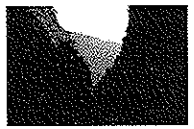
# List of Invited Institutions/Persons of Third Stakeholder Meeting in Kathmandu

**Upper Seti (Damauli) Storage Hydroelectric Project**
**3rd Stakeholder Meeting, May 10, 2007/ Baishak 27, 2064.**
**List of Invited Institutions/Persons**

| S.No. | Name | Address | Number of Participants |
|---|---|---|---|
| 1 | Ministry of Environment Science and Technology | Singha Durbar | 1 |
| 2 | Ministry of Water Resources | Singha Durbar | 1 |
| 3 | Department of Electricity Development | Singha Durbar | 1 |
| 4 | Ministry of Forest and Soil Conservation | Singha Durbar | 1 |
| 5 | Ministry of Agriculture | Singha Durbar | 1 |
| 6 | Ministry of Land Reform | Babarmahal | 1 |
| 7 | Fisheries Development Directoriate | Balaju | 1 |
| 8 | IUCN | Bakhundol | 1 |
| 9 | Nepal Forum of Environmental Journalist | Thapathali | 1 |
| 10 | Embassy of Japan | Panipokhari | 1 |
| 11 | JICA | Pulchok, Lalitpur | 1 |
| 12 | JBIC | Mr. Krishna Manandhar Local Representative, JBIC, Kathmandu | 1 |
| 13 | ADB | Kamaladi, Kathmandu | 1 |
| 14 | The World Bank | Durbar Marga | 1 |
| 15 | Engineering Association of Nepal | Pulchok | 1 |
| 16 | EIA Association of Nepal | SchEMS | 1 |
| 17 | NGO Federation | Buddha Nagar | 1 |
| 18 | Local NGO Representative | Tanahu | 1 |
| 19 | Water Nepal ( Ajay Dixit) | Patan | 1 |
| 20 | Nepal Academy of Science & Technology | Satdobato, Lalitpur | 1 |
| 21 | Radio Sagarmatha | Sanepa, Lalitpur | 1 |
| 22 | The Kathmandu Post | Subidhanagr, Kathmandu | 1 |
| 23 | The Himalayan Times | Ananmnagar, Kathmandu | 1 |
| 24 | The Rising Nepal | Dharampath, Kathmandu | 1 |
| 25 | IMAGE Channel | Lazimpat, Kathmandu | 1 |
| 26 | Kantipur TV | Subidhanagr, Kathmandu | 1 |
| 27 | JICA Study Team | | 10 |
| 28 | NESS Consult | | 5 |
| 29 | Project Office | | 3 |
| 30 | NEA-ESSD | | 8 |
| 31 | Planning NEA | | 22 |
| 32 | NORAD | Bakhundol, Lalitpur | 1 |
| 33 | KFW | Bakhundol, Lalitpur | 1 |
| 34 | ICIMOD | New Baneshwor | 1 |
| 35 | WWF | Maharjung, Kathmandu | 1 |
| 36 | Winrock International | Baneshwor, Kathmandu | 1 |
| 37 | National Planing Commission | Singa Durbar | 1 |
| 38 | Napal Toursim Board | Exhibation Road | 1 |
| 39 | Department of Gelogy | Lazimpat, Kathmandu | 1 |
| 40 | Federation of Indigenus People | Sanepa, Lalitpur | 1 |
| 41 | Nepal Communist Party (Maost) | Ananmnagar, Lalitpur | 1 |
| 42 | Nepal Communist Party (UML) | Balkhu, Kathmandu | 1 |
| 43 | Nepali Congress | Sanepa, Lalitpur | 1 |
| 44 | Nepali Congress (Democratic) | Bansbari, Kathmandu | 1 |
| 45 | Sadaabhana Party (Anandidevi) | Tripureshwor, Kathmandu | 1 |
| 46 | Nepal Peasant Party | Bhaktapur | 1 |
| 47 | Joint Peoples Movement of Nepal | Dharahara | 1 |
| 48 | Left Movement of Nepal | Dhobidhara | 1 |
| 49 | Ministry of Women and Social Welfare | | 1 |
| 50 | Dr. Jagdish Chandra Pokhrel | N.P.C. Singha Durbar | 1 |
| 51 | H. Parlamentary Member Tuk Raj Sigdel | | 1 |
| 52 | H. Parlamentary Member Govinda Raj Joshi | | 1 |
| 53 | Ex. Parlamentary Member Amar Raj Kaini | | 1 |
| 54 | Hon. Rama Kanta Gauro | | 1 |
| 55 | Hon. Suresh Ale Magar | | 1 |
| 56 | Hon. Sabitri Dura (Gurung) | | 1 |
| **Total Number of Participants** | | | 99 |

Presentation Material in Kathmandu



# Major Findings of Upgrading Feasibility Study

JICA Study Team

Malla Hotel, Kathmandu
May 10 2007

## Contents of Presentation

1. **Background & Outlines of Study**
2. **Findings**
   - 2.1 **Power Demand & Supply**
   - 2.2 **Characteristics of Project Site**
   - 2.3 **Contents of Study**
3. **Conclusions and Recommendations**
4. **Time-line of the Project**

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## 1. Background (1)

- Power Supply
  - Hydropower shares 99 % in energy generated in Nepal
- Electrification: around 25 % in households
- Supply Balance
  - Annual maximum demand: recorded during dry season
    - Minimum monthly discharge: less than 10 % of maximum one
    - Countermeasures: power import, thermal power, & load shedding
- Load shedding
  - FY 2004/05 12 days, July 2005 to May 2006 137 dyas
- Affects of Shortage of Power
  - People's living & economic activities in the country

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## 1 Outlines of the Study (1)

- Chronology of Study
  - 2000: Identification and Feasibility Study of storage projects by NEA
  - 2001: F/S by NEA
  - 2004: Upgrading F/S by NEA
  - 2004: Preliminary study by JICA
  - Feb. 2005: Commencement of Upgrading F/S by Study Team
- Study Period: Feb. 2005 to Jun. 2007
- Purpose
  - Formulate the optimum plan
  - Assess its environmental, technical, economical and financial viabilities

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## 1 Outlines of the Study (2)

Preminary Study Stage
1. Review of existing documents and data
2. Preparation of alternative layout
3. Preparation of investigation plan
4. Power Sector Survey

Detailed Investigation Stage
1. Investigation
   by Subcontracting
   by Study Team
2. Environmental assessment
3. Optimization of Development Plan

Fesbibility Design Stage
1. Design at F/S level
2. Preparation of construction plan
3. Project cost estimation
4. Economic & financial analysis

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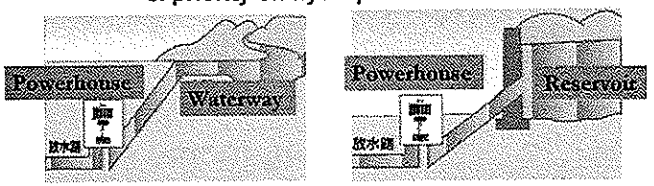
## 2.1 Power Demand & Supply (1)

- Total Installed Capacity : 611 MW, Hydropower 90%
- Annual Energy: Hydropower 99%
- Peak demand sources: storage type: 92MW (15%)

Thermal: a. expensive fuel cost
b. procurement risks and foreign currency
c. priority on hydropower




Run-off-River Type  Storage Type

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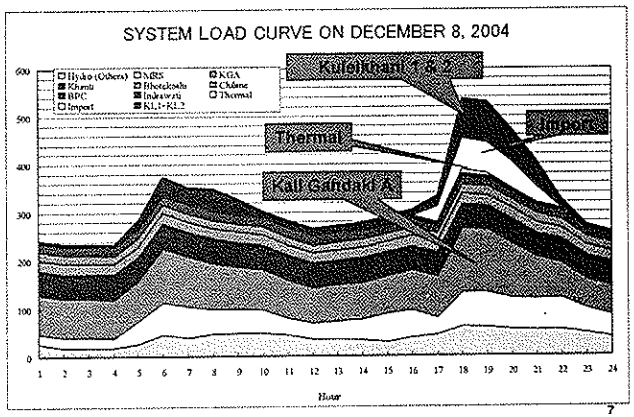
## 2.1 Power Demand & Supply (2)

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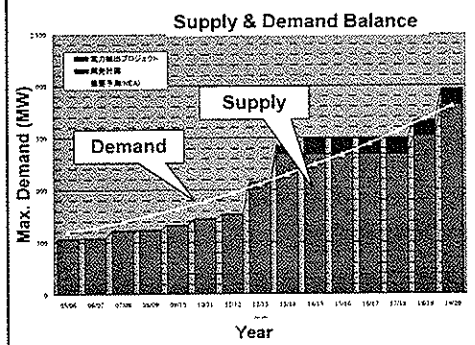
## 2.1 Power Demand & Supply (3)




- Annual Growth Rate: 8 % in past 10 years
- Demand forecast: 8 % per annum

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## 2.2 Characteristics of Project (1)

Main Features of the Project

| 1) Reservoir | |
|---|---|
| Full Supply Level | 415.0 m |
| Gross Storage Volume | 295.1 million $m^3$ |
| Effective Storage Volume | 167.0 million $m^3$ |
| Reservoir Area | 7.26 $km^2$ |
| Reservoir Length | 27.0 km |
| Drawdown Depth | 27.8 m |
| Design Flood (PMF) | 7,377 $m^3/s$ |
| 2) Dam | |
| Type | Concrete Gravity |
| Height x Length of Crest | 140 m (H) x 170 m (L) |

| 3) Powerhouse | |
|---|---|
| Type | Underground |
| Width x Height x Length | 22 m (W) x 42 m (H) x 90 m (L) |
| Turbine Type | Vertical Francis |
| Number of Turbine | Two (2) nos. |
| 4) Generation | |
| Effective Head | 113.0 m |
| Maximum Discharge | 127.4 $m^3/s$ |
| Installed Capacity | 64MW x 2 |
| Annual Energy Production | 475.2 GWh |

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## 2.2 Characteristics of Project (2)

Characteristics of the Site

- Geology: Foundation of high dam
  Underground powerhouse
- Sedimentation:
  Annual sediment: 6,500 ton/year/$km^2$
- Environment: Storage project
  Category A in JICA Guidelines

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## 2.3 Study (Geology)

- **Result of geological investigation**

1) Geology around reservoir will be watertight
2) Rock foundation will have enough strength for 140-m high concrete gravity dam.
3) Rock around underground powerhouse will be hard.

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## 2.3 Study: Sedimentation

- Countermeasures for Sedimentation

1. Sediment flushing facilities in dam
2. Sediment flushing at the beginning of rainy season
3. Coating of turbines due to erosion by small particle of soil

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## 2.3 Study (Environment)

- Environmental Impact Assessment (EIA)

1. Review of NEA's EIA
2. Supplemental Environmental Survey
3. Supplemental EIA
4. Proposals on Mitigation Measures
5. Frame work of Resettlement Plan and Social Action Plan
6. Stakeholder Meeting

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## 2.3 Study (Stakeholder Meeting)

- Findings at 1st and 2nd Stakeholder Meetings

1st Meeting: 402 participants, 2nd Meeting: 574 participants

1) The proposed project is requisite and essential
2) The proposed project needs to provide the maximum benefits to the local society.
3) Due consideration should be given to the compensation and resettlement issues.
4) The alternative mode of transportation for inundated roads and affected suspension bridges should be considered.
5) The mitigation measures to protect Bhimad Bazaar and other necessary areas from erosion should be seriously considered.
6) The affected community forest and grazing lands need to be delineated and compensated.
7) Various development needs such as electricity facility, drinking water and schools should be considered and undertaken.

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## 2.3 Study (Optimization)

- Optimization of Development Plan

1. Preparation of 5 layouts for comparison
2. Estimate on environmental cost every 10m of Full Supply Level
3. Cost: Construction and O & M Costs of Project
4. Benefit: Construction and O & M Costs of Thermal Power Plant
5. Comparison of Benefit – Cost ratio

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## 2.3 Optimization Result

- Selected Plan

1. FSL: EL.415 m
2. Dam: Concrete gravity type
3. Installed Capacity: 128MW
4. Powerhouse: Underground type

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## 2.3 Study (Design, etc.)

- For the selected plan

1. Design at F/S level
2. Preparation of construction plan
3. Estimate project cost
4. Economic and financial evaluation
5. Proposal on further investigations

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## 2.3 Study (Construction Cost & Schedule)

Construction Cost

| | Item | (Million US$) |
|---|---|---|
| 1 | Preparatory Works | 2.24 |
| 2 | Civil Works | 192.93 |
| 3 | Hydromechanical Eq. | 16.63 |
| 4 | Electromechanical Eq. | 47.18 |
| 5 | Transmission Lines | 9.00 |
| | Direct Cost | 267.98 |
| 6 | Environmental Cost | 29.10 |
| 7 | Admin. & Engineering Fee | 18.76 |
| 8 | Contingency | 24.61 |
| | Indirect Cost | 72.47 |
| 9 | Total | 340.45 |

- Construction Period:

6 years including preparatory works

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## 2.3 Study: Economic Evaluation

- Economic Evaluation

1. Method: Comparison of Thermal Power Plant
2. Benefit (B): Construction and O&M Cost of Thermal Power Plant
3. Cost (C): Construction and O&M Cost of Project
4. Results: Confirmed more benefit than thermal power plant

Economically feasible

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## 2.3 Study: Financial Evaluation

- Financial Evaluation

1. Benefit: Electric tariff of NEA
2. Electric tariff: Assumed reasonable increase
3. NEA can get benefit from Project

Confirmed financially feasible

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## 2.3 Study: Others

Other Benefit from Project

1. Make stable power frequency
2. Maintain power voltage in network
3. Reduce/replace operation hours of costly thermal power plants
4. Reinforce NEA's network by transmission

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## 3 Conclusion & Recommendation

- Judged feasibility from technical, environmental, economical, and financial viewpoint
- Recommended to proceed to the next stage as new power sources

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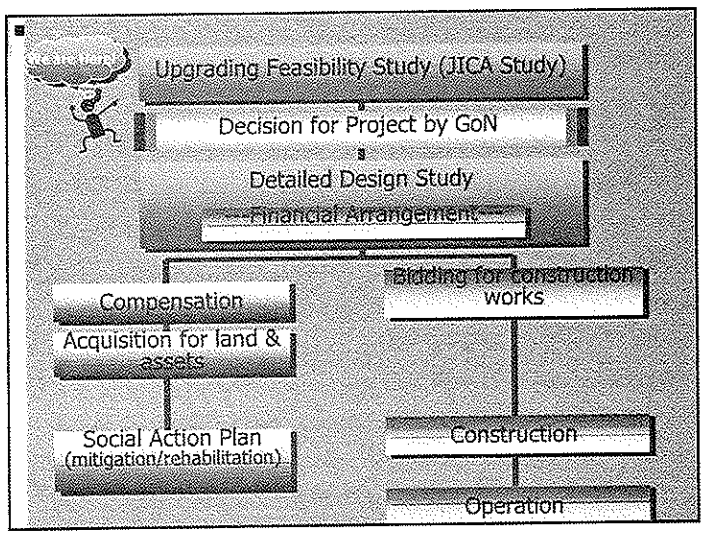
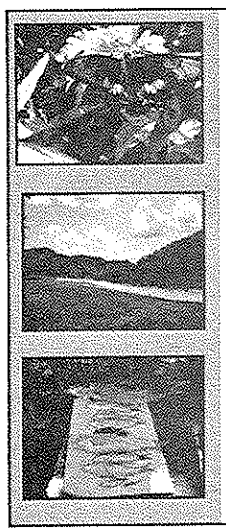




# Natural Environmental Impacts and Mitigation Measures

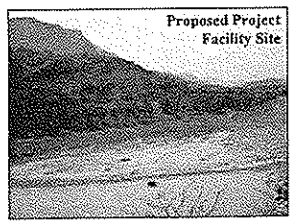
*The Upgrading Feasibility Study on Upper Seti Storage Hydroelectric Project in Nepal*

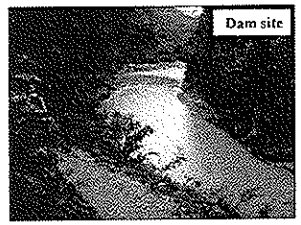
Malla Hotel, Kathmandu,
May 10 2007

1

## Contents of presentation



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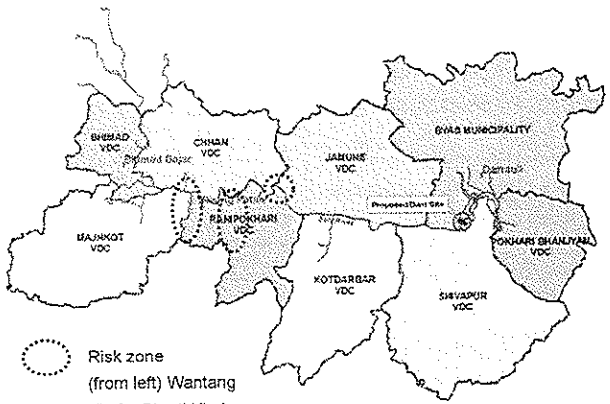
## Proposed dam site and affected DVC

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## 1. Impact and Mitigation for the physical environment

### 1.1 Impact and mitigation during the construction phase

Changes of land use:

| SN | Land use | Affected area (ha) | | | |
|---|---|---|---|---|---|
| | | Reservoir area (FSL: 415 m) | Project facility site | Risk Zone | Total |
| 1 | Cultivation | 108.89 | 35.82 | 6.51 | 144.71 |
| 2 | built up | 1.34 | 0.25 | 0.11 | 1.59 |
| Total cultivation / built up area | | 110.23 | 36.07 | 6.62 | 152.92 |
| 3.1 | Grazing land | 102.56 | 7.35 | 2.24 | 109.91 |
| 3.2 | Shrubs | 28.18 | 4.67 | 2.31 | 32.85 |
| Total grazing land / shrub | | 130.74 | 12.02 | 4.55 | 147.31 |
| 3.3 | Hill sal Forest | 29.46 | 44.46 | 1.85 | 73.92 |
| 3.4 | Khair / Sissoo Forest | 52.62 | 0.00 | 0.06 | 52.62 |
| 3.5 | Mixed Open Forest | 271.81 | 24.24 | 0.00 | 296.05 |
| Total Forest | | 353.89 | 68.70 | 1.91 | 424.50 |
| 4 | Barren land | 1.43 | 0.00 | 0.00 | 1.43 |
| 5 | Escarpment | 8.70 | 0.00 | 0.00 | 8.70 |
| 6 | River | 98.45 | 7.01 | 0.00 | 105.46 |
| 7 | Sand | 128.54 | 9.28 | 0.33 | 137.82 |
| | Grand Total | 831.98 | 133.08 | 13.42 | 978.47 |

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## 1.1 Impact and mitigation during the construction phase (continued)

| Construction phase | | |
|---|---|---|
| Items | Impact by the Project | Proposed Mitigation |
| 1. Landuse & topography | 1) Inundation of land and changes of existing land use<br><br>2) Excavations, drilling and blasting etc, are potential to generate new sets of land instabilities at tailrace area and dam site. | - To set the lower FSL (Proposed FSL: 415m + risk zone 10 m) based on the optimum balance between incurred losses and Project benefits.<br><br>- To select the layout of facilities minimizing the impact of land use changes in the communities e.g. Beni Pokari & Shivapur. |
| 2. Air Quality | Excavations, filing, construction vehicle movements, etc. will generate the dust which detriorate the air quality in the reservoir. | - To water on the road, dusty barren areas and spoil disposal areas.<br><br>- To restrict on-site vehicle speed<br>- To wash vehicles before leaving the site |
| 3. Noise | Cut-and cover activities, excavation,transportation of the vehicles and other construction activities will generate more noise. Vibration also will be generated by drilling, blast activities, etc. | - To use and correct fitting of silencers, mufflers and acoustic shields<br><br>- To take care in the replacement and orientation of noisy plants from sensitive receivers |
| 4. Water quality | 1) Poor facilities for sanitation in the construction area and camp site may cause the open defecation of solid waste in the river bed, which degrades the water quality.<br><br>2) Accidental spills or discharge of materials (oil, cement, etc.) can also degrades the water quality. | - To set up good water supply & sanitation facilities in the work camp<br><br>- To set up the effective solid waste collection facilities in the camp<br><br>- Discharge of batching plant, aggregate washing plants, etc. should be done just after appropriate treatment to the river. |
| 5. Construction Spoils | Erosion may occur at the spoil bank constructed at the right bank of the river | - To construct dry stone gabion structure at the toe of the spoil bank<br><br>- To construct a water collection system for the bank |

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## 1.2 Impact and mitigation during the operation phase

| Operation phase | | |
|---|---|---|
| Items | Impact by the Project | Proposed Mitigation |
| 1. Land use & Topography | | |
| (1) Reservoir area / Reservoir Shoreline Failure | 1) Risk of slope instability in the upper reservoir area<br><br>2) Risk of terrace breaks by toe cutting of the stream | -To complete protection embankment works with concrete blocks near the Bhimad Bazaar.<br><br>- To conduct land acquisition program to stabilize the erosion prone area in the 10m above from FSL and in the vicinity of Wantang Khola, Pedhi Khola and Tutuwa.<br><br>- To plant trees and grasses in the erosion prone area along the tributaries of Seti river.<br><br>- To formulate and implement Watershed Management Plan to reduce the erosion rate in the upstream of Seti river watershed |
| (2) Full Supply Level (FSL) / Environmental Flow | Sedimentation and backwater may occur if FSL is not appropriate to control them. | - Proposed FSL 415 m will effectively control any sedimentation.<br>- In case of FSL 415 m, the sedimentation will not occur around Bhimad Bazaar.<br>- Backwater effect after sedimentation is minor. |
| (3) Impact in the Downstream of the Dam | High sediment deposit at the sediment flush operation and river scouring at the normal operation is supposed to occur immediately below the dam. | - To monitor the sedimentation patterns in 10km downstreams of the dam<br><br>- The environmental flow 2.4 m3/s proposed by NEA is likely to be reasonable range to mitigate the impact of aquatic ecology in the downstream. |

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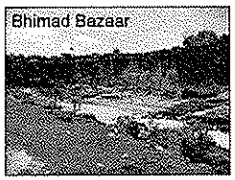
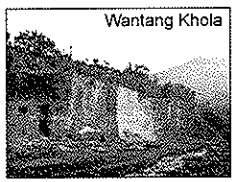
## 1.2 Impact and mitigation during the operation phase (continued)

| Operation phase | | |
|---|---|---|
| Items | Impact by the Project | Proposed Mitigation |
| 2. Water Quality | | |
| (1) Eutrophication of the Reservoir | 1) The current phosphorous level in the reservoir is much higher than 0.03 mg/l.<br>2) Eutrophication possibly occurs by the inflow of phosphoruos expected to increase during the operation phase. | - To install the fraction fence (low cost and easy maintenences)<br>- To install the aerator<br>- To install vegetated floating inland<br>- To input minerals<br><br>- To conduct sediment flush operation once a year to prevent the nutrient from accumulating in the bottom of the reservoir |
| (2) Sediment Flush Operation | The operation may degrade the water quality in the downstream environment. | It needs to be examined sufficiently based on the past experience.<br><br>Sediment flush operation should be carried out once a year to maintain the good water quality in the reservoir |

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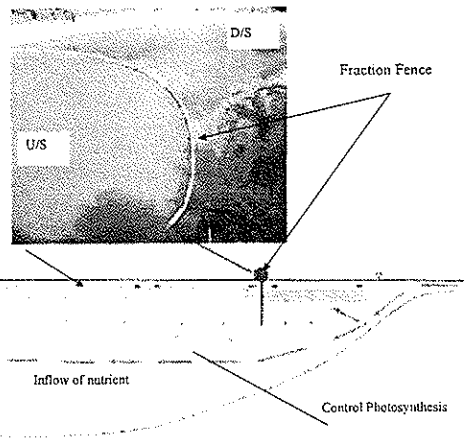
## 1.2 Impact and mitigation during the operation phase (continued)

**Fraction fence:**

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## 2. Impact and Mitigation for the biological environment

| Items | Impact by the Project | Proposed Mitigation |
|---|---|---|
| 1. Forest & Vegetation | 1) Baseline: Among 209 plants found in the area, 3 species under GON, 6 species under CITES and 6 species under IUCN conservation categories.<br><br>2) In total, 422.58 ha of forests (excluding 1.91 ha of Risk zone) are affected. Among them, 296.05 ha (70%) is "hardwood mixed forest". | - To plant trees in the national and community forest following the Forest Department Regulation with rate of lost / plant trees to be 1:25<br><br>- To compensate for the fuel wood, timber and fodder in the affected community and private forest |
| 2. Wildlife | 1) Baseline: 16 species of mammals, 7 species of reptiles & amphibians, 3 species of birds found in the site are indicated as protected species under CITES Appendixes and IUCN Red Data List.<br><br>2) Impacts on habitat and lives of the mammals & reptiles in the project facility site & riverine area due to the construction works, establishment of workers camp and poaching (illegal hunting) | - To minimize the cutting of trees by selecting appropriate site layout and providing alternative energy e.g. kerosene for the workers camp<br><br>- To restrict hunting and trapping of wildlives<br><br>- To save endangered animals by a rescue operation using boats |
| 3. Fish & Aquatic life | 1) Baseline: None of the species are listed in CITES and IUCN red list among 36 species found in the site.<br><br>2) Impact of dam construction to the habitat of fish and aquatic lives<br><br>3) Barrier impacts by the dam to the migrating fish species (economically important),<br>4) Impact on the fish species structure in the down stream by sediment flushing and decline of water level | - Fish trapping & trucking, fish rock or ladder<br><br>- Extension of fish hatchery in Kaligandaki A Project to supply fry to the river |

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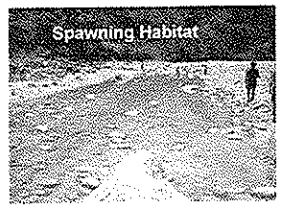
## 2. Impact and Mitigation for the biological environment (continued)

Some comments on the impact and mitigation for the biological environment

- Since similar habitat conditions are widely seen in the vicinity of the study area, it is considered that possibility of specific species extinction is little in the wider area including the project site.
- Further survey on the protected species and their habitat conditions should be conducted. If it is needed, the proper measures should be taken during the detailed design stage and/or construction stage.

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## 3. Cost for Mitigation and Monitoring

Construction phase

| Environmental Impact | Mitigation Measures | Cost (NRs. Million) |
|---|---|---|
| 1. Land instabilities & erosion | Bio-engineering of the cut batter slopes of the access roads (lump sum) | 2.0 |
| 2. Air Quality | Suppression of dust by sprinkling | 4.9 |
| | Dust masks to workers | 0.7 |
| 3. Water quality | Sanitation (toilet provisions) | 4.5 |
| | Solid waste management system | 2.8 |
| | Sedimentation tank | 10.0 |
| 4. Construction Spoil Drainage | Dry gabion wall approximately 1,300m (1.5 m high and 1 m wide) | 5.0 |
| | Run off catch drainage of mountain slope | 3.2 |
| 5. Accidental costs | Vibration effects | 10.0 |
| | Total | 43.1 |

Operation phase

| Environmental Impact | Mitigation Measures | Cost (NRs. Million) |
|---|---|---|
| 1. Downstream impacts to community activities | Siren network along the Seti downstream tailrace (lump sum) | 3.5 |
| | Awareness training on the safety measures to downstream areas (lump sum) | 0.3 |
| | Total | 3.8 |

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## 3. Cost for Mitigation and Monitoring (continued)

Watereshed management

| Measure | Cost (NRs. Million) |
|---|---|
| 1. Studies and planning | 1.5 |
| 2. Bio-enginnering Measures for Soil Erosoin Control | 25.0 |
| 3. Afforestation Programs in the watershed | 15.0 |
| 4. River training works | 25.0 |
| 5. Landslides Stabilisation Measures | 10.0 |
| 6. Check dums in the tributary streams (draining to reservoir) | 35.0 |
| Total | 111.5 |

Cost for monitoring changes of physical environment

| Particulars | Cost (NRs. Million) |
|---|---|
| Construction phase | |
| 1. Measurement of the indicators (air, water, noise, spoil, erosion, etc.) | 5.32 |
| 2. Effect of the measurements for downstreams | 3.80 |
| Operation phase | |
| 1. Measurement of the water quality fro twenty (20) years | 3.00 |
| 2. Measurement of river bed sedimentation & erosion for twenty (20) years | 2.00 |
| Total | 14.12 |

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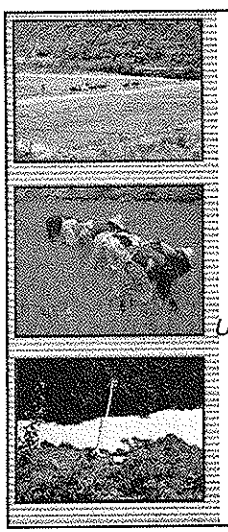
### 3. Cost for Mitigation and Monitoring (continued)

Mitigation measures and cost for fisheries

| Priticulars | Mitigation Measures | Cost (NRs. Million) |
|---|---|---|
| 1. Financial & technical assistance to Kali Gandaki A hatchery | Assistance in adding the production, developing the facility and conducting the research for upstream & downstream stocking in Seti river | 73.5 |
| 2. Release of fish | Annual release of puchased exotic carps to the reservoir | 1.2 |
| | Trial cage & aquaculture program | 0.7 |
| 3. NEA Extension program | Extension program foe fisheries and mitigation to local fisherman | 1.0 |
| | Total | 76.5 |

Monitoring costs - Construction & Operation phase

| Monitoring items | Cost (NRS. Million) |
|---|---|
| Aquatic ecology survey in the 7 baseline stations twice a year for 5 years during construction phase, @ 0.1 million NRs/monitoring season, sub total for 5 years | 1.0 |
| Aquatic ecology survey in the 7 baseline stations after two years of project operation for 10 years, @ 0.15 million NRs/monitoring, sub total monitoring cost for 10 years | 3.0 |
| Total | 4.013 |



# Framework of Resettlement Plan and Social Action Plan

*The Upgrading Feasibility Study on Upper Seti Storage Hydroelectric Project*

Malla Hotel, Kathmandu
May 10 2007

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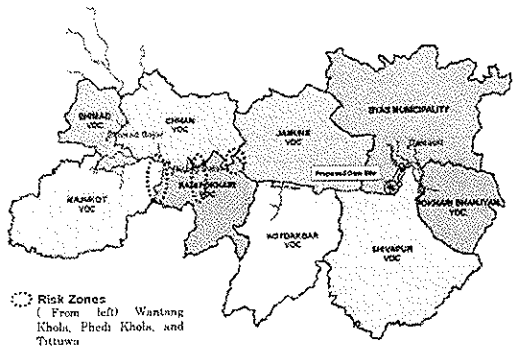
## 1 Identification of Affected Areas

Affected 7 VDCs & 1 Municipality

| | | |
|---|---|---|
| ❶ | Reservoir Areas (FSL 415+10m) | Bhimad, Chhang, Majkot, Rising Ranipokhari, Kotdurbar, Jamune, Kahun, Shivapur VDCs, Vyas Municipality |
| | Risk Zones (A 50 m horizontal distance from the edge of the cliff) | i)Wantang Khola (Majkot-Rising Ranipokhari), ii)Phedi Khola (Rising Ranipokhari), and iii) Tittuwa (Rising Ranipokhari) |
| ❷ | Project Facility Sites | Kahun Shivapur, Vyas Municipality |
| ❸ | Downstream Areas | Kahun Shivapur, Pokhari Bhanjyang, Keshavtar, Dharampani, Baidi, Chhipchiipe, Devghat, Deurali VDCs |

2

## 1 Affected VDCs and Municipality

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## 2 Major Socio-Economic and Cultural Impacts

FSL415 +10 m

- Affected Cultivated Land ---------- 151.22 ha
- Affected Built up Area ---------- 1.7 ha
- Affected Forest Land ---------- 424.5 ha
- Loss of Agricultural Production -------- 660.77 MT
- Number of Affected Private Structure- 313
- Number of Affected Community Structure- 7 (1 Ghat, 5 Resting place, 1 Temple)
- Number of Affected Private Land Owners- 838 hh
- Number of Affected Structure Owners- 110 hh (half of them living in the project facility sites)
- Number of Residential Structure Owners =Relocatee ---------- 86 hh (about one-third of them having non-legal title)

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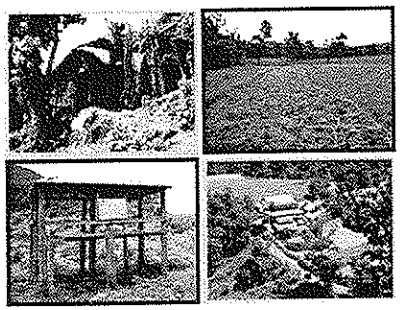
## 2. Major Socio-Economic and Cultural Impacts

FSL415 m

| | |
|---|---|
| Affected Infrastructures -- | 2 stretches of Motorable roads, 6 suspension bridges, 20 foot trails, 1 irrigation cannels, 2 electric distribution line routes |
| Loss of Water Resources and Forest Resources ------- | Giving negative impacts on those who are highly dependent on forest resources such as fodder and fuel wood and water resources in their daily lives |
| Inflow of a Large Number of Workers ---------- | Giving significant stress to the local water supply system and existing public facilities, deteriorating the sanitation conditions and environment |

5

## Framework of Resettlement Plan



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## 4. Resettlement Policy Framework for the Project

- Land acquisition and involuntary resettlement shall be avoided where feasible or minimized to the extent possible.
- Where population displacement is unavoidable, individuals, households and community losing assets, livelihood and other resources shall be informed and consulted.
- Affected Persons(APs) shall be compensated at replacement cost for all losses and damaged assets. The absence of legal titles to lands, property and facilities shall not be a bar to compensation.
- APs shall be fully compensated and resettled before their houses are demolished and their land and facilities are acquired.

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## 4. Resettlement Policy Framework for the Project

- A resettlement plan shall be prepared and consulted with APs in advance of the implementation of the project .
- The resettlement plan implementation shall be monitored.
- The resettlement shall be executed as part of the development project.
- After RP implementation, the economic and social conditions of the APs should be improved or at least maintained.

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## 2. Entitle Matrix for Compensation/Rehabilitation

| Types of APs | Type of Compensation/Rehabilitation | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | Permanent loss of land at replacement cost | Loss of crops and natural resource | Loss of house and other structures at replacement cost | Loss of community facilities and resources | Loss of government property | Grant for disturbance compensation to displaced households | Grant of transportation allowance to displaced households/community structures | Grant of land plot | Loss of business | House rental allowance |
| Landowner | ✔ | ✔ | | | | | | | | |
| Land tenant | ✔ | ✔ | | | | | | | | |
| Structure owner | | | ✔ | | | | | | | |
| Business owner | | | | | | | | | ✔ | |
| Community | | ✔ | | ✔ | | | ✔ | | | |
| Government Agency | | ✔ | | | ✔ | | | | | |
| Relocatees | | | | | | | | | | |
| House & Lot owner | ✔ | ✔ | ✔ | | | ✔ | ✔ | ✔ | ✔ | ✔ |
| House owner tenant | ✔ | ✔ | ✔ | | | ✔ | ✔ | ✔ | ✔ | ✔ |
| Informal settler | | | ✔ | | | ✔ | ✔ | ✔ | ✔ | ✔ |
| House occupant | | | | | | ✔ | ✔ | ✔ | ✔ | ✔ |

## 3. Cost Estimation for Resettlement Plan

| Summary | Million NRs |
|---|---|
| Cost Estimation for the Private Land | 999.51 |
| Cost Estimation for the Structures | 33.972 |
| Cost Estimates for Agriculture Production Equivalent to One Year Production | 0.647 |
| Other Rehabilitation Compensation to Relocatee | 44.95 |
| Transportation Allowance to affected Structure Owners Other than the Affected Residential Structure Owners | 0.56 |
| Monitoring for 10 years | 1.80 |
| Grand Total | 1,081.4 |

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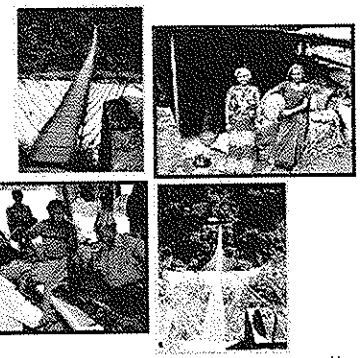
## Proposed Social Action Plan



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## 4. Social Action Plan Framework for the Project

- Social Action Plan is designed to mitigate socio-economic impacts on the affected communities and affected persons, and rehabilitate the quality of life of these communities and persons.
- Social Action Plan includes a package of 8 social programs.

1. [illegible]
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4. [illegible]
5. [illegible]
6. [illegible]
7. [illegible]
8. [illegible]

## 2. Proposed Social Programs

1. Restoration of Project Affected Infrastructure

- ◆Target Groups: Affected local communities in which infrastructure will be affected.
- ◆Program Components: Affected infrastructure such as motorable roads, suspension bridges, and foot trails will be restored.

2. Affected Communities Initiative Support Program

- ◆Target Groups: Affected communities of the project-affected VDCs/municipality of the Reservoir area
- ◆Program Components: Some development funds will be allocated to each affected VDC to undertake programs as per local needs. The local affected VDCs are expected to contribute 25% of the estimated cost in cash or in kind for the selected program.

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## 2. Proposed Social Programs

3. Skill Enhancement Training Program

- ◆Target Groups: Local interested and eligible people from affected people and communities. The priority should be given to the poor, destitute and disadvantaged people.
- ◆Program Components: Training will be carried out focusing on enhancement of skills required for the project employment.

4. Agricultural Development Program

- ◆Target Groups: Affected persons and affected communities.
- ◆Program Components: It includes agricultural, horticultural and herbal and vegetable faming development by providing practical training and improved seeds or samplings.

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## 2. Proposed Social Programs

5. Community Health, Sanitation and Education Program

- ◆Target Groups: One program is targeted near the construction sites. The other is targeted in the close vicinity of the reservoir affected VDCs.
- ◆Program Components: It focuses on the improvement of public health, sanitation, water supply, health and education institutions. Various public awareness and education activities such as environmental sanitation, HIV/AIDS, STI and other communicable diseases, and prevention, will be also undertaken.

6. Women Empowerment Program

- ◆Target Groups: Women in the affected VDCs and municipality
- ◆Program Components: It includes income generation skills, education on HIV/AIDS, STI, family planning, and girl trafficking, and micro-credit funds.

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## 2. Proposed Social Programs

7. Community Watershed Management Program

- ◆Target Groups: Affected communities located close to the reservoir in affected VDCs and municipality.
- ◆Program Components: With the technical support of the watershed management experts in the detailed design phase, the program will be launched and managed by the affected communities.

8. Rural Electrification Program

- ◆Target Groups: Unconnected part of the affected VDCs and municipality.
- ◆Program Components: It is designed to meet the electricity connection needs of the local communities.

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## Cost Estimation for Social Action Plan

| Summary | Million NRs |
|---|---|
| Replacement of Affected Infrastructures by the Reservoir | 85.5 |
| Community's Initiative Support Program | 52.13 |
| Skill Enhancement and employment | 10.14 |
| Agricultural Development Programs | 27.51 |
| Community/Public Health and Education Enhancement Programs at the Project Construction sites | 9.66 |
| Community/Public Health and Education Enhancement Programs at the Reservoir affected VDCs | 6.27 |
| Women Development Program | 13.03 |
| Watershed Management Programs | 12.31 |
| Monitoring for 10 years | 19.55 |
| Grand Total | 236.10 |

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## Recommendations and Further Investigation at the Detailed Design Stage

- Update and finalize the affected land plots and land owners
- Conduct an inventory structure survey for areas such as Wantang Khola, Phedi Khola and Tittuwa as well as the Project Facility Sites
- Update the framework of Resettlement Plan and the Social Action Plan
- Incorporate the proposed mitigation and enhancement measures in Tender Documents and Contract Agreement

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Participants Registered in the Third Stakeholder Meeting

in Kathmandu

## Participants Registered in the Third Stakeholders Meeting at Kathmandu, May 10, 2007

| SN | Name | Caste | Address | Office / organization | Profession /Grade | Phone | Age | Sex |
|---|---|---|---|---|---|---|---|---|
| 1 | Surendra Pandey | | K.K.P | | | 4258338 | 45 | Male |
| 2 | Dr. Mukesh Kumar Pandey | | NEFEJ | NEFEJ | Service | 5526893 | 50 | Male |
| 3 | Radesh Man Pradhanang | | SRCL/NEA | NEA | Service | 4243227 | 54 | Male |
| 4 | Jagdishwor M. Singh | Newar | NEA | NEA | Service | 4212297 | 45 | Male |
| 5 | Bhim Raj Kadariya | Bhramin | Public Ralation | NEA | Service | 4225477 | 37 | Male |
| 6 | Ritu Duwal | Newar | ESSD | NEA | Service | 4226780 | 36 | Female |
| 7 | K.R Bhatta | Bhramin | Chameliya HEP | NEA | Service | 4482788 | 52 | Male |
| 8 | Prem Rajbhandari | | NEA, ESSD | NEA | Service | 4378074 | 45 | Female |
| 9 | Mathura Dangol | Newar | MOWR | Singh Durbar | Service | 4211504 | 52 | Male |
| 10 | Raja Rishi Kadel | Bhramin | NEA/ESSD | Employee | Service | 491502 | 37 | Male |
| 11 | Bhakta Bdr. Belayas | Chhetri | Doti | Nepali Congress (Dem | M.P | 9.851E+09 | 59 | Male |
| 12 | Birendra Kumar Pathak | | NEA, Durbar Marg | NEA | Service | 4227039 | 49 | Male |
| 13 | Dr. Tej Kumar Shrestha | Newar | Zoology Res. T.U | T.U | Professor | 4070748 | 57 | Male |
| 14 | B.P Dhakal | Bhramin | Tanahu | DDC | GDOE | 9.856E+09 | 45 | Male |
| 15 | Raj Kumar K.C | | TRN | TRN | | 9.841E+09 | | Male |
| 16 | D.P Bashyal | Bhramin | NEA, HEAD Office | NEA | Service | 985101843 | 53 | Male |
| 17 | Raju Manandhar | Newar | Anam Nagar | The Himalayan | Reporter | 4771489 | 30 | Male |
| 18 | Sanak Man | Newar | Kath | NWDD | | 4352787 | 41 | Male |
| 19 | Resham Raj Dhital | Bhramin | Kath | Fisheries (Directorate) | Officer | 4350662 | 55 | Male |
| 20 | Shyam Shrestha | | NEA | Director NEA | GM | 4248101 | 55 | Male |
| 21 | Sayako Tokuda | | Pulchok | JICA | ARR | 5552711 | 32 | Female |
| 22 | Neera Pradhan | | Thamel | MOFSC | HMG Service | 4230832 | | Female |
| 23 | Ghana Shyam Sharma | | | CPN (JA Morcha) | G.S | 4112241 | | Male |
| 24 | D.P Upadhaya | | NEA | NEA | GM | 4225852 | | Male |
| 25 | Shyam Bhandari | | NEAEU | NEA | Vice Precident | 9.851E+09 | 48 | Male |
| 26 | Vishnu Bdr. Sigh | | NEA | NEA | Dir/PPD | 4370432 | | Male |
| 27 | Iswor Onta | | Nepal Eng. Council | NEA | Chair | 985100427 | 65 | Male |
| 28 | Shiva Chandra Jha | | Swyambhu | NEA | Engineer | 4279217 | | Male |
| 29 | Shailendra Lal | | Baneshwor | NEA | Employee | 470151 | 51 | Male |
| 30 | Thakur Raj Pandey | | Bhaktapur | NEA | Service | 4495642 | 56 | Male |
| 31 | Janaki Sangraula | | NEA-ESSD | NEA | Ast. Director | 4431628 | 57 | Female |
| 32 | C.B Bajracharya | | NEA-ESSD | NEA | Director | 422534 | 56 | Male |
| 33 | R.B Shrestha | | DMG | DMG | Geologist | 4416679 | 52 | Female |
| 34 | Arjun K. Kafle | | | NEA | | | | Male |
| 35 | Suman Basnet | | | Winrock | Director | 4467087 | | Male |
| 36 | Binod Shrestha | | Baneshwor | Winrock | Sr. Pr. Officer | 4467087 | | Male |
| 37 | Krishna C. Manandhar | | Thamel | JBIC | Coordinator | 4226467 | | Male |
| 38 | Upendra Dev Bhatta | | | NEA | Director | 4229651 | | Male |
| 39 | Sabitri Gurung Dura | | Tanahu | C.P.N (Maoist) | M.P | 9.841E+09 | | Male |
| 40 | Hari Krishna Shah | | NEA | NEA | Employee | 9.841E+09 | | Male |
| 41 | Suresh Ale Magar | | CPN | CPN (Maoist) | Politics | 9.842E+10 | | Male |
| 42 | Saurab Rana | | Sanghayakosh Building | JICA | | 9.851E+09 | | Male |
| 43 | Satis Chandra Devkota | | NEA-ESSD | NEA | Economist | 9.841E+09 | | Male |
| 44 | Dr. Toran Sharma | Braman | NESS, Kathmandu | NESS | Consultant | 4244989 | 52 | Male |
| 45 | Surendra Sharma | Braman | NESS, Kathmandu | NESS | Service | 4244989 | 30 | Male |
| 46 | Amrit Paudel | Braman | NESS, Kathmandu | NESS | Service | 4244989 | 27 | Male |
| 47 | Pradeep Kumar Maharjan | Newar | NESS, Kathmandu | NESS | Service | 4244989 | 30 | Male |
| 48 | Mr. Yoshimasa Ishii | | | JICA Study Team | | | | Maleale |
| 49 | Mr. Hironobu Nishimiya | | | JICA Study Team | | | | Maleale |
| 50 | Mr. Tomoo Aoki | | | JICA Study Team | | | | Maleale |
| 51 | Dr. Hiromi Yasu | | | JICA Study Team | | | | Maleale |
| 52 | Mr. Tadashi Amano | | | JICA Study Team | | | | Maleale |
| 53 | Ms. Toshiko Shimada | | | JICA Study Team | | | | Female |

# Minutes of Third Stakeholder Meeting in Kathmandu

**Upgrading Feasibility Study of Upper Seti Storage Hydroelectric Project**

**Third Stakeholders Meeting**

| | |
|---|---|
| **Time**: | 10.30 AM |
| **Date** : | May 5, 2007; Baishakh, 27, 2064 |
| **Venue**: | Malla Hotel, Thamel, Kathmandu |
| **Organized by**: | Nepal Electricity Authority with the Assistance of Japan International Cooperation Agency |
| **Master of Ceremony**: | Mr. Satish Devkota, NEA |

The stakeholder meeting was chaired by ***Mr Arjun Bahadur Karki***, Managing Director, Nepal Electricity Authority. Other guests who took chair in the dais were:

1. Mr. Bhakta Bahadur Balayar – Representative Nepali Congress (D)
2. Mr. Bhoj Raj Regmi – General Manager, Nepal Electricity Authority
3. Mr. Shiva Chandra Jha – Head, Environmental and Social Studies Department, NEA
4. Mr. Yoshimasa Ishii, Team Leader, JICA Study Team
5. Mrs. Sabitri Gurung Dura - Representative NCP Maoist
6. Mr. Suresh Ale Magar - Representative NCP Maoist
7. Mr. Ghana Shyam Sharma – Representative, Jana Morcha

Mr. Bhoj Raj Regmi – General Manager, Nepal Electricity Authority, delivered opening address to the participants of the stakeholder meeting. Welcoming the participants, he briefly described the project features and objective of the stakeholder meeting.

The project is undertaken by the collaboration of the NEA and JICA Study Team. The JICA Study team initiated the project feasibility Study from 2062 (2005). The draft report has been submitted to NEA and the final report of the project is expected in June 2007. During the project study, JICA study Team has also conducted detailed environmental and social studies. To disseminate the findings of the study and to collect feed back from the concerned stakeholders, two stakeholders meeting have already accomplished by the team. This is the third stakeholder meeting.

Nepal is passing though a phase of severe electricity shortage. In this context the project is of utmost significance. The past screening studies, and the present investigations, have shown that the project is the best among the available options for implementation. NEA has already requested JBIC and ADB for the financial arrangements for the project. This project is twice the capacity of currently operational Kulekhani storage project. With your cooperation and creative and constructive suggestions to the study team, the project could be developed as environmentally sound and socially acceptable project.

***Mr. Yoshimasa Ishii***, Team Leader, JICA Study Team presented the finding of the upgrading feasibility study. His presentation was divided into four topics as under:

1. Background & Outlines of Study
2. Findings
   2.1 Power Demand & Supply
   2.2 Characteristics of Project Site
   2.3 Contents of Study

3 Conclusions and Recommendations
4 Time-line of the Project

***Dr. Yasu***, Member, JICA Study Team, presented the findings of natural environmental studies. His studies focused on.

1. Baseline physical and biological environment of the project
2. Project impacts and proposed mitigation measures on physical and biological environments
3. Monitoring plan and project physical and biological environment mitigation costs.

***Miss Shimada,*** Member, JICA Study Team, presented the findings of Social and socio-economic environments of the project. Her presentation focused on:

1. Identification of the Project impact areas
2. Major Socio-economic and Cultural impacts
3. Framework of Resettlement Plan
4. Framework of Social Action Plan
5. Recommendations and further investigations in the detail design phase

After the deliberations from the JICA Study Team the floor was open for comments and suggestions on the project findings on natural and social environments.

***Mrs. Neera Pradhan – Representative Ministry of Forests and Soil Conservation***

The project seems to affect a large portion of riverine forest. A few of the species reported are also listed in the conservation lists of Government of Nepal, IUCN and CITES. The project should give emphasis on the conservation of forest area as much as possible. Appropriate mitigation measures should be designed and implemented, if the impacts on the forest areas are unavoidable.

***Mr. Ghanashyam Sharma Poudel – General Secretary, Jana Morcha, Nepal***

Though the project is estimated to cost 34 corores of US$, our experience is that it may even exceed 50 Corores of US$. The cost estimations should be more pragmatic and reflect actual conditions.

How much of the project cost is to be borne by NEA? Does Government of Nepal also invest on the project? Have you allocated shares to the Nepali people? What is the number or quantity of allocated shares to the people?

JBIC and ADB are requested for loan. What is the amount of loan and what are the conditions attached to the loan?

How much of the productive land of Bhimad area will be affected? As far as possible such productive land should be conserved. The Bote community of the area will be affected. Provisions for such community should be considered. The river banks are highly unstable and would require protection. My suggestion is to minimize the loss of productive land and forest as far as possible. We should consider to built the project on our own effort than depend on loan and attached conditions.

***Mr Bishnu Prashad Dhakal, Local Development Officer, Tanahu***

The project has been a source of inspiration to the local community. The District Development Committee meeting has endorsed the project and has shown commitment for the project implementation. The local people expect minimum impacts to the local community and resources from the project. They expect adequate mitigation measures to minimize the project impacts. In this regard, they have expected a pragmatic resettlement Plan and social action plan to rehabilitate the project's impact to the affected community.

Job opportunity in the project is the other concern of the local people. Maximum job opportunity should be made available to the local people and a mechanism of employment of the affected district and affected people need to be well considered before the project construction activity. In this connection, skill training programs should be launched at least six month before the project construction works to train the local interested people in the project construction works.

***Mr. Suresh Ale Magar – Representative, NCP Maoist***

Our party is in favor of any good work that makes the people quality of life better. That is why we emphasize the project to be people centric. Development project of this scale, we know is going to have some negative impacts. But the project should try to minimize the negative impacts as far as possible and maximize the beneficial impacts.

This is a 140m high dam. We must also look into its implication in the downstream areas on the event of any accidents. The compensation and resettlement plan need to be robust and should not marginalize affected people.

We have to change the prevailing mindset and start new approach in the project implementation. In all conditions, the local people should get maximum benefit.

***Mr. Ishwor Onta – Representative Nepal Engineering Council***

The project has a risk of sedimentation. Watershed management should be one of the components of the project and should give emphasis in the control and prevention of erosion. The estimated sedimentation rate is quite high, further investigation is desirable.

The project has considered only two turbines for power generation. Our experience in the repair and maintenance of the turbine is not very good. Many times, the repair and maintenance work hinder the electricity generation in the most critical period. I would request that the number of turbines be increased. I purpose 43MW capacity three turbines instead of 64 MW capacity two turbines.

This project should be developed as a company. Shares should be opened for the people. There is no dearth of money in the market. Remittance of the workers outside Nepal is a good source of money for investment. Only deficit amount should be taken from the funding agencies local or foreign (JBIC/ADB).

We have started implementing hydropower projects since long. However, we are still lagging behind in the technical and contractual aspects. It is therefore, we must develop a mechanism to include our consultants and contractors in the project both during investigation and construction. Our contractors and consultants could be involved in joint

venture with the foreign companies. Government has to develop such regulations and obligatory provisions.

Further investigations will bring new impact issues. This is a continuous process and should be continued. Some of the mitigation measures are very good. The example of fraction fence to control eutrophication is a good example. To implement the resettlement plan and social action plan local committee need to be constituted and resettlement and compensation should be accomplished before the beginning of the project construction.

***Mr. Suman Basnet – WINROCK International***

In the context of Climate Change, the storage project is better than the thermal projects. However, the impacts of high dam projects are also high and require high investments for the mitigation of the project effect. The project should consider the provisions of Cleaner Development Mechanism and its benefits to implement the mitigation measure required for the project impacts.

***Mr. V.B. Singh - NEA***

Is there any provision for emission trading management system /CDM mechanism in this project? Can we introduce benefit from CDM for financial analysis?

***Mr. --- Representative, Employee Union, NEA***

This project will take minimum of six years for the construction. In this period many other projects will come up, such as 309 MW Tamakosi, which NEA is implementing. What is the rate of return of this project? If we have to take loan, the interest rates are very high. Hence, I purpose to focus on the Run off The river projects than in the storage projects.

***Mr. Sanat Man Shrestha – Representative, Nepal Worker's and Peasants Party***

The NEA is always interested in the mega projects. Why we have not given adequate attention to the small scale projects? They are environmentally and otherwise are more beneficial. At policy level, we need to consider these things.

When we start a new project of this type, we are happier. But when the project construction starts, a new sets of problem surface and the project cost becomes high. It is therefore, it is opportune moment to take stock of the likely problems during project construction and take needed mitigation options such that the project cost does not shoot up and the local problems are adequately addressed.

Much is said on the financial aspect of the project. How much is the loan from JBIC and ADB?. What is the rate of return of the project. We must allocate share for the Nepali citizens and project area people.

To enhance and strengthen our technical skills and capabilities, we must give preference to the local consulting firms and contractors in the study and project construction. As far as possible we must use our local technology to maximize the benefit.

***Mr. Resham Raj Dhital - Fisheries Directorate***

For the control of phytoplankton, the fishes could be effectively used. Fish culture provision in the reservoir should also be considered for fish production and economic enhancement of the local people and their culture.

**Mr. Bhakta Bahadur Balayar – Representative, Nepali Congress (Democratic) Former Minister of Environment**

All development works should benefit the local people. As this is a storage project, we have to incorporate the lesson learned from the Kulekhani project in the design and conceptualization of the mitigation measures of this project. Sedimentation of the reservoir is a major problem. Comprehensive watershed management plan is a pre-requisite of the project to control and minimize the sedimentation impacts.

The local have the right over their resources. Project is expected to encroach upon the peoples right. Hence adequate attention should be given to conserve the natural resources, and culture of the people. The displaced people should be the target group to up keep their living standards after the project implementation.

The local people should be given adequate opportunities for jobs related to the project. Skill enhancement programs should uplift their skills for maximization of job opportunities. The people should be told in advance what benefits and other development programs that they will be getting from the project.

All the information with regard to the project should be delivered to the people before hand. So that they could understand and participate in the decision making process.

***Mr. Shiva Chandra Jha - Head, Environmental and Social Studies Department, NEA***

On behalf of NEA, I extend my thanks to all the participant members of this stakeholder meeting. Your suggestions are very valuable to us and will certainly help the study team in finalizing the Upgrading feasibility study.

This being a storage project, we are focused to the impacts of the project on the local communities and households. The study has emphasized on the Resettlement framework and Social action plan framework to minimize the impacts and rehabilitate the effects of the project.

For the implementation of the project we will have to depend upon the donor agencies. This study is conducted as per the JICA guideline to make the feasibility study technically sound and financially bankable from the international agencies. Your continued cooperation will move the project forward. Once the government gives approval, the project will go ahead with further detailed studies.

***Mr Arjun Bahadur Karki, Managing Director, Nepal Electricity Authority.***

The concerns of the stakeholders raised in this meeting certainly strengthen the project. We are going through a phase of critical power shortage. Only 40% of the Nepalese people have

been using electricity. Even these people are affected by the recent load shedding. If the situation remains like this, these 40% people will also become like remaining 60% who have not got electricity supply.
We have Run Off the River system for hydropower generation. The seasonal variation in water discharge affects our power generation. In the dry season out of 611MW installed capacity we could only get 170MW. The Kulekhani storage project is supplementing the power demand in this period. It is for this reason; we have no other alternative than to go for storage project like this for the management of power deficit in the coming years. Implementation of only ROR project is not going to manage our power system. Further we have to provide power to the remaining 60% of Nepalese population. Certainly storage projects are costly than ROR projects, but in long term storage projects are more dependable than the ROR for power demand and supply management.

It is high time for us to implement such projects by 2014 despite all problems. We require foreign assistance in the project development. It is said that the money market is inundated with excess liquidity. The remittance money could be utilized for the required project investment. However, our experience in the case of Tama Koshi Project, does not reveal such a situation. Even the national banks, Karmachari Sanchayakosh refuses to lend money for investment despite our commitment to directly transfer revenue of some of the projects into their accounts. We are not against local investment, but there should be government mechanism established for such investment environment.

Only way for the development in Nepal is the development of hydropower. We can sell the excess electricity to growing Indian market. Considering this we have an agreement with India to built high capacity Transmission Line projects for power transfer. The project is underway for development.

The concern that hydropower project have made us poorer, but are we getting richer by allowing our rivers to rundown without harnessing electricity. We are constrained by many limitations for the development of hydropower projects. This is one of the reasons why our projects are becoming costlier. Government policy is different for different sector. This policy conflict does not allow us to complete jobs in time. Unified policy at national level and at all sectors is very essential for the development of the hydropower. This demands a long term political commitment and review of the existing policy, and legal provisions.

Lengthy EIA process, Forest policy conflict, etc are instrumental in the project delays. We are not against EIA; we understand that project impacts have to be internalized in the project cost; no body should be marginalized by the project, but could we not carry out all EIA required things hand in hand during project implementation. Let us form a committee involving all sector ministries and department to look into these matters for speedy project development. Our Board has requested such an arrangement to the cabinet.

We are in the process of opening power bond. Such power bond could be converted into share if the investor would like to do so. We welcome every one in the public life for the development of the hydropower in Nepal.

# Advance Notification of Third Stakeholders Meeting

# in Kathmandu

13-1 Public notice published in the national newspaper "The Himalayan Times" 11th May 2007.

# NEA seeks hydropower policy

**Himalayan News Service**

*Kathmandu, May 10*

Managing director of the Nepal Electricity Authority (NEA) Arjun Kumar Karki said today that the country would not develop unless the government came up with a clear policy for the execution of power projects.

"Lack of consensus among the political parties is hampering the exploitation of water resources," Karki said at a programme on the Upper Seti Storage Hydroelectricity Project.

He urged the parties to build a consensus on the execution of hydropower projects. Terming the "differences among leaders over the utilisation of water resources" 'very disappointing', Karki said hydropower could not be harnessed unless parties came up with a unified stance on harnessing of natural resources.

"Some party leaders say no country has become rich by exporting electricity. I wonder if any country has become rich by letting water flow off the river."

He called on the government to make a policy with help from ministries concerned and enable the NEA to execute hydroelectricity projects.

13-2 Public notice published in the national newspaper "The Himalayan Times" 11th May 2007.

# Go ahead with Upper Seti project, experts tell NEA

Himalayan News Service

*Kathmandu, May 10.*

A team of experts from the Japan International Cooperation Agency (JICA), which is conducting feasibility study of 128 MW Upper Seti Hydroelectricity Project, has advised the Nepal Electricity Authority to do the needful to develop the project as new source of power.

"We recommend the NEA to proceed to the next stage of study to develop the Upper Seti project as a new power source," said Masayoshi Ishii, while addressing a stakeholders' meeting today. He is the leader of the Japanese study team.

He said the team examined the feasibility of the project in terms of technology, impact on the environment, economic cost and financial aspect from February 2005 to January 2007 and found it suitable to be developed.

The project has been identified as a possible remedy for the current power shortage. The NEA had undertaken a feasibility study in 2001, an upgrading feasibility in 2004 and the JICA had initiated a preliminary study in 2004.

The findings of the recent Upgrading Feasibility Study by the JICA team showed that the project would make stable power frequency, maintain power voltage in the network, reduce or replace operation hours of costly thermal power plants and reinforcement of NEA's network by transmission.

The study has estimated that the project would cost to the tune of $340 million and would take six years, including preparatory work.

Previous stakeholders meeting for the same project had pointed out that provision of electricity, drinking water and schools should be given priority.

Meantime, a member of the JICA team, Masami Yasu, said the project is going to make impact on land use, air quality and water quality.

The report states that habitat of some wild species will be disturbed by the project.

"Since similar habitat conditions are widely seen in the vicinity of the study area, it is considered that possibility of specific species extinction is little in the wilder area including the project site," the report states. Toshiko Shimada, who had studied the framework of resettlement plan and social action plan, said land acquisition and involuntary resettlement should be avoided where feasible and minimised to the extent possible.

"Affected persons shall be compensated at replacement cost for all losses and damaged assets. The absence of legal titles to lands, property and facilities shall not be a bar to compensation," she said. The study estimates that the resettlement plan alone would cost over Rs 1000 million to the project.

13-3 Public notice published in the national newspaper "The Rising Nepal" 11th May 2007

# Upper Seti to cover power deficit

By Raj Kumar KC

KATHMANDU, May 10: If everything goes uninterrupted, the state-owned Nepal Electricity Authority with the financial/ technical assistance of Government of Japan will begin the country's biggest reservoir type project-the Upper Seti Storage Hydroelectric Project (USSHP) in the next couple of months.

Major political parties in the country have also expressed their full commitments to support it as long as the project does 'good' for the local people.

USSHP, the second reservoir project (after Kulekhani First Hydropower Project) is expected to supply 128 MW of peaking power throughout the year.

The NEA with the technical support of Japan International Cooperation Agency (JICA) began feasibility study of the USSHP in February, 2005. The study will be completed by June this year, *according to the NEA officials.*

The 128MW Storage Hydroelectric Project is expected to play a vital role in reducing power-deficit and more importantly providing economic opportunities to the local people without causing much damage to the local environment.

Even though the storage hydro-electric project is costlier than the run-of river (RoR) hydro-power projects, it is need of the nation to cut down the power-shortages.

If we fail to initiate this project, the people (who are bearing hours of load-shedding now) will have to bear the brunt of more load-shedding in future, said Chairman of the NEA Arjun Kumar Karki.

Karki also noted that the USSHP is more feasible in comparison to other projects. The study report has proved that degree of risks can be minimised to a larger extent, he added. However, he lamented over the dearth of fund for hydropower development.

It is said that the money market is inundated with excess liquidity, but bankers or even top financial institutions including the Karmachary Sanchaya Kosh (Employees' Provident Fund) which has billions of rupees in its coffer are reluctant to invest in the power sector, he lamented.

On top of that bankers are also not interested to investment in the hydropower sector, said Karki adding "the country's economic development is possible only through the generation of hydropower."

Karki while speaking at the third Stakeholders' meeting expressed confidence over the economic and technical viabilities of the project.

The NEA and JICA have already hold three consultative meetings with the local people/ stakeholders in its project site in Tanahu. Apart from that two meetings in the capital have already been held in the past.

However, in today's stakeholders' meeting people from different walks of life underlined the need for sustainability of the project.

Some even questioned why the NEA chose storage hydro-electric Project instead of cheaper and more sustainable RoR hydropower projects. The NEA management and concerned authorities at the Ministry

*See UPPER, Page 6*

# UPPER: Seti to cover power deficit

of Water Resources have been much criticized for choosing expensive project.

However, NEA officials have flatly denied the charges saying that the project would be more viable though the initial costs of the project are bigger.

Yoshimasa Ishii, team leader of JICA Study team while presenting the study report described the technical viability of the project.

Other JICA experts presented their social- cost and benefit analysis. They noted that the project to the greatest possible extent has tried to mitigation losses.

However, political leaders emphasised on the aspects of the welfare of the people. Suresh Ale Magar, a senior leader of Communist Party of Nepal-Maoist assured his party's full support to the project. "But the project should serve the interests of majority of people."

The Local Development Officer of Tanahu district informed that the local people had pinned much hope on the project that it would do something to support their livelihoods.

According to him, around 19 houses will be displaced from the project.

Bhakta Bahadur Balayar a former minister also spoke about the environmental aspects of the project area. He said that the project will affect the major cultivable land and create the problem of inundation. The people who are likely to be affected by the project should be adequately compensated, he said.

As of July 2006, total installed capacity of the country is 614 MW out of which 90 per cent is contributed by hydropower.

Energy demand in Nepal has been on the rise by eight per cent per annum since last one decade, according to NEA. But the supply has not been increased even after the addition of 144 MW Kaligandaki 'A' hydropower project in the system.

According to the NEA the RoR type of hydropower plants dominates Nepal's hydro power capacity.

However, RoR type of plants can marginally regulate river discharge for power generation. Thus to cope with problem of power shortage in the dry season, NEA has initiated the process of developing storage type of hydropower plants that can seasonally regulate river discharge for generation.

The main objective of the study, according to NEA and JICA officials is to formulate the optimum development plan of the project and to assess the technical and economical and financial and environmental viabilities of the USSHP.

**Major features of USSHP**

| Specifications | Value |
|---|---|
| Type | Underground |
| Width x Length x Height | 22m x 42m x 90 m (L) |
| Turbine Types | Vertical Francis |
| Maximum Discharge | 127.4 $m^3/s$ |

# ENVIRONMENTAL AND SOCIAL CONSIDERATIONS (ESC) REPORT

## PART E

## IEE FOR 220 KV TRANSMISSION LINE

# PART E IEE FOR 220 KV TRANSMISSION LINE

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# CHAPTER 1 INTRODUCTION

## 1.1 Objectives

The proposed 220 kV Transmission Line from Upper Seti (Damauli) Storage Hydroelectric Project (the Project) Switch Yard to Bharatpur Substation would deliver power from the Project to the National Grid System at Bharatpur. Presently, the 220 kV transmission line development proposal is under study at the feasibility level to assess different viable options.

This IEE level study of the 220 kV transmission line has the objective to assess the implications of the different alignments of power line development on the existing bio-physical and social environment and to select the best alternative alignment for detailed study and design.

## 1.2 Project Line Route and Affected Areas

The selected 220 kV transmission line project, will connect the USSHEP to Bharatpur Sub-station, cut across five VDCs of Tanahu District, namely Kahun Shivapur, Pokhari Bhanjyang, Keshavtar, Dharampani, and Devghat VDCs, and one VDC and one municipality of Chitwan District , namely Kabilas VDC and Bharatpur Municipality. The resources (physical, biological and social) of the above VDCs and municipality of Tanahu and Chitwan Districts lie under the 60 m ROW of the project and are directly affected, whereas the resources lying outside the TL ROW are indirectly affected by the project.

| | |
|---|---|
| Nominal System Voltage | : 220 kV |
| Circuit | : Double circuit |
| Length of Line | : 38.42 km |
| Nominal span | : 300 m |
| Number of Towers | : Approximately 130 |
| Right of Way | : 60 m |
| For tower foundation | : 5.2 ha (Agricultural land: 1.76 ha, Forest land: 3.44 ha) |
| Land use restricted under ROW | : 193.02 ha |

# CHAPTER 2 ALTERNATIVE STUDY

## 2.1 Alignment Alternatives

The alignment of a new transmission line should be selected taking into consideration the following criteria:

- Right-of-ways which have minimal environmental impact
- Improvement of reliability of the power system
- Increase in competition in the generation market to lower the cost of electricity

Based on the above principles, three possible alternative alignments were selected to evacuate power from Upper Seti (Damauli) Storage Hydroelectric Project's switchyard to Bharatpur substation (NEA, May 2006). **Figure 2.1-1** presents the three proposed alignments.

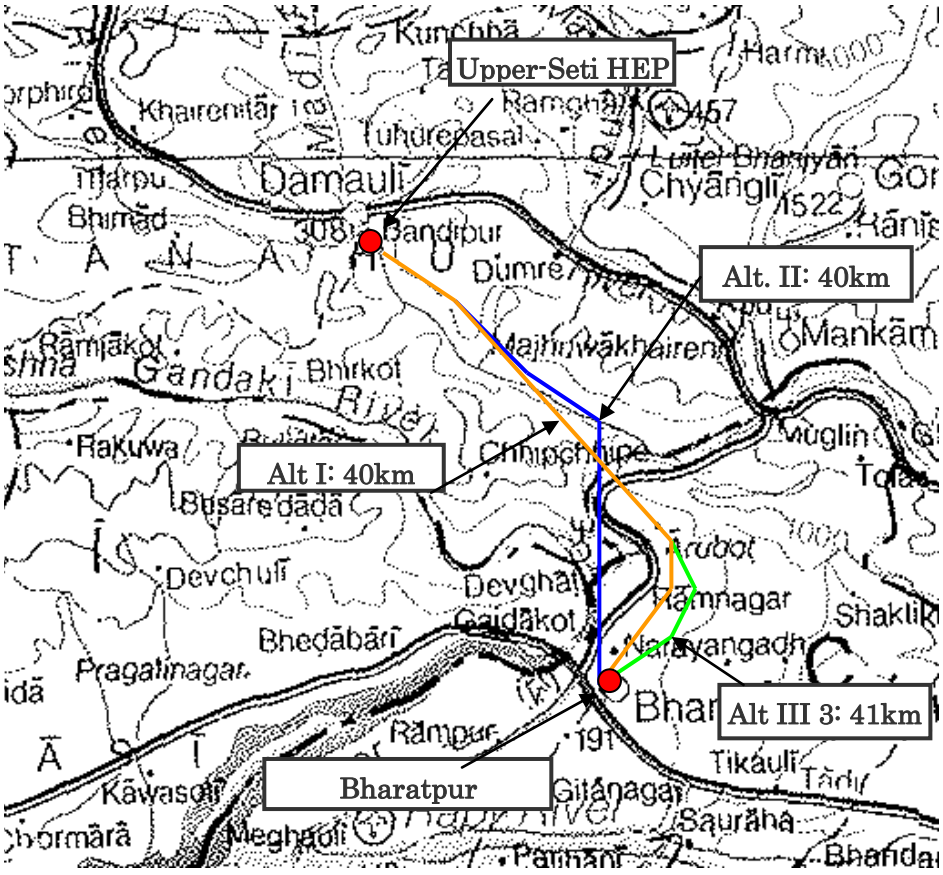


**Figure 2.1-1 Alternative Route of Transmission Line**

## 2.2 Comparison of Alternatives

**Tables 2.2-1**, **2.2-2** and **2.2-3** presents the land use characteristics of the three alignments and approximate areas required for acquisition and land use restriction under the ROW of the alignments. Land use under the ROW of the three alignments shows that:

- Alternative I and II passes mostly through the agricultural/grazing areas compared to the Alternative III
- Alternative I has the least ROW area under forest cover compared to Alternative II and III
- The number of built structures under Alternatives I, II and III are almost the same with Alternative III having 17 built structures compared to 19 and 24 in Alternative I and II respectively
- Alternative III is the longest followed by Alternative I and II but the lengths of Alternative I and II are comparable.

From the environmental viewpoint to avoid or minimize impacts, Alternative I is selected for detailed survey and design for the following reasons:

- The loss of forest due to clearance of trees under the ROW is minimized in comparison with the other two options including the opening up of new areas of the Narayani Protected Forest
- Total ROW area under Alternative I can be minimized by alignment of the ROW to the existing TL for about 11 km distance, which further reduces the forest losses
- Agricultural areas along the ROW could continue and the impact to local socio-economy is envisaged to be minimal.

**Table 2.2-1 Land Use along Transmission Line Alternative Alignment I**

| District | VDC | Land Use | | | | | | | | Total Length (m) | Total Area (ha) | Structures | Streams | Settlement / village |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Forest | | Agriculture | | River | | Others | | | | | | |
| | | Length (m) | ROW (sq.m) | Length (m) | ROW (sq.m) | Length (m) | ROW (sq.m) | Length (m) | ROW (sq.m) | | | | | |
| Tanahu | Kahun Shivapur | 675 | 40500 | 675 | 40500 | 125 | 7500 | 0 | 0 | 1475 | 8.85 | 0 | Seti | Banchare |
| | Pokhari Bhanjyang | 50 | 3000 | 4500 | 270000 | 15 | 900 | 0 | 0 | 4565 | 27.39 | 7 | Khirkhadi Khola | Simalswara, Chhapdanda, Arkhale Pani |
| | Keshavtar | 2000 | 120000 | 3725 | 223500 | 15 | 900 | 0 | 0 | 5740 | 34.44 | 3 | Dhad Khola (2) | Guwandanda, Marauto |
| | Dharampani | 4850 | 291000 | 1775 | 106500 | 125 | 7500 | 0 | 0 | 6750 | 40.5 | 1 | Bagar Khola, Seti | Huslan, Bagarkhola, Setigaon |
| | Devghat | 0 | 0 | 2270 | 136200 | 125 | 7500 | 2575 | 154500 | 4970 | 29.82 | 4 | Bar Khola, seti | Bargaon, Chaughare, Duighare |
| | Kabilas | 9200 | 552000 | 3675 | 220500 | 0 | 0 | 1375 | 82500 | 14250 | 85.5 | 4 | Das Khola | Duighare, Upper syalni, Tandran, Devitar |
| Chitwan | Bharatpur | 0 | 0 | 2125 | 127500 | 0 | 0 | 0 | 0 | 2125 | 12.75 | 0 | | |
| Total | | 16775 | 1006500 | 18745 | 1124700 | 405 | 24300 | 3950 | 197500 | 39875 | 239.25 | 19 | 8 | 16 |

*Source: Based on the measurements in 1:25000 Topographic Maps of the Area, Transmission Line ROW = 60m*

**Table 2.2-2 Land Use along Transmission Line Alternative Alignment II**

| District | VDC | Land Use | | | | | | | | Total Length (m) | Total Area (ha) | Structures | Streams | Settlement/ village |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Forest | | Agriculture | | River | | Others | | | | | | |
| | | Length (m) | ROW (sq.m) | Length (m) | ROW (sq.m) | Length (m) | ROW (sq.m) | Length (m) | ROW (sq.m) | | | | | |
| Tanahu | Kahun Shivapur | 675 | 40500 | 675 | 40500 | 125 | 7500 | 0 | 0 | 1475 | 8.85 | 0 | Seti | Banchare |
| | Pokhari Bhanjyang | 50 | 3000 | 4500 | 270000 | 15 | 900 | 0 | 0 | 4565 | 27.39 | 7 | Khirkhadi Khola | Simalswara, Chhapdanda, Arkhale Pani |
| | Keshavtar | 2000 | 120000 | 3725 | 223500 | 15 | 900 | 0 | 0 | 5740 | 34.44 | 3 | Dhad Khola (2) | Guwandanda, Marauto |
| | Dharampani | 4850 | 291000 | 1775 | 106500 | 125 | 7500 | 0 | 0 | 6750 | 40.5 | 1 | Bagar Khola, Seti | Huslan, Bagarkhola, Setigaon |
| | Devghat | 0 | 0 | 2270 | 136200 | 125 | 7500 | 2575 | 154500 | 4970 | 29.82 | 4 | Bar Khola, Seti | Bargaon, Chaughare, Duighare |
| Chitwan | Kabilas | 8375 | 502500 | 4000 | 240000 | 875 | 52500 | 1375 | 82500 | 14625 | 87.75 | 6 | Das Khola, Narayani | Duighare, Upper syalni, Tandran, Devitar, Jugedi Bazzar |
| | Bharatpur | 0 | 0 | 1625 | 97500 | 0 | 0 | | 0 | 1625 | 9.75 | 3 | | Ganeshsthan, Barmelichouk, Baseni |
| Total | | 15950 | 957000 | 18570 | 1114200 | 1280 | 76800 | 3950 | 237000 | 39750 | 238.5 | 24 | 9 | 20 |

*Source: Based on the measurements in 1:25000 Topographic Maps of the Area, Transmission Line ROW = 50m*

**Table 2.2-3 Land Use along Transmission Line Alternative Alignment III**

| District | VDC | Land Use | | | | | | | | Total Length (km) | Total Area (ha) | Structures | Streams | Settlement /village |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Forest | | Agriculture | | River | | Others | | | | | | |
| | | Length (m) | ROW (sq.m) | Length (m) | ROW (sq.m) | Length (m) | ROW (sq.m) | Length (m) | ROW (sq.m) | | | | | |
| Tanahu | Kahun Shivapur | 1250 | 75000 | 0 | 0 | 125 | 7500 | 0 | 0 | 1.375 | 8.25 | 0 | Seti | Banchare |
| | Pokhari Bhanjyang | 4750 | 285000 | 0 | 0 | 15 | 900 | 0 | 0 | 4.765 | 28.59 | 0 | Khirkhadi Khola | Simalswara Chhapdanda,Arkhale Pani |
| | Keshavtar | 4325 | 259500 | 1175 | 70500 | 20 | 1200 | 0 | 0 | 5.52 | 33.12 | 0 | Dhad Khola (2) | Guwandanda, Marauto |
| | Dharampani | 10800 | 648000 | 575 | 34500 | 90 | 5400 | 0 | 0 | 11.465 | 68.79 | 5 | Bagar Khola, Seti | Huslan, Bagarkhola, Setigaon |
| | Devghat | 5075 | 304500 | 2450 | 147000 | 340 | 20400 | 3500 | 210000 | 11.365 | 68.19 | 9 | Bar Khola, Narayani | Bargaon, Chaughare, Duighare |
| | Kabilas | 4875 | 292500 | 250 | 15000 | 10 | 600 | 0 | 0 | 5.135 | 30.81 | 0 | Das Khola | Duighare, Upper syalni, Tandran, Devitar |
| Chitwan | Bharatpur | 0 | 0 | 1500 | 90000 | 0 | 0 | 0 | 0 | 1.5 | 9 | 3 | | Ganeshsthan, Barmelichouk, Baseni |
| | | 31075 | 1864500 | 5950 | 357000 | 600 | 36000 | 3500 | 210000 | 41.125 | 246.75 | 17 | 8 | 19 |

*Source: Based on the measurements in 1:25000 Topographic Maps of the Area, Transmission Line ROW = 60m*

# CHAPTER 3 BASELINE DATA

## 3.1 Physical Environment Impacts

Detailed field surveys of the transmission line corridor show that the total length of the corridor to be approximately 40 km. Of the total length approximately 1.7 km passes over the rivers, streams, creeks and roads. The length covered by forest, grazing land and cultivated land is approximately 21.6 km, 2.1 km and 12.9 km, respectively. Taking 60m as the ROW for 220 kV transmission line (i.e. 30 m either side from the TL central line), the total ROW area required for the proposed project is 230.5 ha. Since the ROW areas over rivers, streams, creeks and roads is not required for acquisition, the total ROW area is further reduced to 220.3 ha.

Also as the proposed ROW from 29210 Chainage onwards to the Bharatpur Sub-station is shared with the existing 132 kV transmission line, only 197.4 ha is actually required for the new ROW acquisition or restricted land use. Of the 197.4 ha of the ROW land requirement, about 73.7 ha falls under agricultural land use category, 12.8 ha under grazing land use category and remaining 110.9 ha under forest land use category.

## 3.2 Biological Environment Impacts

(1) Forest and Vegetation

In the Bio-geographic map (NARMSAP, 2002), the proposed 220 kV transmission line corridor lies in the Central Nepalese Bio-geographic region comprising *Schima-Castanopsis* Forest zone, Hill Sal Forest Zone and Lower Tropical Sal Forest Zone.

There is no distinct separation of the above forest zones in the TL corridor area. The *Schima – castonopsis* zone occurs usually between 1000 to 2000 m. Below 1000 m *Schima wallichii* is mixed with *Shorea robusta* and other elements of deciduous Hill Sal Forest. The TL corridor in the Dharampani, and parts of Keshavatr VDC of Tanahu District passes along this zone. The Hill Sal (Shorea robusta) occurs usually between 300 m to 1000 m. *Shorea robusta* is the dominant tree species of this zone and the land is undulating to flat. Orchids are especially abundant in ravine areas. Besides, a number of endangered plant species such as *Cycas pectinanta*, *Gnetum montanum*, *Cyathea spinulosa* are found associated with *shorea robusta* in this zone. *Acacia Catechu* and *Bombax cieba*, the protected tree species in Nepal under the Forest Regulation, 1995 are also found along the ravine corridors and alluvial tars along the Sei River.

(2) Wildlife

The TL corridor extends from the Mid Hills region in the north to the Dun valley (a component of Siwaliks and Terai) in the south. It is the transition zone of the Lowlands and the Mid Hills, is diverse in its faunal composition. Ecologically, though the corridor area is dominated by the Lower Tropical Sal, Hill Sal and *Schima –castonopsis* Forests, it also consists of other ecological types of tropical and

sub-tropical zones of central Nepal. Only a few species of wildlife and birds are listed in the IUCN, CITES and HMG protection. None of these species is threatened to any degree by the T/L Project.

## 3.3 Socio-economic and Cultural Environment Impacts

(1) Affected VDCs

This section is based on available secondary information of the affected VDCs of the Tanahu and Chitwan Districts. **Table 3.3-1** presents the demography of the districts traversed by the 220 kV transmission line corridor. Population density is about 210 persons/ $km^2$, average household size is around 5 and the female population is marginally higher than the male population.

**Table 3.3-1 Demographic Characteristics of the Affected Districts**

| District | Chitawan | Tanahu |
|---|---|---|
| Total Population | 472,048.00 | 315,237.00 |
| Male | 235,084.00 | 146,788.00 |
| Female | 236,964.00 | 168,449.00 |
| Number of Households | 92,863.00 | 62,898.00 |
| Average Household Size | 5.08 | 5.01 |
| Area in $km^2$. | 2,218.00 | 1,546.00 |
| Population Density Person/$km^2$. | 213.0 | 204.00 |

*Source: CBS, 2001*

The demographic features of the Village Development Committees (VDC) traversed by the transmission line corridor are presented in **Table 3.3-2**. Hill VDCs show slightly higher Household size than occurs in the Municipality of Bharatpur.

**Table 3.3-2 Population Distribution in the Affected VDCs and Municipality**

| **Village Development Committee / Municipality** | **Total Population** | **Total Household** | **HH size** | **Male** | **%** | **Female** | **%** | **M:F** |
|---|---|---|---|---|---|---|---|---|
| Kahun Shivapur (T) | 8066 | 1087 | 7.4 | 4031 | 50.0 | 4035 | 50.0 | 1 : 1 |
| Pokhari Bhanjang (T) | 4082 | 832 | 4.9 | 1902 | 46.6 | 2180 | 53.4 | 0.87 : 1 |
| Kesavtar (T) | 5423 | 1054 | 5.1 | 2513 | 46.3 | 2910 | 53.7 | 0.86 : 1 |
| Dharmapani (T) | 3914 | 709 | 5.5 | 1780 | 45.5 | 2134 | 54.5 | 0.83 : 1 |
| Devghat (T) | 7620 | 1666 | 4.6 | 3691 | 48.4 | 3929 | 51.6 | 0.94 : 1 |
| Kabilas (C) | 5513 | 985 | 5.6 | 2765 | 50.2 | 2748 | 49.8 | 1.008 : 1 |
| Bharatpur NP (C) | 89323 | 19922 | 4.5 | 45858 | 51.3 | 43465 | 48.7 | 1.05 : 1 |
| **Total Affected Population** | **123941** | **26255** | 4.7 | **62540** | 50.5 | **61401** | 49.5 | **1.02 : 1** |

*Source: CBS, 2001 Note (T) = Tanahu; ( C) =Chitawan*

In general the major ethnic composition of the TL corridor VDCs is mainly Magar and Gurung in the hills and rural areas with groups of Brahmins and Chettris outnumbering the other groups within the Municipality of Bharatpur. Kami, Damai and Sarki (KDS), the disadvantageous ethnic groups, are

distributed all along the TL corridor of the various VDCs in smaller numbers. Their numbers are comparatively higher in the hills of Tanahu District compared with Chitwan District.

(2) Characteristics of Affected Persons and Properties

Detailed information on the project affected people is not available. Detailed surveys are required for the above purposes along the TL ROW corridor. However, information on the potentially affected land and built structures can be roughly estimated from the available database of the detailed survey (Masina Continental Associates et. al, July 2006).

A total of 32 structures are located under the TL ROW, of which 18 are residential structures and 14 are cowsheds or field structures used seasonally during crop harvesting as noted in **Table 3.3-3**. Estimated agricultural land under the ROW of transmission line is 77.5 ha. Of this total of agricultural land, only 1.76 ha is required permanently for the construction of tower foundations, while 75.73 ha agricultural land will be restricted to some degree for land uses such as tree plantations and structures.

Agricultural land plots identified for permanent land acquisition and land use restrictions are presented in the Supplemental EIA. An indicated total of 447 land parcels located on 20 Cadastral Maps have been identified. Landowners of these land parcels are to be identified and their socio-economic and social conditions are to be ascertained through a structured questionnaire survey during the EIA for the TL to be undertaken by NEA Environmental and Social Studies Department (ESSD). Besides this is the factor that, in a number of places along ROW, there are land units under agriculture use that are not legally registered and identification of these plots and their users is also required during detailed filed surveys.

**Table 3.3-3 Houses & Other Structures and Features along 220 kV Transmission Line Right-Of-Way**

| Drawing Number | Approx. Distance m | Village | No of Houses | No of Sheds | Total Structures | Feature | Along RoW C/L | Within T/L RoW | Outside T/L RoW | RoW Width -m | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 230 | Dharapeni | 1 | - | 1 | - | - | - | 1R | 60 | |
| 2 | 785 | Banchare | 1 | 2 | 3 | - | - | 1L | 2L | 60 | |
| 2 | 935 | Banchare | 1 | 1 | 2 | - | - | - | 2L | 60 | |
| 2 | 1365 | - | - | - | - | Seti River | - | - | - | - | 40m wide |
| 3 | 1425 | - | - | - | - | Road to Belbas | - | - | - | 60 | |
| 3 | 1545 | - | - | 3 | 3 | - | 2 | 1R | - | 60 | |
| 3 | 1710 | Majhkot | 1 | 1 | 2 | - | - | 2R | - | 60 | |
| 4 | 3800 | - | - | - | - | Gagate Khola | - | - | - | 60 | 20m wide |
| 4 | 4127 | - | - | - | - | Kirandi Khola | - | - | - | 60 | 40m wide |
| 5 | 4555 | - | - | - | - | Chisopani Khola | - | - | - | 60 | 5m wide |
| 5 | 5126 | Kukurdhunge Gudi | 1 | 1 | 2 | - | 1 | 1L | - | 60 | |
| 5 | 5445 | | 1 | 2 | 3 | - | 1 | 2L | - | 60 | |
| 6 | 6027 | - | - | - | - | Khirekhadi Khola | - | - | - | 60 | |
| 7 | 7051 | - | - | 1 | 1 | Road to Kesabata | 1 | - | - | 60 | |
| 7 | 7693 | Guwandanda | 1 | 1 | 2 | - | - | 2R | - | 60 | |
| 7 | 8195 | - | - | - | - | Road to Kesbata | - | - | - | 60 | |
| 8 | 8605-8901 | - | - | - | - | Sukaura Khola | - | - | - | 60 | 300m along valley |
| 9 | 9854 | No Name | 1 | - | 1 | - | - | 1L | - | 60 | |

| Drawing Number | Approx. Distance m | Village | No of Houses | No of Sheds | Total Structures | Feature | Along RoW C/L | Within T/L RoW | Outside T/L RoW | RoW Width -m | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | 10380 | | | | | Danda Kho;a | - | - | - | 60 | |
| 9 | 10685 | No Name | 1 | - | 1 | - | - | 1R | - | 60 | |
| 9 | 10835 | No Name | 1 | - | 1 | - | - | 1R | - | 60 | Track to Sukaura |
| 10 | 11781 | - | - | - | - | Dhada Khola | - | - | - | 60 | 30m wide |
| 11 | 14915 | - | - | - | - | Bakse Khola | - | - | - | 60 | 15m wide |
| 14 | 17935 | Kesartar | 1 | - | 1 | Bagar Khola | - | 1L | - | 60 | 110m wide |
| 15 | 18285 | Kesartar | 1 | - | 1 | - | - | 1L | - | 60 | |
| 15 | 18578 | - | - | - | - | Seti River | - | - | - | - | 120m wide |
| 15 | 19010 -19245 | Serenghat | 2 | - | 2 | Boad Khola | - | 2R | - | 60 | 235m wide |
| 16 | 20045 | - | - | - | - | Daduwa Khola | - | - | - | 60 | 30m wide |
| 18 | 23460-23620 | - | - | - | - | Narayani River | - | - | - | - | 160m wide |
| 18 | 23697 | - | - | - | - | XXHighway | - | - | - | 60 | Mugling-Bharatpur |
| 19 | 23940 | No Name | 1 | - | 1 | - | - | 1R | - | 60 | |
| 19 | 24360 | - | - | - | - | Parallel 132kV T/L | - | - | - | 60 | |
| 19 | 24600 | - | - | - | - | Bench Mark 788 | - | - | - | 45 | 132kv T/L adjacent to East |
| 21 | 27450 | - | - | - | - | Das Khola | - | - | - | 45 | 25m wide |
| 21 | 27880 | No Name | 1 | 1 | 2 | Tandrang Kholsi | 2 | - | - | 45 | 80m wide junction |
| 22 | 28915 | - | - | - | - | Khahare Khola | - | - | - | 45 | 52m wide |
| 22 | 29210 | No Name | 2 | 1 | 3 | - | 1 | 2R | - | 45 | Crossing 132kV T/L |
| 23 | 29617 | - | - | - | - | Bharlang Khola | - | - | - | 30 | For 160m follows Bharlang valley |
| 23 | 29990 | - | - | - | - | Jugedi | - | - | - | 30 | 220m wide valley |

| Drawing Number | Approx. Distance m | Village | No of Houses | No of Sheds | Total Structures | Feature | Along RoW C/L | Within T/L RoW | Outside T/L RoW | RoW Width -m | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Khola | | | | | |
| 23 | 30415 | - | - | - | - | Crossing of 132 kV T/L | - | - | - | 30 | |
| 24 | 30948 | - | - | - | - | Bhateri Kholsi | - | - | - | 30 | 30m wide + landslide |
| 24 | 31789 | - | - | - | - | Sal-National Forest | - | - | - | 45 | Bench Mark 827 & reserve boundary |
| 26 | 34786 | - | - | - | - | Ramnagar Khola | - | - | - | 45 | 40m wide |
| 27 | 36200 | - | - | - | - | Jal Binayak Khola | - | - | - | 45 | 20m wide |
| 28 | 37858 | Chihan | - | - | - | Temple Complex | 1 | - | - | 45 | 80m long |
| 29 | 38151 | - | - | - | - | 132kV T/L exits | - | - | - | 60 | - |
| 29 | 38415 | Ganeshsthan | - | - | - | Bench Mark 900 | - | - | - | 60 | End of T/L _ Substation adjacent |
| TOTAL | 38.42km | 8 Villages | 18 | 14 | 32 | | 8 + 1 | 14 | 5 +5 | | |

**NOTES:**
1) Approximately 1702 m of river, creek and road crossing
2) Approximately 21614 m of Forest crossing;
3) Approximately 2138 m of grazing and scattered tree area crossing
4) Approximately 12916 m of cultivated land area crossing
5) ROW area required for restriction on land use in the grazing and agricultural land = 86.484 ha
6) ROW area required for forest clearance = 110.94 ha
7) ROW area under rivers, streams, creeks and road not required for acquisition = 10.212 ha

# CHAPTER 4 INITIAL ENVIRONMENTAL EXAMINATION

## 4.1 Environmental Impacts and Mitigation

Transmission lines are linear projects, covering long distance but limited in the area disturbed at any specific point. Unlike other linear projects such as roads, their area of influence is limited to the corridor only. Furthermore, their construction and operation activities are not as extensive as road projects requiring huge amount of excavation, quarries and drainage alterations bringing significant changes to local land systems. However, changes in the land use are the major and key environmental issues of transmission line projects with implications to the biological, social and socio-economic environments of the corridor area affected.

The impacts have been divided into insignificant and significant impacts in the Supplemental EIA of which only the significant are given in **Table 4.1-1**.

**Table 4.1-1 Environmental Impact and Mitigation Measure Matrix for Significant Adverse Environmental Impacts of the 220 kV Transmission Line Project**

| SN | Environmental Issue | Environmental Impact | Stage of Project | Mitigation Measures |
|---|---|---|---|---|
| **1.Physical Environment** | | | | |
| 1.1 | Soil erosion | Land degradation and landslides | Construction phase | • Ground clearance should not be carried out by uprooting of trees and ground vegetation<br>• Tower foundation excavation should be minimized to required levels and spoil should be properly placed and compacted in designated areas |
| 1.2 | Land Use* | Change in land use | Construction & operation phases | • Reduction in ROW width |
| **2. Biological Environment** | | | | |
| 2.1 | Terrestrial forests and vegetation* | Loss of forests and vegetation | Construction and operation phases | • Reduction in ROW width<br>• Restriction on illegal felling of trees in areas other than required for ROW and T L itself |
| 2.2 | Wildlife and wildlife habitat* | Loss of wildlife habitat and wildlife | Construction phase | • Reduction in ROW width<br>• Restriction on hunting of wildlife by the construction workforce |
| 2.3 | Avian Fauna* | Loss of avian fauna | Operation phase | |
| **3. Socio-economic and Cultural Environment** | | | | |
| 3.1 | Telephone/electric lines and built structures* | Disruption of services and losses of built structures | Construction phase | • Adequate clearance height of the conductors above the telephone and electrical lines<br>• Information to local people for the service disruption during construction<br>• Adequate compensation to the owners of built structures without deduction of depreciation costs<br>• Resettlement and rehabilitation package to the affected structure owner |

| SN | Environmental Issue | Environmental Impact | Stage of Project | Mitigation Measures |
|---|---|---|---|---|
| 3.2 | Public Health and safety* | Risks to public health and safety | Operation phase | • Bill boards and hoarding boards with information about the hazards<br>• Public awareness programs on measures for public health and safety in the TL corridor |
| 3.3 | Agricultural production | Loss of Agriculture production due to disruption | Construction phase | • Adequate compensation of the loss of agricultural produce<br>• Scheduling of the construction activity such that the agricultural fields are without crops during construction period. |
| 3.4 | Loss of Land and Property* | Livelihood and future opportunity | Construction & Operation phase | • Reduction in ROW width<br>• Adequate compensation to the affected land and property owners with permanent occupation of areas affected<br>• Adequate compensation for the affected land under ROW for restriction considering the future opportunity of the agricultural land<br>• Resettlement and rehabilitation package to the affected population |
| 3.5 | Tourism and Aesthetics | Loss of tourism and aesthetic value | Construction and operation phases | • Restriction on haphazard storage, camp managements, and disposal of spoils<br>• Design the tower structures that complements to the natural background |
| 3.6 | Occupational Health | Risks to the health of construction and operation workforce | Construction and operation phases | • Provision of appropriate protective equipment and gear to the construction and operational workforce<br>• Trainings on the possible occupation hazards to the construction and operation workers |

*Note: * Irreversible impacts*

## 4.2 Institutional Requirements and Environmental Monitoring Program

The Nepal Electricity Authority (NEA), compared to other institutions in Nepal, has established an Environment and Social Studies Department (ESSD) to deal with environmental studies and monitoring. However, it has shortages of trained manpower to effectively carry out environmental monitoring to the project requirements. There is a need to strengthen the ESSD in respect of its monitoring capabilities. Environmental and social monitoring, particularly in the construction phase of TL projects is very important.

## 4.3 Findings and Conclusion

This IEE level assessment has identified key issues of environmental concerns for the proposed 220 kV transmission line project. The project is not envisaged to have any significant damage to the physical environment except for limited erosion and land stability issues. But the concerns that are

associated with clearance of trees in Protected Forests are a major issue to be addressed in the full EIA. Other issues such as tower foundation excavation and spoil management also require attention.

There is some potentials of irreversible damage to the local biological environments, particularly in forested areas, whereas the impacts on wildlife habitat are limited along the TL ROW in a stretch of about 21.6 km of forest land. About 1.76 ha of agricultural land will be permanently acquired for tower foundations and some restrictions within the corridor on land use would occur. A total of 18 residential house structures will have to be acquired as well as 14 ancillary structures.

In summary, the significance of the impacts due to loss of forest land, and agricultural land and property are yet to be assessed. Also thee is a need to design site-specific mitigations to minimize and rehabilitate losses to natural and social infrastructure. A project specific mitigation program and monitoring program should be prepared and include an Environmental Management Plan and Resettlement and Rehabilitation Management Plan.

The IEE level study for the proposed 220 kV TL, has established sufficient justifications for the selection of the best TL alternative from among the various TL options and to proceed to the next phase of detailed design study. The study has also identified the key significant adverse environmental issues for the nominated TL alternative for the detailed EIA. It is concluded that the selected TL option be considered acceptable according to the provisions of Environmental Protection Rule (1997) of Government of Nepal and in compliance with the JICA Guidelines (2004).

# ENVIRONMENTAL AND SOCIAL CONSIDERATIONS (ESC) REPORT

## PART F

## ENVIRONMENTAL MANAGEMENT FRAMEWORK

# PART F ENVIRONMENTAL MANAGEMENT FRAMEWORK

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# CHAPTER 1 ENVIRONMENTAL MANAGEMENT FRAMEWORK

## 1.1 Background

The Environmental Management Plan (EMP) represents the key mitigation/enhancement measures and monitoring for major impacts, which are translated into concrete action programs/projects and defines the institutional framework and mechanisms for ensuring their appropriate implementation to actually be carried out in subsequent stages of project development. It likewise provides the estimated investment requirements and commitments/guarantees to carry out the proposed plan. The EMP is based on the experiences of previously constructed hydropower projects of similar nature, and findings of the EIA study, Social Action Plan (SAP), Resettlement Plan (RP), review of other EMPs prepared for the environmental management and Government of Nepal Act, Regulations and Guidelines relevant to the hydropower projects.

## 1.2 Overall EMP Summary

The overall EMP summary including mitigation/enhancement measures, schedule of implementation, estimated investment requirements, institutional responsibilities and guarantees/agreements is shown in **Table 1.2-1**. The cost computations are rough estimates and need to be verified/ validated during the detailed design stage.

**Table 1.2-1 Summary of Environmental Impacts and their Corresponding Mitigation/Enhancement Measures and EMP**

| Impact Items/ Project Activities | Potential Environmental Impacts | Degree /type of Impact | Mitigation/Enhancement Measure | Cost | Responsible Institution | Guarantees/ Agreements |
|---|---|---|---|---|---|---|
| **1. Pre-Construction/ Construction Period** | | | | | | |
| *A. Physical Environment* | | | | | | |
| (1) Land Use and Topography | | | | | | |
| ▪ Inundation of the land for reservoir | Loss of current land use opportunity for villagers, and loss of habitat for wildlife and vegetation | S, P (negative) | ▪ Unavoidable impact, but selection of lower reservoir Full Supply Level could minimize existing land use changes drastically. | ▪ n/a | ▪ NEA | ▪ n/a |
| ▪ Construction activities of various types in the dam site and project facility sites involving excavations, drilling, blasting and material removals | Land instabilities | NS, T (negative) | ▪ Locating the access road route under the Vyas-Shivapur footbridge rather than through the village, with associated benefits of traffic separation;<br>▪ Shifting the spoil bank to the river side to reduce the affected area;<br>▪ Locating the permanent NEA camp at the southern end of the flat area and close to the power station;<br>▪ Shifting the main access road to uphill from the present road so that project-related traffic is separated from schools and shops along the existing road in Beni Patan. | ▪ Bio-engineering of the cut batter slopes of the access roads (lump sum): 2.0 million NRs | ▪ Contractor, NEA | ▪ Part of contractor's contract |
| ▪ Spoil bank to be constructed along with the right bank of the Seti River | Soil erosion | NS, P (negative) | ▪ Construction of a dry stone gabion structure at the toe of the spoil bank;<br>▪ Construction of a water collection system for the spoil bank to avoid free flow of the run off from the mountain slope over the spoil material;<br>▪ Proper grading of the spoil surface with adequate drainage provisions after the closure of spoil disposal at the site;<br>▪ Afforestation and bioengineering of the spoil area after proper grading and drainage management. | ▪ Dry gabion wall approximately 1,300 m (1.5m high and 1m wide): 5.0 million NRs<br>▪ Run off catch drainage of mountain slope (approx. 900m): 3.2 million NRs | ▪ Contractor, NEA | ▪ Part of contractor's contract |
| (2) Air Quality | | | | | | |
| ▪ Dust generated from excavation, filling, stockpiling and construction vehicle movements associated with the construction of the various surface and sub-surface structures and transportation of the spoil materials to the spoil bank. | Increase in particulates and gaseous emissions | MS, T (negative) | ▪ On-site vehicle speed restrictions and vehicle washing before leaving the site;<br>▪ Frequent watering of the road in the dry season ensuring that the road surface does not generate dust.<br>▪ Frequent watering of the dusty barren areas or spoil disposal areas. | ▪ Water sprinkling: 4.9 million NRs (2 tankers /day/245 days a year/5 year)<br>▪ Dust masks to workers: 0.7 million NRs (twice a year (lump sum)/5 year) | ▪ Contractor, NEA | ▪ Part of contractor's contract |

| Impact Items/ Project Activities | Potential Environmental Impacts | Degree /type of Impact | Mitigation/Enhancement Measure | Cost | Responsible Institution | Guarantees/ Agreements |
|---|---|---|---|---|---|---|
| (3) Noise/Vibration Level | | | | | | |
| ▪ Noise generated from cut-and-cover activities, excavation, back filling and construction of above ground structures and transportation of the construction vehicle.<br>▪ Vibration generated from and drill & blast activities in the dam, tunnel and powerhouse. | Increase in noise and vibration levels<br><br>It is not expected to effect communities living away from source. However, impacts to wildlife are expected. | MS, T (negative) | ▪ Care in the placement and orientation of noisy plants away from sensitive receivers;<br>▪ Use and correct fitting of silencers, mufflers and acoustic shields;<br>▪ Regular maintenance of plant and equipment;<br>▪ Awareness programs and information sharing with the communities on the noise related issues | ▪ Part of construction cost | ▪ Contractor, NEA | ▪ Part of contractor's contract |
| (4) Water Quality | | | | | | |
| ▪ Poor sanitation facilities to construction workforce at the construction camps and construction areas may promote the use of the adjacent river bed areas for open defecation dislodging of solid waste and other sanitation uses. | Changes in river water quality<br><br>Such uses of the river area, especially in the dry season, may substantially degrade the water quality in the Seti River due to discharges of organic load. | MS, T (negative) | ▪ Establishment of good water supply and sanitation facilities in the construction work camps, at actual construction sites;<br>▪ Establishment of effective solid waste collection facilities in the construction work camps;<br>▪ Public awareness program to the construction workforce and the construction on good health and sanitation practices | ▪ Sanitation (toilet provisions) at all work and campsites<br>4.5 million NRs<br>(lump sum, about 100 toilets)<br>▪ Camp solid waste collection management system and disposal facilities:<br>2.8 million NRs | ▪ Contractor, NEA | ▪ Part of contractor's contract |
| ▪ Excavation works are expected to increase the turbidity and total suspended solids in the flowing water. Besides, accidental oil spills of the operating equipment will be released to the flowing water. And also, discharge of concrete plants, aggregate washing plants etc. provide huge amount of fine sediment to the receiving water bodies. | Changes in river water quality | MS, T (negative) | ▪ Discharge of batching plant, aggregate washing plant, and tunnel seepage waters only after appropriate treatment (sedimentation facility) to the natural water bodies;<br>▪ Public awareness program to the construction workforce and the construction on good health and sanitation practices;<br>▪ Disposal of construction related spoils only into defined and well protected spoil disposal sites approved by concerned authorities. | ▪ Sedimentation tank for batching discharges, tunnel discharges and aggregate crushing discharges and spoil disposal area:<br>10 million NRs | ▪ Contractor, NEA | ▪ Part of contractor's contract |

| Impact Items/ Project Activities | Potential Environmental Impacts | Degree /type of Impact | Mitigation/Enhancement Measure | Cost | Responsible Institution | Guarantees/ Agreements |
|---|---|---|---|---|---|---|
| *B. Biological Environment* | | | | | | |
| (1) Terrestrial | | | | | | |
| ▪ Forest and vegetation clearing, excavation and grading and other construction activities | Loss, disturbance and damage to existing vegetation;<br>Habitat degradation of dependent species | MS, P (negative) | <u>Forest and vegetation</u><br>▪ For every tree cut, the compensatory plantation at 1:25 trees must be made<br>▪ Secure necessary permit for tree cutting<br>▪ Implement tree balling where practicable<br>▪ Immediate revegetation<br>▪ To provide alternatives of kerosene rather than fuel wood<br><u>Wildlife</u><br>▪ Selecting the appropriate layout to minimize the cutting trees (especially from the dam site to the lower reservoir area)<br>▪ To restrict hunting and trapping<br>▪ To save endangered animals by a rescue operation using boats during the filling of the reservoir and relocating them to compatible ecosystem in nearby forests. | ▪ Part of construction cost | ▪ Contractor, NEA | ▪ Part of contractor's contract |
| *C. Socio-economic Environment* | | | | | | |
| ▪ Inundation by reservoir development | Inundation of existing infrastructure facilities of the communities such as motorable roads, suspension bridges, foot trails, irrigation canals, and electricity distribution. | MS, T (negative) | ▪ Implementation of restoration of project impacted infrastructure program under social program of the project<br>▪ Implementation of rural electrification program under social program of the project | ▪ Restoration of project impacted infrastructure program: 85.5 million NRs<br>▪ Rural electrification program: 19.6 million NRs | ▪ Contractor, RSISU-PMO -NEA, local government | ▪ Social program of the project |
| | Inundation of existing community built structure (cremation, resting places etc.). | MS, T (negative) | ▪ Provision of compensation for affected community structures under the framework of Resettlement Plan<br>▪ Implementation of affected community's initiative support program under social program of the project | ▪ Compensation for community structures : 0.39 million NRs<br>▪ Affected community's initiative support program: 52.1 million NRs | ▪ Contractor, RSISU-PMO -NEA, local government | ▪ Social program of the project |

| Impact Items/ Project Activities | Potential Environmental Impacts | Degree /type of Impact | Mitigation/Enhancement Measure | Cost | Responsible Institution | Guarantees/ Agreements |
|---|---|---|---|---|---|---|
| | Inundation of land, loss of yield, involuntary resettlement, and impact on the livelihood of Affected Persons (APs) | MS, P (negative) | ▪ Land acquisition, and provision of compensation including the affected private land, the affected structures, loss of agricultural production equivalent to one year production, and other rehabilitation compensation fees for relocatee<br>▪ Implementation of separate package programs for restoration of livelihood and enhancement of quality of life. They include agricultural development program, skill enhancement and employment program, affected community's initiative support program, women development program, and community-based watershed management program. | ▪ Compensation and relocation costs: 1,080 million NRs<br>▪ Agricultural development program: 27.51 million NRs<br>▪ Skill enhancement and employment program: 10.14 million NRs<br>▪ Women development program: 13.03 million NRs<br>▪ Watershed management program: 12.31 million NRs | ▪ Contractor, RSISU-PMO -NEA, local government | ▪ Resettlement action plan<br>▪ Social program of the project |
| | Risk of shoreline erosion and land failure, where the people often utilize the edge of land for cultivation and other purposes | MS, P (negative) | ▪ Acquire land as risk zones by delineating a 10 m vertical height from the FSL with measures such as planting work<br>▪ Implementation of community-based watershed management program and community's initiative support program | ▪ Included in the land acquisition cost and in the mitigation cost for forest and vegetation<br>▪ Included in community-based watershed management program, and community's initiative support program | ▪ RSISU-PMO -NEA | ▪ Social program of the project |
| ▪ Influx of large number of workers | Shortages of drinking water | NS, T (negative) | ▪ Provide water supply for construction workers by contractors<br>▪ Implementation of community/public health and education enhancement program under social program of the project including the support for water supply taps | ▪ Part of construction cost<br>▪ Community/public health and education enhancement program: 15.9 million NRs | ▪ Contractor, NEA<br>▪ Contactor, RSISU-PMO -NEA, local government | ▪ Part of contractor's contract<br>▪ Social program of the project |
| | Deterioration of the existing sanitation conditions and break of the epidemics such as typhoid, cholera, and diarrhea and other communicable diseases like STD and HIV | MS, T (negative) | ▪ Implementation of community/public health and education enhancement program under social program of the project | ▪ Included in community/public health and education enhancement program cost | ▪ Contractor, RSISU-PMO -NEA, local government | ▪ Social program of the project |

| Impact Items/ Project Activities | Potential Environmental Impacts | Degree /type of Impact | Mitigation/Enhancement Measure | Cost | Responsible Institution | Guarantees/ Agreements |
|---|---|---|---|---|---|---|
| ▪ Land clearing within project facility site; site grading, excavation, hauling/stockpiling of excavated and construction materials including land acquisition for project site | Total or partial loss of land/farm area, properties and crops, involuntary resettlement, impacts on the livelihood of APs including loss of income due to land acquisition | S, P (negative) | ▪ Negotiate with PAFs/PAPs for an acceptable compromise on valuation and compensation<br>▪ Finalize the RAP incorporating therein the agreements reached during public consultations<br>▪ Land acquisition and provision of compensation as stated previously<br>▪ Implementation of several social programs for restoration of livelihood and enhancement of quality of life as stated previously | ▪ Included in compensation and relocation costs<br>▪ Included in social action program costs | ▪ RSISU-PMO -NEA | ▪ Resettlement action plan<br>▪ Social program of the project |
| ▪ Construction activities for the project | Work related injuries and accidents | MS, T (negative) | ▪ Project contractors will be responsible for the occupational health of workers. | ▪ n/a | ▪ Contractor | ▪ Part of contractor's contract |
| | Girl trafficking, and sexual and labor exploitation, child labor | S, T (negative) | ▪ Implementation of women development program under social program of the project, including education on HIV/AIDS, STD, family planning, and girl trafficking. | ▪ Women development program: 13.0 million NRs | ▪ Contractor, RSISU-PMO -NEA, local government | ▪ Social program of the project |
| | Increase in employment opportunities | MS, T (positive) | ▪ Require contractors to source workforce from qualified locals<br>▪ Contractors to orient workers on desirable working relationship especially if there are non-resident workers<br>▪ Implementation of skill enhancement and employment program under social program of the project | ▪ n/a<br>▪ Skill enhancement and employment program: 10.1 million NRs | ▪ Contractor, RSISU-PMO -NEA<br>▪ Contractor, NEA, local government | ▪ Part of contractor's contract<br>▪ Social program of the project |
| | Increase in livelihood and business opportunities | MS, T (positive) | ▪ Priority to be given to local subcontractors<br>▪ Priority to be given to local suppliers of construction materials and equipment<br>▪ Supply of food and catering to be preferentially awarded to local suppliers<br>▪ Implementation of skill enhancement and employment program, agricultural development program, and women development program including income generation and micro credit funds | ▪ n/a<br>▪ Included in social action program costs | ▪ Contractor, RSISU-PMO -NEA | ▪ Part of contractor's contract<br>▪ Social program of the project |

| Impact Items/ Project Activities | Potential Environmental Impacts | Degree /type of Impact | Mitigation/Enhancement Measure | Cost | Responsible Institution | Guarantees/ Agreements |
|---|---|---|---|---|---|---|
| | Potential health, sanitation and safety problems including accidental risks for local community people | NS, T (negative) | ▪ Contractor to provide construction camp as temporary housing facilities for workers equipped with adequate water and sanitation facilities<br>▪ Contractors to implement proper solid waste management in the work site, workers will be oriented to observe proper hygiene and sanitation practices and provided with appropriate protection gears while working<br>▪ Construction areas to be enclosed as necessary and provided with appropriate signage to avoid accidents | ▪ Part of construction cost | ▪ Contractor, RSISU-PMO -NEA | ▪ Part of contractor's contract |
| **2. Operations and Maintenance Period** | | | | | | |
| *A. Physical Environment* | | | | | | |
| (1) Land Use and Topography | | | | | | |
| ▪ Failure at the terrace breaks associated with the toe cutting by the stream, caving and overhanging | Soil slides associated with the terrace materials in the upper reservoir area | S, P (negative) | ▪ Completion of protection embankment works with concrete blocks cover in the vicinity of Bhimad Bazaar<br>▪ Land acquisition program and stabilization of erosion prone in the risk zone area from Full Supply Level to 10m high above<br>▪ Selective planting of ground cover and trees at the base of areas susceptible to erosion in tributary stream leading into the Seti River<br>▪ Land acquisition program and stabilization of erosion prone areas with suitable tree species in the vicinity of the Wantang Khola, the Pedhi Khola and Tittuwa | ▪ Part of construction cost | ▪ Contractor, NEA | ▪ Part of contractor's contract |
| ▪ Full supply level at 415m and flushing operation | Backwater effects of the reservoir | NS, T (negative) | ▪ The annual flushing of the reservoir at FSL 415 m will effectively control any sedimentation.<br>▪ In the case that nominated Full Supply Level is 415 m, the sedimentation will not happen around the Bhimad Bazaar.<br>▪ The backwater effect after the sedimentation is minor. | ▪ n/a | ▪ NEA | ▪ n/a |
| ▪ Diverted water flowing out from tailrace outlet and immediate increase of downstream water level by dam operation | Impact to agricultural land in the downstream of the dam | NS, P (negative) | ▪ The agricultural land on the left bank appears to be high enough that it would not be affected.<br>▪ The agricultural land on the right bank will be acquired for the construction.<br>▪ The permanent river protection work will not be required in this section.<br>▪ Monitoring of sedimentation patterns should be undertaken in this zone for at least 10 km below the outlet. | ▪ Land acquisition cost for agricultural land on the right bank | ▪ NEA | ▪ n/a |

| Impact Items/ Project Activities | Potential Environmental Impacts | Degree /type of Impact | Mitigation/Enhancement Measure | Cost | Responsible Institution | Guarantees/ Agreements |
|---|---|---|---|---|---|---|
| (2) Water Quality | | | | | | |
| ▪ Environmental flow | Changes in river water quality and flow volume | S, P (negative) | ▪ The mitigating effects of joining the Madi River downstream which has a flow regime equivalent to 75% of the Seti River flows.<br>▪ Impacts on the river's aquatic ecology and fish resources are unavoidable in the section of the Seti River immediately downstream of the dam and must be mitigated to the fullest extent possible. | ▪ n/a | ▪ NEA | ▪ n/a |
| ▪ Eutrophication of the reservoir | Changes in river water quality | S, P (negative) | ▪ Installation of Fraction Fence system in the reservoir<br>▪ Development of sewerage system in the upstream urban area to prevent waste water with nutrient salt flowing into the river | ▪ n/a<br>▪ To be estimated, but not be covered by the project | ▪ NEA<br>▪ Local government | ▪ Part of contractor's contract<br>▪ n/a |
| ▪ Sediment flush operation | Changes in river water quality | S, P (negative) | ▪ Optimum operation to minimize environmental impact based on experiences of operation in Japan | ▪ n/a | ▪ NEA | ▪ n/a |
| *B. Biological Environment* | | | | | | |
| (1) Freshwater | | | | | | |
| ▪ Change of flow regime due to dam | Local aquatic habitat alteration and permanent/temporary displacement of species | MS, P (negative) | ▪ Fish hatchery backed with open water stocking of suitable fish species, as is being done at NEA's Kali Gandaki A HEP. | ▪ Financial and Technical Assistance to Kali Gandaki A hatchery for added production & facility development and research for Upstream & Downstream Stocking in Seti River system: 73.6 million NRs<br>▪ NEA Extension program for fisheries and mitigation to local fishermen: 1.0 million NRs | ▪ NEA | ▪ n/a |

| Impact Items/ Project Activities | Potential Environmental Impacts | Degree /type of Impact | Mitigation/Enhancement Measure | Cost | Responsible Institution | Guarantees/ Agreements |
|---|---|---|---|---|---|---|
| *C. Socio-economic Environment* | | | | | | |
| Downstream safety | | | | | | |
| ▪ Immediate increase of water level in power generation and just after the sediment flushing operation | Danger in downstream communities and river users | S, P (negative) | ▪ Installation of siren system<br>▪ Public awareness on safety for downstream communities | ▪ Siren network along the Seti in the downstream of dam (lump sum): 3.5 million NRs<br>▪ Awareness training on the safety measures to downstream areas (lump sum): 0.3 million NRs | ▪ Contractor, NEA | ▪ Part of contractor's contract for installation |
| White water rafting in the downstream of the dam | | | | | | |
| ▪ Decrease of flow volume in non-power generation period, and immediate increase of water level in power generation and just after the sediment flushing operation | Danger of the rafting activity in the river and camp site at the riverside for the rafting participants | S or MS, P (negative) | ▪ Scheduled rafting activity to avoid immediate increase of water level<br>▪ Public awareness on safety for both rafting operators and participants<br>▪ Select safe location of the camp site for the rafting participants | ▪ n/a | ▪ NEA | ▪ n/a |

Note: S - Significant impact, MS - Moderately significant impact, NS - Not significant impact
T - Temporary impact, P - Permanent impact
(negative) - negative impact, (positive) - positive impact

RSISU - Resettlement Plan and Social Action Plan Implementation Sub-unit under Environmental and Social Monitoring Unit of PMO, NEA

## 1.3 Stakeholders under the EMP

The EMP for the Project is prepared to show linkages with different parties envisaged to be involved during the different phases of project development and operation in compliance with the existing Act and Rules. Overall project environmental management is the responsibility of the Project, Project Management Office (PMO) of NEA. There are a number of key stakeholders to be involved in project environmental and social management. These key stakeholder and their main roles and responsibilities are presented below.

**Table 1.3-1 Environmental Management Roles and Responsibilities**

| Organizations | Roles and Responsibilities | Timings |
|---|---|---|
| **MOEST** | ▪ Ensure that the environmental measures and cost are included in the project documents and tender clauses<br>▪ Monitoring of the overall project<br>▪ Auditing of project performance | ▪ Prior to Final Project approval<br>▪ At least once a year during construction<br>▪ After two years of project completion - operation phase |
| **MOWR/ DOED** | ▪ Ensure that the environmental measures and cost are included in the project documents and tender clauses<br>▪ Monitoring of the overall project | ▪ Prior to Final Project approval<br>▪ At least twice a year during construction and once during operation |
| **NEA Board/NEA/ NEA-ESSD/USSHEP - PMO** | ▪ Ensure that the EIA and EMP measures are incorporated in the final project design and costs.<br>▪ Acquire necessary permits and approval for project construction and operation.<br>▪ Ensure that the project construction activities are in accordance with legislative requirements.<br>▪ Implementation of repair and maintenance of project components including environmental safeguards as recommended by EMP, MOWR, DOED and MOEST<br>▪ Monitoring and record keeping regarding environmental measures and impacts as per EMP<br>▪ Ensure public participation and involvement in all phases of project implementation | ▪ Prior to contract award<br>▪ Before construction<br>▪ During construction continuously<br>▪ During operation continuously<br>▪ During operation continuously<br>▪ Project period continuously |
| **Panel of Experts (POE)** | ▪ Review and recommend the final design of the project and ensure that the EMP measures are included in the design and Tender<br>▪ Review monitoring and auditing reports of the supervising consultants and Project- Environmental Monitoring Sub-unit (ESMU) and recommend corrective measures to meet the objectives of EMP | ▪ Prior to contract tendering in Detail Design Phase<br>▪ During construction phase every six month |
| **Detail Design Consultants** | ▪ Incorporate environmental mitigation measures as per POE recommendation in the design, project cost and tender documents<br>▪ Include EIA recommendations in the design, project cost and tender documents | During Detail Design Phase |
| **EIA Consultant** | ▪ Verify and improve upon the earlier EIA reports and EMP and recommend environmental measures to Detail Design Consultants<br>▪ Verify and prepare detailed programs for Affected Persons/Affected Families and communities and recommend final RP costs to Detail Design engineers<br>▪ Verify and complete RP and recommend final RP measures and costs to Detail Design Consultants | During Detail Design Phase |

| Organizations | Roles and Responsibilities | Timings |
|---|---|---|
| **Supervising Engineers** | ▪ Approval to civil construction as per design<br>▪ Monitoring of civil construction as per detail design<br>▪ Ensure that the EMP provisions are implemented and recorded<br>▪ Ensure that the Project corrective actions are duly implemented. | Continuously in Construction phase |
| **USSHEP -ESMU** | ***RSISU:***<br>▪ Implementation, and supervision of land acquisition, compensation and resettlement as per RP and record keeping of these<br>▪ Implementation, and supervision of SAP as per SAPF<br>▪ Liaison with other Nepalese authorities for EMP/RP/SAPF items<br>▪ Information Dissemination through Public Information Center and other media and collection of feed back through regular consultation with the various stakeholders<br>▪ Distribution of the Project's bimonthly monitoring reports of EMSU to different central and local level stakeholders<br>▪ Project grievance and complaint handling<br>***EMSU:***<br>▪ Monitoring of natural environmental, RP and SAP mitigation measures as per EMP/RP/SAPF by EMSU and recommend concerned engineers and sections for corrective actions and bi-monthly report preparation<br>▪ Environmental impact and compliance monitoring of construction works as per EMP by EMSU and recommend corrective actions to supervising engineers and bi-monthly report preparation. | Pre-construction and construction phase, continuously |
| **Construction Contractor** | ▪ Implement civil construction as approved by supervising engineers<br>▪ Implement mitigation measures as specified in EMP and recommended by Supervising engineers<br>▪ Front line Monitoring and record keeping of environmental mitigation measures as per EMP through a special monitoring unit<br>▪ Maintain good public relationship with the project area people | Construction phase continuously |
| **NGOs, CBOs, VDCs,/ Municipality and DDCs and other stakeholders** | ▪ Monitor that the environmental and social mitigation measures are implemented in all stages of the project as per EMP, RAP, SPAF<br>▪ Ensure that the public participation and involvement in the project implementation is maximized by the project owner, consultants and contractors. | Project period |

EMP structure for different phases of project development and implementation are illustrated in **Figure 1.3-1**.

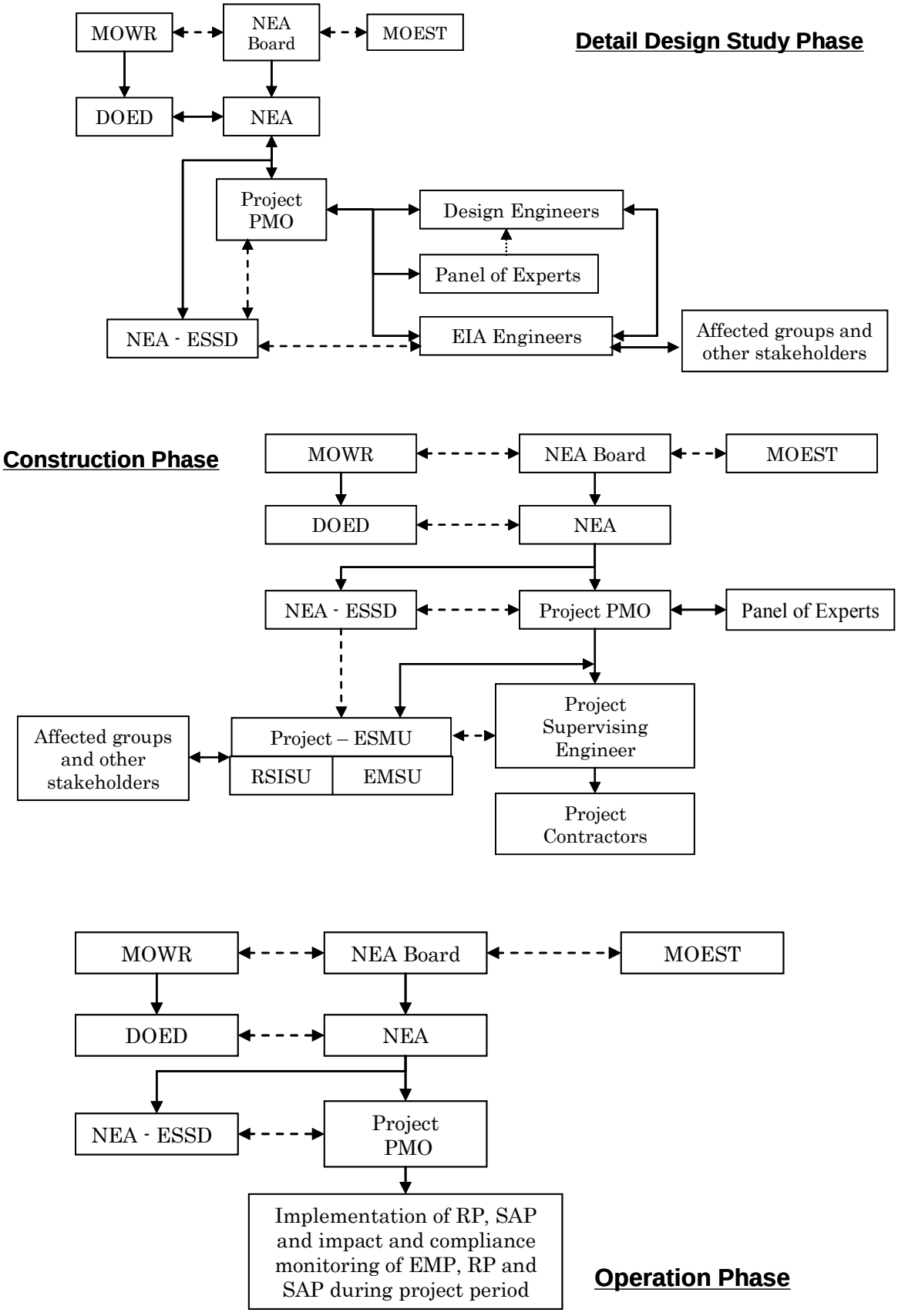


**Figure 1.3-1 Environmental Management Plan Structure**

## 1.4 Project's Environmental Management Office

As per the Nepalese Environmental Protection Rules, environmental management of the project is the responsibility of the proponent. For the Project, NEA and NEA-Project Management Office (PMO) have the responsibility of Project's Environmental Management. NEA has a separate "Environment and Social Studies Department" to look into the environmental matters of projects, planned, under implementation and operational. The Department has limited manpower to fully undertake the environmental Management of the Project.

To ensure that the Supplemental EIA recommended mitigation and monitoring actions are duly implemented, monitored, assessed, evaluated and disseminated to the stakeholders for feed back and improvement, the project - PMO should establish a separate Environmental and Social Monitoring Unit (ESMU) within the Project-PMO as the other on-going hydroelectric projects did. The proposed ESMU will comprise of two sub-units, namely RP and SAP Implementation Sub-unit (RSISU) and Environmental Monitoring Sub-unit (EMSU). The former sub-unit, to which the staff members of NEA with past similar experiences are to be assigned, will be responsible to implement RP and SAP. The latter sub-unit will be managed by the consultants with experience in environmental monitoring of the hydropower projects in the past. The project ESMU shall be established at least eight months before the project's civil construction award. The ESMU shall function directly under the Project Manager but the EMSU will have a responsibility to co-ordinate with the project's Supervising Consultant, Whereas RSSISU will coordinate with NEA – ESSD and stakeholders of the project such as Local VDCs, DDCs, NGOs, CBOs, affected parties, DOED, MOWR, and MOEST (**Figure 1.4-1**).

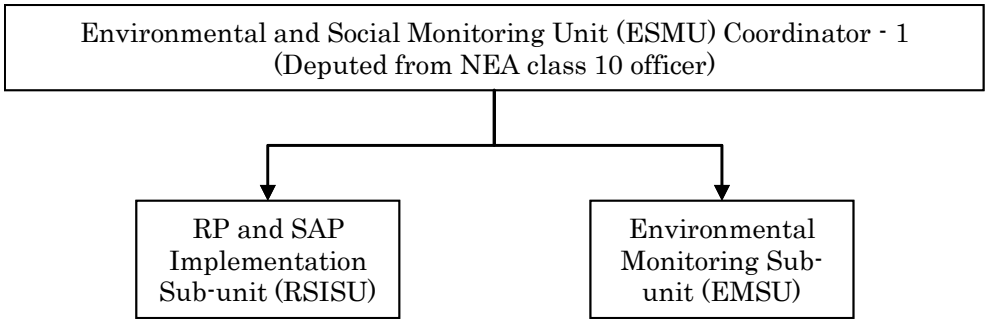


**Figure 1.4-1 Organization Framework of ESMU**

## 1.5 Administrative and Management Cost for ESMU

Office for the ESMU shall be established in the engineer's camp as a part of the civil construction workforce. Administrative and management cost is estimated based on the assumption that most of the persons shall be deputed from NEA, ESMU particularly for RSISU and shall not require additional project cost. The cost required is for the EMSU consultants. Administrative and management costs are illustrated in **Table 1.5-1, 1.5-2, 1.5-3** and summarized in **Table 1.5-4**.

**Table 1.5-1 Manpower Remuneration**

| SN | Position | Numbers | Period (yr) | Project Allowance/month (NRs.) | Total NRs. Million |
|---|---|---|---|---|---|
| 1. | ESMU - Section chief (Environmental Management – Team Leader consultant) | 1 | 5.66 | 90000 | 6.11 |
| 2. | Environmental Engineer (ESMU) | 2 | 5.66 | 60000 | 4.08 |
| 3. | Sociologist (ESMU) | 2 | 5.66 | 60000 | 4.08 |
| 4. | Part time consultant (socio-economist/ Terrestrial ecologist/ Aquatic ecologist) | | 3.33 | 60000 | 2.40 |
| 5. | Office runner (ESMU) | 2 | 5.66 | 10000 | 0.68 |
| **Total** | | | | | **17.34** |

**Table 1.5-2 Support Facilities**

| SN | Particulars | Unit | Cost | Total NRs. (Million) |
|---|---|---|---|---|
| 1. | Computers and printers | 10 sets | 150000.00/unit | 1.50 |
| 2. | 4 wheel drive vehicles | 5 nos | 3000000.00/no | 15.00 |
| 3. | Furniture | | Lump sum | 0.00 |
| 4. | Other equipment (camera, tape recorders, power point projector, pH meter, turbidity meter, flow meter, photocopier etc.) | | Lump sum | 0.00 |
| 5. | Office consumables | 5.66 years | 40000/month | 2.72 |
| 6. | Telephone and electricity | 5.66 years | 15000/month | 1.02 |
| 7. | Vehicle operation including Driver, Fuel and O &M (4 vehicles) | 5.66 years | 45000/month/vehicle | 12.23 |
| **Total** | | | | **32.47** |

**Table 1.5-3 Information Dissemination and Feedback**

| SN | Particulars | Years | NRs./yr | Cost NRs. (Million) |
|---|---|---|---|---|
| 1. | Information through internet and web page | 5.66 | 75000 | 0.42 |
| 2. | Information dissemination through FM | 5.66 | 100000 | 0.57 |
| 3. | Regular stakeholder meetings in the project area | 5.66 | 125000 | 0.71 |
| **Total** | | | | **1.70** |

**Table 1.5-4 Summary of Administrative and Management Costs for ESMU**

| SN | Particulars | NRs. Million |
|---|---|---|
| 1. | Consultant Remuneration | 17.34 |
| 2. | Support facilities | 32.47 |
| 3. | Information Dissemination and Feedback | 1.70 |
| **Grand Total** | | **51.51** |

## 1.6 Environmental Monitoring Program

Environmental monitoring shall be undertaken;

- To ensure that the recommended mitigation and enhancement measures as embodied in the EMP;
- To undertake regular monitoring of specific parameters in compliance with existing environmental quality standards; and
- To determine the effectiveness of the EMP and make recommendations for any corrective or additional mitigating measures.

A monitoring plan shall be developed based on the mitigation/enhancement measures identified for significant environmental impacts and those that are moderately significant, but can have critical effects if not mitigated. The environmental monitoring plan proposed including the key parameters to be monitored is presented in **Table 1.6-1**. This covers both the pre-construction/construction and operation stages. The baseline information generated during the EIA will generally serve as the benchmark data.

## Table 1.6-1 Environmental Monitoring Plan

| Project Phase | Method and Scope | Parameter | Location | Frequency | Responsibility | Cost (NR) |
|---|---|---|---|---|---|---|
| **1. Pre-Construction/ Construction Period** | | | | | | |
| *A. Physical Environment* | | | | | | |
| ▪ Land acquisition<br>▪ Vegetation clearing/tree cutting<br>▪ Excavation works<br>▪ Foundation works | ▪ Measurement of ambient air quality | ▪ Dust (TSP/PM10) | ▪ Jhaputar and Damauli (close to the District Public Health Office) | Three times a year in dry season (Nov., Feb., and May). Baseline data shall be taken before construction in dry season (April/May) | Contractor | NRs 5.3 million (lump sum including air, water, noise, spoil management, land erosion, etc.) |
| | ▪ Compliance of mitigation measures for air pollution | a) Gravelling of road and its maintenance<br>b) Control on vehicle speed<br>c) Watering of roads<br>d) Careful handling the contaminant or dumping of dusty materials<br>e) Covering of exposed areas and site restoration<br>f) Provision of dust mask to drivers and workers | a) Along the construction road<br>b) Along the construction road<br>c) Along the construction road<br>d) Temporary waste stock facility and disposal site<br>e) Excavated area<br>f) Construction sites | a) Once a three months<br>b) Once a day<br>c) Once a day<br>d) Once a week<br>e) Once a week<br>f) Once a week | Contractor | Part of contractor's contract |
| | ▪ Water sampling and analysis | ▪ Flow velocity, discharge, water temperature, pH, conductivity, total suspended solids (TSS), total phosphorous (T-P), Total Kjeldahl Nitrogen (TKN), ammonia ($NH_3$), nitrate , nitrite, dissolved oxygen (DO), and $BOD_5$ | 1) upstream of the reservoir,<br>2) reservoir area (close to dam site),<br>3) confluence with the Madi River,<br>4) immediate downstream of the tailrace outlet | 4 times a year in 4 seasons (November, March, June, and September) | Contractor/EMSU-PMO-NEA | Included in the lump sum cost mentioned in air quality (dust) measurement. |

| Project Phase | Method and Scope | Parameter | Location | Frequency | Responsibility | Cost (NR) |
|---|---|---|---|---|---|---|
| | ▪ Compliance of mitigation measures for water pollution | a) Adequacy and operation of water supply and sanitation facilities at engineers camps, construction camps and construction sites<br>b) Collection of solid waste and safe disposal practices at engineers camps, construction camps and construction sites<br>c) Awareness program on health and sanitation<br>d) Prohibition on open defecation and solid waste disposal<br>e) Storage facilities for fuel, lubricants, spent oils, and toxic chemicals<br>f) Treatment facilities for waste water of batching plant, aggregate washing and tunnel seepages and its effective operation<br>g) Water quality test for discharge of treated wastewater from batching plant aggregate washing plant, and tunnel discharges<br>h) Disposal of construction spoils only in designated areas | a) Engineers camps, construction camps and construction sites<br>b) Engineers camps, construction camps and construction sites<br>c) All over the construction site<br>d) All over the construction site<br>e) Storage facilities<br>f) Treatment facilities<br>g) Batching plant aggregate washing plant, and tunnel discharges<br>h) All over the construction site | a) Before project and every 3 month<br>b) Once a week<br>c) Every six month<br>d) Once a week<br>e) Before project and every 3 month<br>f) Before project and every 3 month<br>g) Once a three months<br>h) Once a day | Contractor | Part of contractor's contract |
| | ▪ Measurement of noise level | ▪ Noise level | ▪ Jhaputar and Damauli (close to District Public Health Office), and Beltar (near the school) | ▪ Twice a year<br>Baseline data shall be taken before the construction. | Contractor/ EMSU-PMO-NEA | Included in the lump sum cost mentioned in air quality (dust) measurement. |
| | ▪ Compliance of mitigation measures for noise | a) Placement of noise arresting equipment<br>b) Correct fitting of silencers, mufflers and acoustic shields<br>c) Maintenance of plant and equipment<br>d) Blasting restriction provisions as negotiated<br>e) Blasting design and follow ups | a) Construction site near the residential area<br>b) Construction vehicles and machineries<br>c) All over the construction sites<br>d) Blasting site<br>e) | a) Once before construction<br>b) Once a three months<br>c) Once a three months<br>d) Once a day<br>e) Once a three months<br>f) Once a week | Contractor | Part of contractor's contract |

| Project Phase | Method and Scope | Parameter | Location | Frequency | Responsibility | Cost (NR) |
|---|---|---|---|---|---|---|
| | ▪ Compliance of mitigation measures for land instability and erosion | a) Vegetation clearance only to required limits<br>b) Excavation works only to required limit by the design<br>c) Side casting of excavated earth<br>d) Management of spoil in the designated area<br>e) Maintenance of toe protection structure, and drainage structure at spoil disposal; and sedimentation tank at batching yard, spoil disposal area and tunnel discharge areas<br>f) Civil and bio-engineering protection works and their maintenance (including side drains) at access roads | a) Along the project boundary such as FSL 415m area for the reservoir, dam site, and project facility sites.<br>b) All over the construction site<br>c) All over the construction site<br>d) All over the construction site<br>e) Batching yard, spoil disposal area and tunnel discharge areas<br>f) Along the access roads | a) Once a month<br>b) Once a week<br>c) Once a day<br>d) Once a day<br>e) Once a month<br>f) Once a month | Contractor | Part of contractor's contract |
| *B. Biological Environment* | | | | | | |
| ▪ Land acquisition<br>▪ Vegetation clearing/tree cutting<br>▪ Excavation works<br>▪ Foundation works | ▪ Compliance of mitigation measures for illegal tree cutting and poaching through frequent patrol activity | ▪ Identification of illegal tree cutting and poaching | ▪ All over the construction site and adjacent area | Frequent and at random patrol | Contractor | Part of contractor's contract |
| | ▪ Habitat loss around the project sites | ▪ Number of habitat loss identified before construction | ▪ All over the construction site and adjacent area | Every four months | Contractor/ EMSU-PMO-NEA | NRs 1 million |
| | ▪ Species occurrence around project sites | ▪ Number of wildlife species | ▪ All over the construction site and adjacent area | Every four months | Contractor/ EMSU-PMO-NEA | |
| | ▪ Construction disturbances around project sites | ▪ Damage to habitat and/or death of wildlife due to construction activity | ▪ All over the construction site and adjacent area | Once a week | Contractor/ EMSU-PMO-NEA | |
| | ▪ Mitigation measures compliance for wildlife conservation | ▪ Implementation of the proposed measures based on designated schedule | ▪ All over the construction site and adjacent area | Every four months | Contractor/ EMSU-PMO-NEA | |
| | ▪ Aquatic life and ecology survey (fish, phytoplankton, zooplankton and aquatic insects) | ▪ Identification of aquatic species | ▪ 7 baseline stations | Every six months (dry season and wet season) for 5 years | Contractor/ EMSU-PMO-NEA | NRs 1 million |
| | ▪ Observation of compliance of contractual mitigation clauses | ▪ Adequate implementation of the mitigation measures | ▪ At the designated location of the measures | Every three months | Contractor | Part of contractor's contract |

| Project Phase | Method and Scope | Parameter | Location | Frequency | Responsibility | Cost (NR) |
|---|---|---|---|---|---|---|
| **2. Operation and Maintenance Period** | | | | | | |
| *A. Physical Environment* | | | | | | |
| ▪ Operation and maintenance of dam | ▪ Water sampling and analysis (except reservoir area) | ▪ Flow velocity, discharge, water temperature, pH, conductivity, total suspended solids (TSS), total phosphorous (T-P), Total Kjeldahl Nitrogen (TKN), ammonia ($NH_3$), nitrate , nitrite, dissolved oxygen (DO), and $BOD_5$ | 1) Upstream of the reservoir,<br>2) Confluence with the Madi River,<br>3) Immediate downstream of the tailrace outlet | 5 times a year in 4 seasons (November, March, beginning of June before the sediment flushing operation, end of July after the sediment flushing operation, and September) | EMSU-PMO-NEA | NRs 3 million for 20 years |
| | ▪ Water sampling and analysis (reservoir area: close to the dam site) | a) Water temperature, turbidity, DO<br>b) pH, BOD/COD, SS, coliform counts, chlorophyll a, Pheophytin, inorganic nitrogen (I-N), inorganic phosphorus (I-P)<br>c) Ingredient of bottom sediment<br>d) Phytoplankton<br>e) Heavy metals, hazardous substances, carcinogenic substance | a) 0.1 m from the water surface,<br>0.5 m from the water surface,<br>1 m interval from the water surface to the bottom<br>b) Surface layer (0.5 m from the water surface)<br>Middle layer (half of the water depth)<br>Bottom layer (1 m above from the bottom)<br>c) First surface layer of the sediment<br>d) Surface layer of water<br>e) Surface layer of water | a) Once a month<br>b) Once a month<br>c) Twice a year (End of May just before the sediment flushing operation, and November after stabilizing the bottom condition)<br>d) Once a month<br>e) Twice a year in dry season and rainy season) | EMSU-PMO-NEA | Included in the above. |
| | ▪ Monitoring of riverbed sedimentation and erosion | ▪ Riverbed sedimentation and erosion | ▪ Several designated locations in the downstream riverbed | Once a year in dry season | EMSU-PMO-NEA | NRs 2 million for 20 years |
| *B. Biological Environment* | | | | | | |
| ▪ Operation and maintenance of dam | ▪ Transect survey for wildlife | ▪ Wildlife species and population, habitat condition | ▪ All over the construction site and adjacent area | Every 3 years for 20 years | EMSU-PMO-NEA | NRs 1.2 million |
| | ▪ Aquatic ecology survey for impact analysis | ▪ Species composition | ▪ 7 baseline stations | Every six months after 2 years of the project operation,<br>Once a year for 10 years | EMSU-PMO-NEA | NRs 3 million |
| | ▪ Compliance of mitigation measures for aquatic lives | a) Compliance to release of environmental flows at Seti<br>b) Compliance to restriction of fishing activities below tailrace<br>c) Compliance to fish stocking, fish release in the reservoir and downstream area | a) Dam site<br>b) Downstream area of the tailrace<br>c) reservoir and downstream area | a) Daily<br>b) Daily<br>c) Once a year for project life | EMSU-PMO-NEA | Part of project operation cost |

Note: EMSU- Environmental Monitoring Sub-unit under Environmental and Social Monitoring Unit of PMO, NEA

### 1.7 Records and Corrective Actions

To demonstrate compliance with the environmental management, the construction contractors will maintain daily records of his mitigation implementation and monitoring works during the construction phase. The EMSU shall carryout monitoring works with the Supervising Engineers and prepares Bi-monthly Monitoring Reports during construction phase. He shall also maintain the records of any corrective actions recommended to the contractor and its performance. The Bi-monthly Reports produced by the EMSU in co-ordination with other sections of RSISU shall be distributed to the stakeholder for their comments and suggestions after the approval by the Project Manager. The ESMU shall compile the Final Environmental Monitoring Report of the construction phase within 3 months of the construction completion and submit to the Project. The project shall pass the report to stakeholders to get feed back and provide database of environmental management works of the project for future use.

### 1.8 Environmental Audit

As per EPR, Ministry of Environment, Science and Technology shall prepare an environmental audit report of the project after two years of project Operation. The audit shall be based on the monitoring reports of the ESMU, Supervising Engineers, and POE with limited field visits and data collection. Project performance audit reports include a final assessment of the degree to which the project satisfied the proposed environmental requirements, the effectiveness of mitigation measures and institutional development and whether any unanticipated effects occurred as a result of project activities. Though auditing is the legal responsibility and works of MOEST, it lacks adequate resources to cover these works. It is therefore, the proponent is recommended to allocate a sum of NRs. 0.35 million for auditing.

### 1.9 Summary of Environmental Cost

**Table 1.9-1** and **1.9-2** presents the environmental cost summary for pre-construction, construction and operation phases of the project respectively. **Table 1.9-3** presents the total environmental cost of the project.

**Table 1.9-1 Environmental Costs in Pre-construction and Construction Phase**

| | |
|---|---|
| **Physical Environment** | |
| Cost for Clearing the Vegetation in the Reservoir | 43.10 |
| Monitoring for Air, Water, Noise, Vibrations & Spoil Management at Works Areas | 5.32 |
| Watershed Management Programs for 10 Years* | 111.50 |
| Mitigation Measures for Eutrophication | 63.6 |
| **Grand Total (million NRs)** | **223.52** |
| **Biological Environment** | |
| Cost for Clearing the Vegetation in Reservoir | 3.72 |
| Support to Kaligandaki A Hatchery for 5 Years | 73.5 |
| Capture & Release of Wildlife including 2 Reptile Species | 0.5 |
| Fish Monitoring during the Construction Phase | 1 |
| **Grand Total (million NRs)** | **78.72** |
| **Compensation and Rehabilitation** | |
| Cost Estimation for the Private Land | 999.51 |
| Cost Estimation for the Structures | 33.972 |
| Cost Estimates for Agriculture Production Equivalent to One Year Production | 0.663 |
| Other Rehabilitation Compensation to Relocate | 90.88 |
| Transportation Allowance to affected Structure Owners Other than the Affected Residential Structure Owners | 0.47 |
| **Grand Total (million NRs)** | **1125.5** |
| **Social Action Plan** | |
| Replacement of Affected Infrastructures by the Reservoir | 85.5 |
| Community's Initiative Support Program | 52.13 |
| Skill Enhancement and employment | 10.14 |
| Agricultural Development Programs | 27.51 |
| Community/Public Health and Education Enhancement Programs at the Project Construction sites | 9.66 |
| Community/Public Health and Education Enhancement Programs at the Reservoir affected VDCs | 6.27 |
| Women Development Program | 13.03 |
| Watershed Management Programs | 12.31 |
| Rural Electrification Programs | 19.55 |
| **Total (million NRs)** | **236.10** |

**Table 1.9-2 Environmental Costs in Operation Phase**

| Physical Environment | |
|---|---|
| Measures for Downstream Effects | 3.8 |
| Monitoring of Water Quality in Reservoir & Surrounds for 20 Years X 2 Times / Year | 3.0 |
| Monitoring of Reservoir & River Bed Sedimentation and Erosion for 20 Years X Once / Year | 2.0 |
| **Grand Total (million NRs)** | **8.8** |
| **Biological Environment** | |
| Compensation to Dept of Forestry for Trees, Community Forests & to Private Tree Owners | 287.8 |
| Annual Release of Purchased Carp fry & extras – 20 years | 80 |
| Fisheries Extension Program for Reservoir Area | 10 |
| Wildlife Monitor in the Reservoir Area | 0.5 |
| Monitoring of Wildlife for 10 Years | 1.2 |
| Fish Monitoring for 10 Years | 3.0 |
| **Grand Total (million NRs)** | **382.5** |
| **Socio-economic Environment** | |
| Monitoring of affected people and communities for 10 years | 1.80 |
| **Grand Total (million NRs)** | **1.80** |

**Table 1.9-3 Administrative and Management Cost**

| Administrative and Management Cost | |
|---|---|
| Consultant Remuneration | 17.34 |
| Support facilities | 32.47 |
| Information Dissemination and Feedback | 1.70 |
| **Grand Total (million NRs)** | **51.51** |

**Table 1.9-4 Summary of Environmental Cost**

| Summary of Environmental Cost | | |
|---|---|---|
| 1 | Physical Environmental Cost | 224 |
| 2 | Biological Environmental Cost | 461 |
| 3 | Cost for Compensation and Rehabilitation | 1,126 |
| 4 | Social Action Plan | 236 |
| 5. | Socio-Economic Environment | 2 |
| 6 | Administrative and Management Cost | 52 |
| **Grand Total (million NRs)** | | **2,101** |