachinensis*), Koili (*Surniculuslugubris*), Suga (*Psittaculacyanocephala*), Jureli (*Pycnonotuscafer*), Bakulla (*Bubulcus ibis*) Lampuchhre (*Cissaerythrorhyncha*), Chil (*Ictinaetusmalayensis*), Giddha (*Gyps sp.),* Pigeon (*Columbia livia*), Sparrow (*Passer domesticus*) etc. Reptiles include snake, lizard etc.

2.2.4 Rare and Protected Species of Flora and Fauna

None of the protected species of fauna (birds and mammals) are reported in the project site. The proposed area is not located within national park, wildlife sanctuary, buffer zone or conservation area. The area is not major suitable habitat for birds and mammals. So, habitat fragmentation is not caused due to implementation of the project.

2.3 Socio-economic and Cultural Environment

In Staff Quarter area, there are damaged staff blocks (29 nos.) of Devighat powerhouse (PH) due to earthquake of Baishakh 12, 2072 BS. The blocks are abandoned and DevighatPH NEA will demolish all these damaged buildings and relocate it (the staff quarters) to the upper section of staff quarter area which is out of the boundary of the proposed project. There is a secondary school named J. D. Secondary school, run by Devighat PH, NEA itself, within the NEA compound but outside the project footprint. The school has250 students and 18 teachers. The physical condition of the school is not good as most of its classes are damaged by earthquake 2072 BS.The school has reconstructed two building with four rooms which are not enough. From site visit it was found that there is need to construct two rooms for science lab and computer class in the school.

Mandredhunga, Bidur Municipality-6 is the nearest settlement from the project site (Forebay area) which is about150m far behind.Though this settlement is not directly affected by the project activities and its component, but it is indirectly affected by the project such as air and noise pollution.There are approximately 74 HHs in the settlement with majority of Rai (68 HHs) andTamang (6 HHs)community.Hindu is the major religion followed by Buddhism in the settlement. There is also a primary school named Mandredhunga primary school in the settlement with 103 students and 7 teachers. There are new buildings in the school which has made by financial support of NGO,Rupantar Nepal.

The economic character of Mandredhunga settlement is based on agriculture and wage labor. The agriculture lands of the area are productive. Rice, wheat, maize and vegetables are the major crops produced in the area.Furthermore, animal husbandry is another major source of income of the local villagers. Nowadays, poultry farming is the emerging occupation for the people of the project area. There is the water supply pipe line in the Mandredhunga settlement which provides drinking water facilities.

There is 11kV transmission line pole within the project site (Staff Quarter)and 66kV TL within Forebayarea). The road that goes through the settlement is Battar-Charghare-Khadgabhanjyangroad which is an earthen road. The road is being developed by the GoN for the interlinking of Dhading with Nuwakot and in near future will be a paved road. There are no cultural and historical sites within and nearby the project site.

3 ASSESSMENT OF IMPACTS AND MITIGATION MEASURES

3.1 Land Use and Land Take

The land use changes due to the erection of the solar panels in the permanent land. The project site consists of two areas i.e. Forebay area (6.28ha) and Staff Quarter area (6.24ha), therefore atotal of 12.52ha land will be covered by the solar farm. However, the land is under the ownership of NEA, thus no individuals will be affected by the project activities. .

3.2 Air Quality

Impacts:

a. Construction Phase

The construction activities consist of site clearance including clearance of trees, damage structures, cut-fill work for the levelling and grading of the land. These activities will generate dust in the surrounding area of J.D school and staff quarter area of Devighat powerhouse. Forebay area is an open land so dust generation is minimal.Apart from these activities, movement of transporting vehicles carrying the construction materials along Battar-Charghare-Khadgabhanjyang road will generate fugitive as well as combustion emissions and will cause temporary impact on air quality and thus may cause problem on health of construction workers and student of JD school. Gas emissions and particulate matter from project vehicles and equipment will also decrease air quality.

b. Operation Phase

No impact on air quality is envisaged during the operation phase.

Mitigation measures:

a. Construction Phase

- Water will be sprayed through tanker on the road near school area once a day to reduce the dust problem during construction period, particularly when construction materials is being transported to the project sites.
- Maintenance of all vehicles and construction machinery will be done.
- Appropriate protective equipment against noise (e.g. respirators) will be provided for the workers.

b. Operation Phase

No mitigation measures is required in this phase as there is no impact in air and noise quality at this phase.

3.3 Noise Quality

Impacts:

a. Construction Phase

During the construction phase, noise will be generated by the construction vehicles (backhoe,excavator, and loader). The impacts will be felt in staff quarter and school area (noise sensitive receptor).

b. Operation

Noise generated during the operational phase will generally result from vehicular traffic which is expected to be negligible.

Mitigation measures:

a. Construction Phase

- Maintenance of all vehicles and construction machinery will be done.
- Earmuffs or plugs to the workers will be provided as per the requirement.
- The construction work will be limited to daytime as far as possible.

b. Operation

No mitigation required during this phase.

3.4 Waste Management

Impacts

a. Construction Phase

The unmanaged disposal of spoil generated from damaged structures of staff quarter area will hamper the mobility of construction vehicles, workers. The improper disposal of solid waste like cement bags, iron bar and other leftover construction materials and wastes from workers might cause sanitary problem to the school area and also to workers involved. There will be no use of batteries for the proposed solar project so the impact due to battery wastes is eliminated.

b. Operation Phase

The personnel who work during operation period will generate domestic solid waste. There will be no other waste types generated during operation period.

Mitigation Measures

a. Construction Phase

- Spoil generated from damaged structure will be used for backfilling and levelling of staff quarter area
- Domestic type solid wastes are biodegradable which will be managed by burying in pit.
- Recyclable wastes (such as glass, paper, plastic, etc.) will be collected separately to be sent for recycling. Separate waste containers (drums, bins, skips or bags) will be provided for different types of waste.
- No waste will be disposed along public road or in the surrounding area of school.
- Construction workers will be instructed for proper storage and handling procedures of construction waste and other solid wastes.

The contractor will be responsible for the establishment of the waste management system during construction period.

b. Operation Phase

The domestic wastes will primarily consist of organic food waste because this is easily biodegradable and non-hazardous. It will be managed by burying in pits and subsequently covering with soil.

3.5 Light reflection

a. Construction Phase

There is no impact of light reflection during construction phase.

b. Operation Phase

The panel of solar PV are designed to maximize absorption and minimize reflection to increase electricity production efficiency. To limit reflection, solar PV panels are constructed of dark, light-absorbing materials and covered with an anti-reflective coating. The light reflecting percentage of solar PV is as little as 2% of the incoming sunlight. Thus, there will not reflection of light from solar panels. From the study of various assessments relating to solar panels installation as well as the site visit of solar installation areas of Nepal (Training center, Nepal electricity Authority and Chovar site), it is concluded that the glare and reflectance levels from a given PV system are decisively lower than the glare and reflectance generated by the standard glass and other common reflective surfaces in the environments. (*Source: PV Systems: Low levels of Glare and Reflectance vs. Surrounding Environment*).

Mitigation Measures

No mitigation measure is required during construction and operation phase.

3.6 Impact on Standing Trees and vegetation

a. Construction Phase

Standing trees and vegetation will be lost during the construction of the project. Site clearance comprises of removal/clearance of the generated shrubs and herbs species in the area. One species banned for commercial felling, transportation and export as per Forest Rules,2051, i.e. Simal (*Bambaxceiba*) occur in the vicinity of Staff quarter area. Details of the loss of trees is given in the following table.

Table 3-1: Total loss in terms of plant species

S.N.	List of tree loss	Scientific name	Total
1	Bhogate	*Citrus maxima*	25
2	Nibuwa	*Citrus limon*	10
3	Kimbu	*Morusserrata*	3
4	Kutmero	*Litseamonopetala*	3
5	Kharreto	*Hypericumuralum*	4
6	Sissoo	*Dalbergiasissoo*	325
7	Pipal	*Ficusreligiosa*	18
8	Kapur	*Cinnamomumcamphora*	153
9	Amba	*Psidiumguajava*	2
10	Tooni	*Toonaciliata*	16
11	Aap	*Mangiferaindica*	52
12	Bar	*Ficusbenghalensis*	1
13	Sami	*Ficusbenjamina*	1
14	Simal	*Bombaxceiba*	3
15	Khirro	*Sapium insigne*	2

16	Salla	*Pinusroxburghii*	15
17	Naspati	*Pyruscommunis*	1
18	GobreSalla	*Pinuswallichiana*	2
19	Dumrighans	*Ficusracemosa*	5
20	Litchi	*Litchi chinensis*	4
21	Sirish	*Albiziajulibrissin*	18
22	Ipil-Ipil	*Leucaenaleucocephala*	4
23	Bakaino	*Meliaazedarach*	10
Total			677

Source: Field Visit, 2017

b. Operation Phase

Since the operation of the project will permanently occupy land, the ground vegetation cover would be lostdue to project activity.

Mitigation Measures

Since the removal of trees and other vegetation is within the premises of NEA owned land, the procedures specified in the section 4 of the "Standard for removing government trees, 2071" will be followed. In accordance with the Standard for removing Government Trees, 2071, the concerned agency should cut the trees in its own cost and sell the forest products in accordance with the prevailing laws and acts and deposit the income for royalty. For the purpose of this standard, Examination Committee will be comprised of 7 members with DFO as a Coordinator. With the request for removing such trees, the committee will monitor the area and the trees to be cut. The cost for such monitoring will be the responsibility of related office/project.Since the land is owned by NEA, compensatory plantation is not required for the project as per the Standard.

3.7 Impacts on School/Settlement

Impacts

a. Construction Phase

During the project construction phase, the traffic flow will arise from the transportation of solar panels and other construction materials. Since, J.D Secondary is besides staff quarter area, there may be the chances of road accidents. Similarly, Forebay area is also along the road (Battar-Khadgabhanjyang-Dansing road) and main access for the people of nearby settlements, there may be the chances of road accidents and also the issues of pedestrian safety.However the nearest settlement (Mandredhunga) is 150m far behind from project site (Forebay area), there may not be direct impact on the settlement due to project activities.

b. Operation Phase

No impacts on settlement during this phase is found.

Mitigation measures

a. Construction Phase

The impacts and possible traffic accidents to the school will be prevented or minimized through different measures.

- Fencing wall will be constructed around the project sites (both staff quarter and Forebayarea).

- Consultation meeting with school management and local community members regarding the awareness towards the safety issues by the project once prior to construction and twice during construction period,
- Placing traffic signs and limiting the maximum speed of vehicles.

b. Operation Phase

No mitigation measure is required at this phase.

3.8 Health and Safety

Impacts

a. Construction Phase

There is no impact on the health of the people of nearby settlement due to project activities. However, there is minimal risk of electric shock (less than 5%) and occupational injuries to the construction workers during wiring/fitting process. Thus the project should take into consideration for health and safety of the workers.

b. Operation Phase

There will be no prominent impact on this phase.

Mitigation Measures

a. Construction Phase

- An on-site medical facility and first-aid will be provided for the construction phase to cater for primary health care needs of personnel.
- Personal protective equipment (Hard hats, gloves and steel-toed shoes with rubber soles) for workers will be provided, when necessary, to minimize health and safety risks.

b. Operation Phase

No mitigation measure is required at this phase.

3.9 Loss of Structure

Impacts

a. Construction Phase

There are 29 damaged structures (staff quarters) of Devighat PH within the proposed site (Staff Quarter area) which need to be demolished before the erection of solar panels.These blocks are abandoned and Devighat PH NEA will demolish all these damaged buildings and relocate it to the upper section of staff quarter area (Figure 1-3) which is out of the boundary of the proposed project.

b. Operation Phase

There is no impact on structures during this phase.

Mitigation Measures

No mitigation measure is required as the damaged blocks are NEA's own property and Devighat PH NEA will manage for its relocation. The reusable materials such as iron, tin will be sold through auction and the income of it will be deposited as royalty whereas other debris come from the buildings will be used for levelling and grading the site.

3.10 Labor influx and Labor camp

Impact:

a. Construction Phase

The project should make camp for construction labors. The labor camp will be established within NEA's premises (outside the project area), however the location is not still finalized. There will be the issue of health and sanitation of labors within the camp. Thus, the project should take into consideration for the construction of toilets for male and female workers separately and biodegradable wastes produced by workers should be buried in pits. In the same way, influx of outside labor may affect the social and cultural life style of the local people. Since, total number of construction workers (migrated) is very few (approximately 50 to 55 nos.) and their fast mobility, these impacts are expected to low in magnitude, local and short termed in duration.

b. Operation Phase

There is no impact during this phase as all labor force will returned back and labor camp will be demolished.

3.11 Corporate Social Responsibility

During the consultation with management of J. D. secondary school, it was found that the physical condition of the school is very poor as most of its classes are damaged by earthquake 2072. The school has reconstructed two building with four classes which is not enough for it. There is still need of two rooms for science lab and computer class in the school. Therefore, as a part of CSR, project will provide financial support to the school for infrastructure development.For this approximately NRs. 2,000,000 has been estimated.

3.12 Environment Mitigation Plan

The identified impacts due to project activities and the mitigation measures are explained in the given table.

Environmental Impact and Mitigation Matrix

S.N	Issues	Impacts	Mitigation Measures	Location	Timing of Action	Estimated Mitigation Cost (NRs)	Institutional Responsibility	
							Implementation	Supervision
A.	**Construction Phase**							
1	Land use and Land take	A total of 12.52ha land will be covered by the solar farm which is under the ownership of NEA.	No mitigation measure is required.	-	Not required	Not required	Not required	Not required
2	Air Quality	The construction activities consists of site clearance including clearance of trees, damage structures, cut-fill work for the levelling and grading of the land will generate dust in the surrounding area of JD school. Movement of transporting vehicles carrying the construction materials	Water will be sprayed on the road near school area once a day. Appropriate protective equipment against air (e.g. respirators) will be provided for the workers.	Construction site.	Construction phase.	Project Cost	Contractor	ESSD/NEA
3	Noise Quality	Noise will be generated by the construction vehicles (grader, excavator, and dumper)	Maintenance of all vehicles and construction machinery will be done. Earmuffs or plugs to the workers will be provided as per the requirement. The construction work will be limited to daytime as far as possible.	Construction site.	Construction phase.	Project Cost	Contractor	ESSD/NEA

4	Waste managements	The unmanaged disposal of spoil generated from damaged structures of staff quarter area will hamper the mobility of construction vehicles, workers. The improper disposal of solid waste like cement bags, iron bar and other leftover construction materials and wastes from workers might cause sanitary problem to the school area and also to workers involved.	Spoil generated from damaged structure will be used for backfilling and levelling of staff quarter area Domestic type solid wastes will be managed by burying in pit. Recyclable wastes will be collected separately to send for recycling. Separate waste containers will be provided for different types of waste. No waste will be disposed along public road or in the surrounding area of school. Construction workers will be instructed for proper storage and handling procedures of construction waste and other solid wastes.	Construction sites and camp site.	Construction phase.	Project Cost	Contractor	GSEEP/ESSD
5	Impact on Standing trees and other vegetation.	Altogether 677 standing trees and vegetation will be lost for site clearance during the construction of the project.	NEA itself will cut the trees in its own cost and sell the forest products and deposit the income as royalty according to "Standard for removing government trees, 2071".	Staff Quarter area	Construction phase.	NEA Cost	NEA	District Forest Office

6	Impact on School/ Settlement	Increase of traffic flow leads to the chances of road accidents and other pedestrian issues to the school (J.D. secondary school) and nearby settlements.	Fencing wall will be constructed around the project sites (both staff quarter and forebay area); Consultation meeting with the school management and local community members regarding the awareness towards the safety issues by the project ; Placing traffic signs and limiting the maximum speed of vehicles.	In area surrounding the construction site.	Once prior to construction and twice during construction period.	Project Cost	GSEEP/ ESSD	NEA/ESSD
7	Health and Safety	There is minimal risk of electric shock (less than 5%) and occupational injuries to the construction workers during wiring/fitting process.	An on-site medical facility will be designed to cater for primary health care needs of workers; Personal protective equipment (helmet , gloves and steel-toed shoes with rubber soles) for workers will be provided;	Construction site and surround settlement.	Construction phase.	Project Cost	Contractor	NEA/ESSD
8	Loss of structure	29 damaged structures (staff quarters) of Devighat PH within the proposed site (Staff Quarter area) will be demolished.	No mitigation measure is required as the damaged blocks are NEA's own property.The reusable materials such as iron, tin will be sold through bidding and the income	Staff Quarter area	Construction phase	NEA Cost	Devighat PH, NEA	NEA/ESSD

			of it will be deposited as royalty whereas other debris come from the buildings will be used for levelling and grading the site.					

4 MONITORING AND REPORTING MECHANISM

Monitoring is an essential aspect of environmental and social management plan. An Effective monitoring of the whole project cycle, will assist for the implementation of monitoring plan and coordination of work of the project with concerned stakeholders as well as identify the unexpected problems/outcomes that might come in physical, biological and socio-economical sector and facilitate the correction of those. Land use pattern, settlement, health and safety, infrastructure, implementation of the mitigation measures are the few areas of monitoring.

NEA is responsible for regular monitoring and reporting of the implementation of the project.Ministry of Energy (MoEn), Department of Electricity Development (DoED) and local bodies will also be involved during the monitoring.

The environmental monitoring will be carried out at all the project impact areas (Staff quarter and Forebay area) in a regular or intermittent schedule.

The experts from ESSD will visit project site at periodic interval for the environmental monitoring of the project and prepare the monitoring report. The project manager office (PMO) will be responsible for the distribution of report to the concerned agencies. The detail of monitoring parameters, schedule, method and agencies to be consulted during construction and operation phases for physical, biological and socio-economic and cultural environment is presented in table given below.

4.1.1 Environmental Monitoring Plan

A monitoring program, required for the project to evaluate the application and effectiveness of mitigation measures, is formulated in three phases.

a. Preconstruction Monitoring

Since the construction work of the project will start immediately, preconstruction monitoring is not required for the proposed project.

b. Construction Monitoring

Impact and compliance monitoring will be conducted during this phase of project development.

Impact Monitoring

Impact monitoring will be carried out to assess actual level of impact due to project construction. The impact monitoring includes:

- monitoring of the impacts of the project on physical, biological and socioeconomic & cultural environment of the area;
- monitoring of the accuracy of the predicted impacts;
- identify the emerging impacts due to project activities or natural process and develop remedial action; and
- monitoring of the effectiveness of mitigation measures.

Compliance Monitoring

The compliance monitoring will be conducted to monitor the compliance of the proposed mitigation measures and monitoring activities. The compliance monitoring will mainly focus on;

- compliance of the tender clause;
- compliance of the mitigation measures;
- timely and adequately implementation of Environmental Management Plan; and
- overall environmental and social performance of the project.

Table: Monitoring Plan

S.N.	Parameter	Indicators	Method	Location	Schedule
A	**Construction Monitoring**				
Impact Monitoring					
1	Air Quality	Dust around the project area	Observation	Construction site, Battar-Charghare-Khadgabhanjyang road and school area	Weekly during construction
2	Noise Quality	Construction vehicles	Standard of MoEST	Construction area	Weekly during construction
3	Waste Management	Unpleasant odour and visual impact	Observation	Labor camp/ construction sites	Weekly during construction
4	Health and Safety issues	On site medical facilities to the workers; No. of accidents, personal protective equipment to the workers	Inspection of the construction place; Records of accidents	Project area	Continuous during construction period
5	Employment	No. of local people employed by project	Records kept by management	Project area	Continuous during construction period and annually during operation
6.	Infrastructure development	No of class rooms built by the project	Observation, consultation with school management	Project area	Construction period
7	School/settlements	Construction of fencing wall and placement of traffic signs	Observation	Project area	Construction period
Compliance Monitoring					
1	Allocation of adequate budget for implementation of environmental mitigation measures and monitoring works	Yes/No	Review, inquiry and consultation	Kathmandu Office	Preconstruction phase

4.1.2 Environment Mitigation and Monitoring Cost

Environment Mitigation Cost

No separate mitigation cost is required for the proposed project as no individual property will be acquired by the project. The total CSR cost for the project is estimated to be NRs 2,000,000 Which is only 0.13% of the total project cost.

Environment Monitoring Cost

The monitoring costs have been estimated in Table 4-1. The total cost for the monitoring activities (for construction phase) has been estimated as NRs. 2,723,150/-.

Table 4-1: Monitoring Cost of the Proposed GTSPP Block No. 1

S.N.	Item	No. of Persons	Man-month			Rate/Month (NRs.)	Amount (NRs.)
			Office (100%)	Field (150%)	Total		
	Construction Phase						
1	***Manpower***						
	Sr. Environment Expert	1	1	-	1	41,000	41,000
	Coordinator	1	4.5	1.5	6	35000	236,250
	Civil Engineer	1	2.5	1.5	4	35000	166,250
	Environmentalist	1	2.5	1.5	4	35000	166,250
	Socio-economist	1	2.5	1.5	4	35000	166,250
	Electrical Engineer	1	2	-	2	35000	70,000
	Liaison Officer	1	1	-	1	30,550	30,550
	Support Staff	2	6		12	30,500	366,000
	Cost of line agencies monitoring					LS	10,000
	Sub Total	**9**	**34**				**1,243,150**
2	**Out of Pocket Expenses**						
	TA/DA					LS	500,000
	Vehicle hire/ Maintenance					LS	500,000
	Report Production					LS	100,000
	Computer and Printer					LS	120,000
	Community Consultation					LS	100,000
	Miscellaneous					LS	150,000
						Sub-Total	**1,470,000**
						Total of Construction Phase Monitoring	**2,723,150**

4.2 Grievance Redress Mechanism (GRM)

Grievance redress mechanism will be established to allow project affected families/households (PAFs/HHs), community or other stakeholder to make appeal on any disagreeable decisions and practices arising due to project works. GRM provides an effective approach for filing complaints and their resolution effectively and timely. Considering this, a Grievance Redress Cell (GRC) has already been established at project level on 2072/05/11 as required by the project's Environment and Social Management Framework (ESMF).The GRC consists of the following members.

Project Coordinator	Coordinator
Project Manager, GTSPP	Member Secretary

Officer from Bidur Municipality	Member
Secretary, the then Charghare VDC	Member

The field level GRC will be formed after the commencement of work in the site. Till then the project level GRC will look after the grievances, if any. The GRC maintains registration books and files to keep the records of complaints filed by the affected people and community. The GRC seeks to resolve the issues quickly in order to expedite the project works without resorting to expensive and time-consuming legal actions. The budget for setting up the grievance cell has been provided by the PMO itself.

4.3 Implementation of Mitigation/Enhancement Measures and Monitoring Activity

The proponent has prime responsible for implementing the proposed mitigation/enhancement measures and monitoring activities. Proponent has an obligation to carry out all these activities along with cost.

Annex I
Project Related Photographs and Minutes of Consultation Meeting

Figure I: Staff Quarter Area

Figure II: Forebay area

Picture I: Consultation Meeting at Project Site

नेपाल विद्युत प्राधिकरण
वातावरण तथा सामाजिक अध्ययन विभाग

नेपाल विद्युत प्राधिकरणद्वारा प्रस्तावित ग्रिड सोलार तथा इनर्जि इफिसियन्सि आयोजना अन्तर्गत ग्रिडमा आवद्ध सौर्य विद्युत आयोजना कार्यान्वयन गर्दा आयोजना प्रभावित क्षेत्रमा पर्न सक्ने वातावरणीय प्रभावहरुका बारेमा ने.वि.प्रा., वातावरण तथा सामाजिक अध्ययन विभाग, भक्तपुरबाट प्रारम्भिक वातावरणीय परिक्षण (IEE) प्रतिवेदन तयार गर्ने सिलसिलामा खटिआएका वातावरणीय अध्ययन टोली तथा स्थानियबासी, सरोकारवालाहरु विच निम्न मिति, समय र स्थानमा छलफल गरी निम्नलिखित रायसुझाव संकलन गरियो ।

स्थान : जिल्ला : Nuwakot नगरपालिका: Bidur...... (साविकको गा.वि.स..............)

वडा नं./ठाउँ : 6 / Devighat colony. मिति : 2074/09/13. समय:..............

उपस्थिती

क्र.सं.	नाम थर	पद/पेशा	ठेगाना/संस्था	सम्पर्क नं	हस्ताक्षर
१.	Buddhi Sagar Rijal	Principal Teacher	Bidur 6' Devighat colony	9841671915	[signature]
२.	Maniraj Subba	"	"	9803776893	[signature]
३.	Durgesh km. Jha	"	"		[signature]
४.	Sarmila Rijal	"	"	9823-180160	[signature]
५.	Laxmi Adhikari	"	B-6 Battar		[signature]
६.	Rajukm. Rimal	"	Bidur 6' Multhala		[signature]
७.	Shivaram Pudasaini	"	Jilling-3 Nuwakot	9805346544	[signature]
८.	Janaka Rimal	"	Bidur 6' Multhala		[signature]
९.	Sabina Pathak	"	B-6' Maharani 'D'		[signature]
१०.	Bini Pradhan	"	Trishuli		[signature]
११.	S				[signature]
१२.	Dipa Chitrakar	"	Devighat colony		Dipa
१३.					
१४.					

रायसुझाव :
आयोजना बाट प्रत्यक्ष प्रभाव पर्ने शैक्षिक संस्थामा पर्ने देखिएकोले आयोजना प्रमुख र विद्यालय बीच आपसी समझदारीमा कार्य अघि बढाउनु पर्ने देखिन्छ। आयोजना संचालन हुने यस्तो कार्य भएको आवश्यक पूर्वाधार निर्माण कसरी हुने र सो बारे पनि असरको बारेमा अनभिज्ञता रहेको। साथै भुकम्पबाट पूर्ण क्षति भएको मात्र विद्यालयको प्रयोग गर्ने भवन छन्। निर्माणमा सहयोग गर्नु ~~[illegible]~~ पर्ने भएकोले सो र आयोजनाको कार्यमा हातेमालो गर्न सकिनेछ।

नेपाल विद्युत प्राधिकरण
वातावरण तथा सामाजिक अध्ययन विभाग

नेपाल विद्युत प्राधिकरणद्वारा प्रस्तावित ग्रिड सोलार तथा इनर्जि इफिसियन्सि आयोजना अन्तर्गत ग्रिडमा आबद्ध सौर्य विद्युत आयोजना कार्यान्वयन गर्दा आयोजना प्रभावित क्षेत्रमा पर्न सक्ने वातावरणीय प्रभावहरुका बारेमा ने.वि.प्रा., वातावरण तथा सामाजिक अध्ययन विभाग, भक्तपुरबाट प्रारम्भिक वातावरणीय परिक्षण (IEE) प्रतिवेदन तयार गर्ने सिलसिलामा खटिआएका वातावरणीय अध्ययन टोली तथा स्थानियबासी, सरोकारवालाहरु विच निम्न मिति, समय र स्थानमा छलफल गरी निम्नलिखित रायसुझाव संकलन गरियो ।

स्थान : जिल्ला : Nuwakot नगरपालिका: Bidur (साविकको गा.वि.स.....)

वडा नं./ठाउँ : ....6'..... मिति : 2074-09-12 समय:.....

J.D. Secondary School. उपस्थिती

क्र.सं.	नाम थर	पद/पेशा	ठेगाना/संस्था	सम्पर्क नं	हस्ताक्षर
१.	Ranabd Thapa				
२.	Dipa Chitrakar	Teacher	Devighat colony		
३.	Srijana Rimal	"			
४.	Sabitri Chalise	"			
५.	Sadhana Rimal	"			
६.	Mukunda Lamichhane	"			
७.	Mailisadaula	"			
८.	Binda Khanal	"			
९.	Nanumaya Rai	"			
१०.	Sanukanchha Kumal	"			
११.					
१२.					
१३.					
१४.					

रायसुझाव :

School is positive about the projects and hopes to support of infrastructural development to overcome from the devastating earthquake 2072

नेपाल विद्युत प्राधिकरण
वातावरण तथा सामाजिक अध्ययन विभाग

नेपाल विद्युत प्राधिकरणद्वारा प्रस्तावित ग्रिड सोलार तथा इनर्जि इफिसियन्सि आयोजना अन्तर्गत ग्रिडमा आवद्ध सौर्य विद्युत आयोजना कार्यान्वयन गर्दा आयोजना प्रभावित क्षेत्रमा पर्न सक्ने वातावरणीय प्रभावहरुका बारेमा ने.वि.प्रा., वातावरण तथा सामाजिक अध्ययन विभाग, भक्तपुरबाट प्रारम्भिक वातावरणीय परिक्षण (IEE) प्रतिवेदन तयार गर्ने सिलसिलामा खटिआएका वातावरणीय अध्ययन टोली तथा स्थानियवासी, सरोकारवालाहरु विच निम्न मिति, समय र स्थानमा छलफल गरी निम्नलिखित रायसुझाव संकलन गरियो ।

स्थान : जिल्ला : नुवाकोट नगरपालिका: विदुर......... (साविकको गा.वि.स...चाउघेडे

वडा नं./ठाउँ : ...६............ मिति : २०७४/०८/१२........... समय: ९:५५...

उपस्थिती

क्र.सं.	नाम थर	पद/पेशा	ठेगाना/संस्था	सम्पर्क नं	हस्ताक्षर
१.	श्याम बा तामाङ	व्यापार	वि.न.पा. ६	9849615946	[illegible]
२.	गोम्बु राई	व्यापार	,,	9841086560	[illegible]
३.	अमर राई	जागीर	,,	9891086248	[illegible]
४.	सानु राई	कृषि	,,		[illegible]
५.	धन बिर राई	,,	,,	9808529992	[illegible]
६.	रमेश राई	,,	,,	9808853857	[illegible]
७.	तिल बा तामाङ	जागीर	,,	9841833380	[illegible]
८.	लिला बा राई	कृषि		9823205601	[illegible]
९.	डिल बा राई	,,			डिल
१०.	सिता तामाङ	व्यापार	,,	9840589339	सीता
११.	सालानी सापकोटा	प्र.अ. शिक्षक प्रा. वि. [illegible]	वि.न.पा. - ६	9843615673	[illegible]
१२.					
१३.					
१४.					

रायसुझाव :

रोजगारीमा स्थानीयलाई प्राथमिकता दिनुपर्ने

(१) बिजुली जनतालाई निशुल्क दिनु पर्ने ।

(२) यहाँको व्यक्ती हरुलै रोजगार पाउनु पर्छ ।

(३) [illegible]

Issues/Demands received from Consultation meetings (translated in English):

1. The project should provide financial support for infrastructural development of the school.
2. Priority should be given to the locals for employment in the project.
3. Free electrification to the locals.