PT. PLN (Persero)

INDONESIA UPPER CISOKAN PUMPED STORAGE POWER PLANT PROJECT

ENVIRONMENTAL ASSESSMENT

Executive Summary

MARCH, 2011
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<tr>
<td>UCPS</td>
<td>Upper Cisokan Pumped Storage</td>
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<tr>
<td>PT PLN</td>
<td>PT Perusahaan Listrik Negara (Persero) (Indonesia Electricity State Corporation)</td>
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<tr>
<td>EMP</td>
<td>Environmental Management Plan</td>
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<tr>
<td>LARAP</td>
<td>Land Acquisition and Resettlement Action Plan</td>
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<td>AMDAL</td>
<td>Analisis Mengenai Dampak Lingkungan (Environmental Impact Assessment)</td>
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<td>BPLHD</td>
<td>Badan Pengelolaan Lingkungan Hidup Daerah (Environmental Management Agency of West Java Province)</td>
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<td>PP</td>
<td>Peraturan Pemerintah (Government Regulation)</td>
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<tr>
<td>ROW</td>
<td>Right of Way</td>
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<tr>
<td>EMF</td>
<td>Electro-magnetic field</td>
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<td>SIA</td>
<td>Social Impact Assessment</td>
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<td>OEMP</td>
<td>Operational Environmental Management Plan</td>
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<td>EIA</td>
<td>Environmental Impact Assessment</td>
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<td>RPL</td>
<td>Rencana Pemantauan Lingkungan (Environmental Monitoring Plan)</td>
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<td>RKL</td>
<td>Rencana Pengelolaan Lingkungan (Environmental Management Plan)</td>
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I. Introduction

The 1,040 MW Upper Cisokan Pumped Storage Hydropower Project (UCPS) will be located in the hills of West Java, Indonesia, in the catchment of the Upper Cisokan River. It will be approximately 150 km away from Jakarta, the capital of Indonesia and the largest electric power demand center in the country and around 30 km from Bandung, the third largest city in Indonesia. The Upper Cisokan scheme will provide over 1,000 MW of peaking capacity to the Java-Bali integrated power system and significantly improve the security and efficiency of the electricity supply in this most important power system in Indonesia.

The total financial requirement of the project is estimated at US$800 million, of which US$74.46 million has been allocated for compensation and resettlement purposes, and approximately US$1.96 million for implementation of the Environmental Management Plan. PT Perusahaan Listrik Negara (Persero) (Indonesia Electricity State Corporation or PT. PLN) has requested a total of US$640 million in financing from the World Bank. Construction will take place around six years and the project is expected to be operational by 2016.

A series of environmental, social and design studies have been carried since preliminary investigations began in the early 1990’s. A consolidated Environmental Impact Assessment (EIA) updates and synthesizes relevant information from the all previous EIA and Social Impact Assessment (SIA) reports. To complete this consolidated EIA, two separate studies were carried out in 2009 to update the physical culture resources and the biodiversity surveys, and look into the project impacts on the connectivity conditions in the project areas. In addition, numerous technical and design studies have been carried out to determine the feasibility and the detailed design of the hydropower scheme. The key features of these technical documents have also been reflected into the consolidated EIA.

Concurrent with the EIA process is the Land Acquisition and Resettlement Action Plan (LARAP). This Plan involved conducting a comprehensive census of people’s livelihoods and assets and consultations with the people that will need to be resettled as part of the development process. The draft LARAPs were disclosed locally and in the World Bank Infoshop on January 1

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1 Most mitigation measures are included in engineering design, construction, and supervision costs and therefore are part of the contracts.

25, 2011 and document how to mitigate and manage any adverse effects throughout the resettlement process, both at the project site and in the areas where people will be resettled.

The Access Road Construction Environmental Management Plan is also being implemented in a concurrent process to the EIA process. As the access road will be the first construction contract that will be let, the management plan has been prepared separate and prior to the Environmental Management Plan that forms part of this consolidated EIA process. The Access Road Construction Environmental Management Plan documents all of the potential environmental and social risks and impacts along the proposed route, and mitigation measures that should be implemented by PLN and the contractor.

The terms of references for development of the draft EIA (including the environmental management plan (EMP)) and previous versions of major EIA and EMP were the formal subject of public consultations, and meetings with related government institutions and other stakeholders by PLN. Public consultations were also conducted from late 90s to 2007 for all the major EA documents produced before 2007 and in early 2011 for the consolidated EIA and EMP. These draft EIA and EMP reports were subject to formal community and public consultations. Both documents have already been disclosed via World Bank’s website (English version), and PLN’s website (Bahasa version) in mid October 2010. The announcement of disclosure of EIA and EMP was published in local newspapers on November 29th 2010. The documents are available for public review at the PLN Bandung Office and PLN Site Project Office since November 2010. Some public consultations have already been carried out with the local government, NGOs, academics, media, project affected people and local parliament members through formal meetings, and general public through several exhibitions. Additional public consultation with the project affected people will be carried out during the project implementation. The comments and suggestions from the disclosures and public consultations undertaken so far have been incorporated into the final EIA and EMP. The EIA and EMP have also been disclosed at the Bank INFOSHOP in Washington, DC.

II. Project Overview

The Upper Cisokan facility will be the first pumped storage generation plant in Indonesia and will provide 1,040MW of electricity during peak demand hours. The key features of the facility are:

- A 75.5m high upper dam constructed of roller compacted concrete located on the Cirumamis River. The upper dam will have a 10km² catchment, a 80ha reservoir surface area at high water level, and an operating range between high and low water levels of 19m;
- A 98m high lower dam constructed of roller compacted concrete located on the Cisokan River. The lower dam will have a 355km² catchment, a 260ha reservoir surface area at high water level, and an operating range between high and low water levels of 4.5m;
- A 1,040MW generating capacity, with 1,100MW pumping capacity, located in an underground power station connected by tunnels to the reservoirs;
- Two transmission lines connecting the Upper Cisokan with the Cibinong-Saguling line to
the north (15.5km and 15.9km);

- The facility will generate electricity during the peak demand, and will pump the storage water back to the upper reservoir by using the base load power at night. The plant will also provide auxiliary services, such as spinning reserves and reactive power, to the Java-Bali power system;

- After inundation, the majority of the water with the catchments will be passed through bottom outlets or spillways, with only “top-up” water retained in the reservoirs to make up for evaporative losses;

- New access roads 27km in length will be constructed and 7km of existing road will be upgraded, and minor construction site roads;

- The existing Gunung Karang Quarry will be used for aggregate and base course materials; and

- A short 20kV distribution line will be installed prior to construction to assist with construction power needs.

- An estimate of the total workforce required over the 5 – 6 year period is 1,500, including skilled and unskilled workers. The policy is to employ local people in positions that match their skill sets. Approximately 60% of the workforce is estimated to be unskilled labor.

The project owner is PT PLN (Persero). PT PLN (Persero) is the state owned national power company which has successfully implemented many World Bank projects in the past four decades.

### III. Major Environmental and Social Impacts of Project Components

The major social impact under the project is land acquisition and household relocation. The total area of land to be acquired for the project is approximately 833 ha of largely agricultural and productive forest areas. The total number of households affected through land acquisition is 2201. The predominant income of the population in the project area is from farming very small lots of rice and/or cultivated fruits and vegetables. Approximately one-third of households are considered to be at or below the poverty line, compared to 18% nationally. There are no indigenous people living in the project area as defined by the OP 4.10.

The areas required for the pumped storage project are much smaller than those of a conventional hydropower project of similar sizes. Therefore the environmental impacts are usually less significant than the conventional ones. The major environmental impacts of the project include:

- **Biodiversity impacts**: three endangered mammal species were identified in the surrounding project area in a 1 ha remnant secondary growth forest at the margin of the lower reservoir, though all three species have populations in other parts of Java. These endangered species and the 1 ha of the secondary growth forest habitat will be included in a “greenbelt” program around the two reservoirs. The forest patch will be demarcated and protected during construction to prevent risk from construction workers;

- **Downstream river environment impacts**: During construction, discharges of sediment
will affect water quality and stream bed pattern. During inundation, the hydrological regime in the Cirumamis and Cisokan Rivers will be temporarily affected. Finally, during operation, there should be only minor changes to the hydrological regime downstream of the two dams, but changes to erosion and deposition patterns are expected downstream in the Cisokan River, due to the reduced sediment load; and

- **Dam safety and reservoir security**: two large dams (one at height of 98 m, the other at 75.5 m) may impose safety risks to people living downstream of the dams. In addition, the two reservoirs will be unsafe for use by the community for commercial ventures such as aquaculture since the reservoir water levels will rise and lower swiftly in response to generation or pumping.

Appropriate mitigation measures have been identified to address direct and indirect impacts from the project which are organized in two plans: the Environmental Management Plan (EMP), and the Land Acquisition and Resettlement Action Plan (LARAP). The project’s environmental and social impacts will be addressed by the implementation of these plans.
IV. Project Regulatory and Legal Framework

The project is located in two administrative areas in the West Java Province, West Bandung Regency and Cianjur Regency. The project will be approved and operated under a variety of Indonesian laws and regulations. The key legislation is:

- The Draft West Java Province Spatial Plan 2009 – 2019; and

Other relevant national and local legislation include (amongst other matters) guidance and standards for land uses, water quality, protection of threatened species, and environmental management in relation to energy and electrical power projects.

Under the Draft West Java Provincial Spatial Plan 2009-2029, the West Java Province regional development policy is divided into five development zones and one special zone. The UPCS is located in Sukabumi Development Zone. Amongst other planning issues, the development zone directive for the Sukabumi zone is to undertake the development of strategic infrastructure, and develop non-polluting industries and industries not requiring water abstraction, amongst other economic development opportunities. The Cisokan project meets the requirements of this zoning.

The Environmental Impact Assessment process (known as Analisis Mengenai Dampak Lingkungan, or AMDAL, in Indonesia) is mandated by the new Environmental Management and Protection Act No. 32 of 2009 (formerly the Environmental Management Act No.23 of 1997) and implemented in accordance with Government Regulation PP 27 of 1999.

The AMDAL process is an integrated and comprehensive assessment of major and significant impacts likely to result from a proposed project or activity, taking into consideration environmental (geophysical and biological), social and economic aspects.

An AMDAL is required for the development of hydropower electricity generation plants with the following requirements: (i) dam with height more than or equal to 15 meters; (ii) flooded area more than or equal to 200 ha; and (iii) energy capacity more than or equal to 50 MW.

Public involvement in the AMDAL process is defined in the Government Regulation (PP) No. 27, 1999 on AMDAL, and is further elaborated in the Decree of the Head of BAPEDAL No 08, 2000 on Public Involvement and Information Disclosure in the AMDAL Process. Environmental approvals (ANDAL) were issued for the project on 12 April 2007, under the Environmental Management Act No.23 of 1997.

In addition to the requirements of the national legislation, the UCPS Project must also comply with applicable environmental policy and standards of the World Bank Group. As mentioned before, the EIA report is a consolidation of the baseline studies and the assessment of environmental and social impacts from a series of earlier EIA documents and additional studies carried out in 2009. Previous recommendations were updated or validated in this consolidated report. The report satisfies the World Bank Safeguards requirements. The terms of reference
were agreed with the Bank and discussed in public meetings during EIA (*AMDAL*) activities.

The project triggered the following World Bank policies: Environmental Assessment; Natural Habitats; Involuntary Resettlement; Physical Cultural Resources; and Safety of Dams. Compliance with these policies is summarized in Table 1.

<table>
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<th>Safeguard Policies</th>
<th>Actions</th>
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| Environmental Assessment (OP/BP 4.01) | • Category A project. Full EIA and Environment Management Plan (EMP) have been prepared for the project  
• Full, stand alone EMP was prepared for the access road, to be built ahead of the main works.  
• A Panel of Experts on Environmental and Social issues was formed. |
| Natural Habitats (OP/BP 4.04)      | • The project does not have direct impacts on critical natural habitats  
• A detailed biodiversity survey was conducted to assess the project impacts and mitigation measures were incorporated into the EMP.  
• Biodiversity enhancement measures will be implemented in a “greenbelt” area around the two reservoirs |
| Physical Cultural Resources (OP/BP 4.11) | • Physical culture resources survey conducted in the project areas. No sites were found that are listed by local or national authorities as having specific legal protection or significance;  
• Local community graves will be relocated  
• Chance finding procedures during construction have been prepared and will be included in bidding documents and contracts. |
| Involuntary Resettlement (OP/BP 4.12) | • Social Assessment has been conducted  
• Three LARAPs were prepared.  
• Full, stand alone Resettlement Action Plan was prepared for the access road, to be built ahead of the main works. |
| Safety of Dams OP 4.37             | • An independent Project Review Panel was created  
• The Panel will has reviewed all designs and emergency plans  
• A dam safety plan has been developed |
| Consultation                       | • Intensive, culturally sensitive consultation efforts have been carried out in all communities in the area of influence of the project on the EIA and LARAPs. Governmental and Non-Governmental organizations have also been consulted in public meetings. |

### V. Environmental Baseline

**Climate**

The climate in the project area is tropical and influenced by monsoon weather patterns. There are two seasons; dry and rainy. While there are two distinct seasons, other weather conditions throughout the year are more consistent, such as light to moderate winds, warm air temperatures and high humidity. The average monthly air temperatures are in the range from 23 to 26°C. The average monthly wind velocities are from 2.3 to 6.85m/s. The average monthly relative humidity is 86 – 88%. The total monthly rainfalls are 10 – 100 mm (dry season) and 50 – 350 mm (rainy season). The average number of rain days is 2 – 15 days/month in dry season and 12 – 24 days / month. The average daily evaporation potential is 4.5mm. The wettest / most humid months are from November to March. The driest months are from July to August.
Topography, Landscape and Geology

The project site is located in the Bandung zone, a rolling to steep hilly area ranging from 400m to 1000m above sea level. The site is part of a series of hill ranges forming the West Java Southern mountain range, with alluvial plains to the north and the Indonesia Sea to the south. In the wider landscape, volcanic cones are sporadically located within the ranges and on the alluvial plains; notably Gunung Pangrango to the north east of the project site.

The Cisokan River flows generally from the south to the north, with upper tributaries draining steep v-shaped valleys before flowing across the plains to join the Citarum River at the Cirata Dam. The Citarum River flows to the Java Sea to the north and is one of the largest rivers in Java. The Cisokan River is one of its major tributaries.

The ranges in the project area consist of Tertiary volcanic and sedimentary rock, with evidence of geological folding and faulting in a general northeast – southwest direction. Geology in the hill ranges is predominantly sandstones, shales, breccias and occasional andesite lava.

Seismicity

Indonesia is located in a very active seismic zone, along the Pacific ‘ring of fire’. The project area is located in Seismic Zone 4, with small to medium seismic risk for building construction (PLN/Newjec Inc., 2007b). As an example of the frequency and nature of earthquakes in the area, 62 earthquakes were recorded in the Cianjur Regency in 1992/93, located within 344km of the project site, and measuring up to 5 on the Richter scale (PT. PLN, 1998).

Slope stability is an issue in the hill ranges of the project area. Landslides are reasonably common, and result from one or more of the following conditions: loss of dense vegetation cover, high rainfall events, earthquakes, land modification on the face and at the toe of slips, deeply weathered rock and topsoil overlaying bedrock and steep slopes.

Rock porosity is relevant to predict the potential water losses from the reservoirs to the groundwater, and the interaction between surface water and ground water. Foundation rock water tightness has been measured at the dam locations using water pressure tests in test bores. Porosity in the bedrock is mainly low to very low at the lower and upper dam sites, except for one sample at the upper dam. Many of the results from the test bores show higher porosity in the weathered rock near the surface at each dam location.

Settlement Patterns and Transport Infrastructure

For administration purposes in the regencies in Java, there are formal village boundaries. Within the village boundaries the settlement patterns are a mix of small hamlets, individual farm houses and strip developments along roads.

Most roads in the project area can be passed by small and medium vehicles, especially the roads in the sub-district centers and larger village centers. Main roads and roads through larger centers are asphalt, whereas more remote villages are serviced by stone and earth roads. Many of the remote hamlets and farm houses can only be accessed by foot tracks and motorbike tracks.

Most main (asphalt) roads are suitable for transportation vehicle and medium weight vehicles.
(small truck or minibus). Public transportation facilities available at study area are generally public cars, and motorcycles.

**Land Uses and Habitats**

In the project area, the major land use and habitat types include: (i) rice fields and fish ponds; (ii) domestic yards; (iii) shrub-land; (iv) mixed plantation agriculture; (v) plantation forest; and (vi) secondary growth forest.

The dominant land use is rice fields, which support the subsistence lifestyles of the communities that live in the project area. Rice fields may be rain-fed or irrigated from river water. In between rice crops, break crops are raised, such as beans, corn and onions. Fish ponds are constructed amongst dwellings and rice fields.

Many of the villages in the hills do not have traditional yards of rural communities, as most live and tend rice fields and crop plantations and therefore do not have home gardens. The most typical are in the quarry location, and include ornamental plants, fruit trees and vegetable gardens (such as tomatoes and chili). Some dwellings also have gardens and fish ponds.

Shrub is the land that has been cleared by fire or trees have been harvested. In some cases the land has been left to regenerate, and in other cases is being domesticated with fruit trees. Tree and bush clearance is generally to open up more cultivated land. The habitat is highly disturbed and open. It provides adequate habitat for many bird species but not for other wildlife.

Mixed cultivation and plantations can be found within the forest cover. This type of land use is to support subsistence living and provide income. Food crops include coffee, banana, avocado, coconut, and bamboo and aren/sugar palm. This habitat can cover large areas of hillside. Because of the presence of a forest canopy, the variety and diversity of native and exotic species, and the larger areas of continuous land cover, there is good habitat for local fauna.

Plantation forest is dominated by pine and mahogany. Some grasses and shrubs have formed a community of plants on the forest floor. The plantation forest has become default habitat for many local forest-dwelling fauna. Pine sap is harvested from living trees.

The secondary forest is a mix of exotic and native shrub and tree species that have re-established following land clearance. This vegetation is found in fragments throughout the area, generally in steeper areas where agriculture or forestry have not been successfully established. This includes inaccessible cliffs and riverbanks in hilt gullies, and located mainly along the Cirumamis River between the upper and lower reservoir areas. Spared from recent disturbance, large tree specimens and diverse vegetation mixes have developed. The area is a part of the natural habitat for various types of protected and endangered fauna in the survey area. Secondary forest habitat is probably not at risk from further development because of the steep terrain, although logging and harvesting may still occur to some extent. Incidental fire is a risk. Fauna are at risk from the isolation from other breeding populations and the limited carrying capacity of the fragments of forest.
**Vegetation Diversity**

Four surveys of vegetation type have been undertaken since 1995. The most comprehensive survey was undertaken in 2009. Based on field observations, a total of 226 plant species from 69 families were recorded. The access road location had the largest number of plant species, at 173, compared to the quarry with the smallest number of species at 86. The access road has a variety of habitats along the route, whereas the quarry site has been cleared of forest vegetation for some time (at least since the construction of the Saguling dam in 80s and 90s) and is now dominated by grasses and shrubs.

No rare or endangered plants were found during the survey, although salam (*Eugenia polyantha*), baros (*Magnolia glauca*), manglid (*Magnolia blumei*), and kitambaga (*Eugenis cuprea*) are considered locally rare due to land use pressures. The most intact and diverse vegetation community is the secondary growth forest in the Cirumamis River location.

**Fauna**

Four surveys of fauna have been undertaken since 1995. The most comprehensive survey was undertaken in 2009.

**Birds:** A total of 70 species of birds were identified through surveys and interviews with locals in the upper watershed of the hydropower scheme area in the 2009 study. Ten species are endemic to Java. Along the transmission line route, 37 species were identified. Common species across the entire hydropower scheme area were the cave swiftlet, oriental white eye, bar-winged prinia, and the Javan munia. The common sandpiper was the only migratory species noted in the survey. This bird travels to and from the northern hemisphere and Java, being resident in Java from August to March. Common species along the transmission line route were rusty-breasted cuckoo, common tailorbird, pacific swallow, Javan munia, common tailorbirds and white-bellied swiftlet. Diversity and community type were quite different across the sampling sites, and were generally related to the type and availability of vegetation and habitat.

The most notable bird was the black-banded barbet, which is a near threatened species in the IUCN red list. This bird was recorded in the Walet waterfall area in a secondary growth forest. In total, 20 bird species from the 2007 and 2009 surveys are protected by national and international legislation, primarily regarding the regulation of international trade. Threats to endemic bird species are primarily the dwindling availability of forest habitat, and poaching for domestication or sale at markets.

It is to be noted that the reservoirs will not flood any secondary growth forest.

**Mammals:** Mammals are found in a variety of land habitats in the study area. A total of 21 species of mammals were identified in the 2009 study of the watershed area, from 7 orders and 14 families. Six species are endemic to Java. The most common mammal is the Javan treeshrew (*Tupaia javanica*), which is found in a variety of habitats and is not sensitive to human activity. The rice-field rat is a common pest that feeds on rice. A total of eight mammal species were identified along the transmission line route. Thirteen species are protected by national and international legislation, and/or are listed by IUCN as endangered, near threatened or vulnerable. Of note are the Javan gibbon and the grizzled leaf monkey, both of which are endemic and...
endangered according to the IUCN red list. These populations are found in the patches (less than 1 Ha) the remnant secondary forest near the project area. The pangolin, another endangered mammal, is reported by locals to also be in the hydropower and transmission line area, but no sightings were made of the animal during the surveys.

Previous studies had identified through interviews that the Javan tiger (*Panthera tigris sondaica*) was resident in the area. The tiger is actually considered extinct. No field observations have been made in any of the studies, including the 2009 study. It is most likely that the identification of the leopard (*Panthera pardus melas*) or the jungle cat (*Felis bengalensis*) has been mistaken for the Javan tiger, or that interviewees have misinterpreted the interview questions during previous surveys.

**Herpetofauna:** In general, reptiles and amphibians are found in riparian habitat types. The river environments are particularly important for amphibians, where they spend most of their life. A total of 18 reptile species (10 families) and 6 amphibian species (3 families) were identified in the 2009 study. The reptile genera include a gecko, skinks, lizards, a monitor, snakes, pythons, cobras and a turtle. The amphibian genera include toads and frogs. The largest number of reptiles were found in the upper reservoir area (15 species), and the lowest in the quarry (5 species). This is likely to reflect the lack of riparian habitat in the quarry area. Common species found in the survey were the many-lined sun skink (*Mabuya multifasciata*), and the water monitor (*Varanus salvator*). Two python species are protected from unregulated international trade; the Burmese python and the reticulated python.

**Summary of Significant Land-Based Biodiversity**

The proposed development area has been highly modified by human activities. Land clearance, agriculture, human settlements and exotic forestry have replaced all but a few remnants of secondary growth forest habitat that once covered the entire area. The plantation forest and the mixed agriculture habitats do provide some alternative habitat for birds, reptiles and mammals, but it is the small secondary growth forest in deep ravines that provides the best habitat and supports the most diversity in flora and fauna species. This habitat is not at direct risk from further human activities, due to its steepness and inaccessibility along the Cirumamis River, although fire and poaching are still possible threats. The sustainability of the communities of flora and fauna within the remnants is at risk from the isolation from other seed sources and breeding populations. Although the project does not represent a direct threat to these species, it does provide some opportunities for implementing conservation programs around a “greenbelt” that will be established around the two reservoirs.

**Summary of the River Environments**

The hydrology of the Upper Cisokan River catchment responds to rainfall, and appears to have a low flow season and a high flow season consistent with the wet and rainy seasons. The upper tributaries are likely to experience long periods of low flow but do not appear to run dry during the dry season, and are likely to be fed by springs in the volcanic and limestone rock. There are small gravity fed abstractions from the river and its tributaries for rice field irrigation, fish farms and non-potable domestic use. The most significant abstraction is 6m$^3$/s from the Cihea Irrigation System downstream of the project area.

Sediment is discharged to the river from slips and other exposed soil, from rice field and
plantation land, and from roads and settlements. Other discharges to the river are mainly diffuse, and include rice field run-off, washing discharges and defecation activities. The river may also be indirectly affected by septic tanks, and other run-off from settlements.

Overall, water quality in the Cisokan and Cijambu catchments is average to poor, and does not meet Indonesian river water quality standards for many parameters. The main issues are the pathogenic bacteria contamination, which can cause gastro enteric health problems in humans and livestock, and the mercury concentrations, which can create acute and chronic health problems as a bio-accumulants. In December 2010, mercury measurement monitoring in water and sediments revealed that the concentration of mercury is below the government standard. This water quality data is reinforced by the macro invertebrate surveys which indicate moderate to poor water quality.

Fish surveys indicate at least 19 species of fish in the Cisokan and Saguling catchments. No fish from the surveys are listed on the IUCN red list or are legally protected.

**Groundwater, Air Quality, and Noise**

Hydrogeology has not been studied intensively. The interactions between surface water and ground water are not clear but based on observed conditions at the downstream Saguling Dam, and the results of shallow rock porosity tests, shallow groundwater is likely to be connected to the surface water through the weathered rock. When assessed against the drinking water quality standards, the results showed water quality is generally good with low nutrients, heavy metals and trace elements compared to the guidelines.

With little industry in the immediate area, there are no significant point source emissions to the air. Typical discharges include domestic fires (gas, firewood, waste), rice field burn offs, vehicle exhausts (particularly two stroke motorbikes) and dust from roads and fields. The results from the dry season sampling event show that the ambient air quality meets national air quality standards.

The rural environment in the project area is generally quiet. Major noise sources are vehicles, chainsaws, rice threshers, generators and other small machinery. In the hill area, the small, deep valleys help to attenuate noise from one catchment to the next. In 1998 study results showed levels below the maximum standard for residential areas, schools and religious buildings. The site where the loudest noise recordings were made was Bojong hamlet, Sukaresmi village, where there is a high frequency of traffic.

**Physical Cultural Resources, Religious Buildings and Graves**

A survey of physical cultural resources, which included religious buildings and private graves, was carried out in 2009 and involved consultation with local people, site identification, grid reference location using GPS, and photographic records.

No sites are listed by local or national authorities as having specific legal protection or significance. The sites of particular interest, due to their religious or other significance with locals and visitors, are considered to be the sacred graves, the Batu Bedil (gun stone), and Maqom Mbah Tubuy (rest area of a famous preacher). However, the numerous public and private graves and religious buildings in the project area also require respect and protection
during construction and reservoir preparation.

VI. Social Economic Baseline

Overview of Demographics

The administration area covered by each village varies between 5.5 km² (Cibaregbeg) to 105.3km² (Girimulya), and the population in each village varies between 3,758 persons (Karangsari) to 8,211 persons (Sukaresmi). The wide variance in the size of the administration area and population means that the density is also varied in the villages across the project area from 41.7 p/km² (Girimulya) to 1,256 p/km² (Cibaregbeg). The villages with smaller land sizes (Cibaregbeg, Karangsari, Sarinagen, and Margaluyu) are located on the northern plains where population densities are naturally higher due to the more fertile land and proximity to larger centers for employment and social services. Girimulya, with the lowest population density, covers hill country with less fertile land suitable for agriculture/subsistence living.

The gender balance is generally within 5% in most villages, which is expected. Approximately 65% of the population is aged between 15 and 65, the age of the 'productive' work force, but this fluctuates between villages. The percentage of the total population aged below 15 is approximately 30%, and approximately 3.6% aged above 65. The overall ratio of the eligible 'working' population to 'non-working' population is 0.54, but also fluctuates between villages.

Community Structure and Services

The population is distributed throughout Kampungs (hamlets) and comprises small rural families and communities with strong kinship and traditional social and cultural attitudes. Their day to day activities are strongly influenced by the Muslim religion, and village and religious leaders play an important role in decision-making, problem solving and village development. Men are considered the “heads of households” and the main bread-winners and decision-makers, while women manage the household and family matters as well as undertaking planting and harvesting activities. Education levels are low throughout the area, and most people have only attended elementary schools.

In general, kinship patterns are characterized by the traditional Sundanese community kinship system which draws descendent lines bilaterally. In areas characterized by dry land and forestry agriculture, this kinship pattern is very common and has considerable influence on the settlement group. In the communities with rice field agriculture, the kinship patterns are present but do not influence settlement patterns as much. The topographical features and transportation challenges, in combination with local kinship patterns in the settlements, leads to strong feelings associated with being in the “in group”.

A different pattern of social relations developed in the rice field agriculture communities in close proximity to the quarry and existing road. The area is more open and accessible with spacious settlement patterns. Social stratification emerges as a result of educational differences as well as a result of differences in wealth and control of resources, such as landlords.

Along the transmission line route, approximately 70% of houses are 'non-permanent' (made of
bamboo sheeting, rather than concrete or block). Most houses have access to electricity from the grid (approximately 88%) with the remaining households relying on kerosene and solid fuel. Less than one percent of households use their own generators. Approximately 18% of households do not have any means of receiving media from TV, radio or video. Very few households have a refrigerator. Approximately 75% of households have no form of transportation (including bicycles). Of the remaining 25%, the motorbike is the most common means of transportation. Within the hydropower scheme area 93.7% of houses are non permanent. A similar percentage of houses are owned by the occupier (93.9%).

Overall, the education level of the adult population is generally low. The majority of adult survey respondents had passed primary school education (58% hydropower scheme area; 72% in transmission line route). A small percentage of the surveyed adult population had completed some education beyond primary school (approximately 4% in hydropower area, 14.4% in transmission line route). The remaining respondents had not attended school, or did not complete primary school.

Mobility is higher in the transmission line villages, where at least one member of the family travels out of the village for work or market in 78% of households. In the reservoir area, in 46.9% of households at least one member travels out of the village for work or markets. The higher mobility villages tend to be those that are closer to (or part of) larger sub-districts population centers and closer to public transport services and main roads. The more remote villages travel or commute less, because of the lack of (or cost of) transport and because livelihoods are based on the land where they live. Population mobility in the project area is dominated by males. According to respondents, the primary reason for mobility in the population is to commute to areas where the earning potential is higher.

Shallow, hand dug wells are the main source of potable water, although some homes or hamlets which have small waterways nearby will use surface water. Few houses have septic tank wastewater treatment systems, and there is no reticulated and centralized wastewater treatment in any of the villages. The general pattern in the hydropower scheme area is that people living near waterways will use them for bathing, washing and as a toilet. People living further from waterways are likely to have latrines as toilets, but which are not connected to septic tanks.

Community based health services are well-supported if they can be accessed. Mobile health services are provided, but are infrequent in the more remote villages and hamlets because community health officers have difficulty reaching the isolated areas. In the more remote areas, people are less likely to travel to community health centers, and rely more on traditional medicines prescribed by family members or traditional healers in a community.

**Economic Profile**

Livelihoods are mainly subsistence, with rice fields, mixed agriculture and home gardens providing most of the household food. Spare produce may be sold at local markets. Pigs and deer may be hunted (although deer may no longer live in the area, and due to religious beliefs pigs are not eaten by the community), and fish are caught in the rivers.

The main source of income is agriculture. The majority of the heads of households in the project area are farmers or farm laborers (>80%). A small percentage is construction laborers, shop
keepers, motorbike drivers or traveling salespeople. Since most of the rice fields are rain fed there are only two harvests a year, almost 100% of the productive workforce have a second job to supplement their income, mainly within the local area.

The main occupation of the women in the household is also primarily agriculturally based. Around 3% are working overseas and sending money back to the household and 4.5% run shops. Around 44% of women have secondary occupations, mostly relating to agriculture.

The survey in the hydropower scheme area indicates the percentage of respondents on or below the national poverty line is 34.1%. Along the transmission line route, the percentage of respondents on or below the poverty line is 41.9%. The region appears to have a higher proportion of poor people compared to the rest of the country. According to national statistics, 18% of the total population of Indonesia is on or below the poverty line.

In agricultural communities land is the primary resource. Ownership or control of agricultural land affects the economic status of the individuals in the community. Control of agricultural land through leasing or shareholding does not afford the same rights as ownership and is therefore less secure in the event land changes hands. In the hydropower scheme area 45.9% of households surveyed own some land. 63% of the landowners own land holdings less than 0.25ha. Making such small parcels of land profitable is difficult, indicating these small farmers are most likely among the poorer residents in the project area and also considered vulnerable.

VII. Analysis of Alternatives

The scheme has been reviewed a number of times from environmental, social, technical and economic perspectives. This section discusses the alternatives relating to:

- Operating the Java-Bali network without Upper Cisokan
- Dam / reservoir design
- Access road locations
- Sources of suitable aggregate for dam construction
- Efficient transmission line routes

Java-Bali System without the Upper Cisokan Facility

Without the pumped storage hydropower scheme providing peak load electricity, the following scenarios were predicted in a PLN supplementary design study (2007):

- Oil-fired plants will cover the total peak power load. Higher costs will be borne by PLN for power generation at this time.
- At minimum load, coal fired power plants would reduce their power slightly to meet the lower power demand. This leads to a reduction in the efficiency of the the coal fired power plants.
- The Cirata hydropower plant would continue to operate as the load frequency control power plant, at a 65% efficiency load factor rather than 100% efficiency.
The ability to meet peak demand requires a reliable supply that can respond rapidly to demand fluctuations. This is best met by hydropower, because it can store energy (unlike wind); it can respond rapidly to load fluctuations (unlike coal) and is more economical than oil, diesel or gas. The PLN Detailed Design Study (2002) dismissed conventional hydropower as an alternative to the pumped storage scheme because of the difficulties of finding a large enough site for the reservoir within the Java-Bali system, without the additional constraints of social and environmental impacts.

**Alternative Dam/Reservoir Configurations**

Several dam location and configurations have been analyzed throughout the years. For instance, an alternative location to the upper dam was considered in the feasibility study of 1995, which involved a smaller reservoir footprint. The purpose was to minimize the number of households and cultivated land that would be flooded. The method was to relocate the dam upstream to the confluence of the Cipateungteung and Citapos Rivers, and excavate up to 15 million cubic meters of hill side within the reservoir footprint. The result would be a deeper, steep-sided reservoir. The alternative was not considered viable due to the high extra cost, the risks from the steep slopes, and the additional work required in removing and stabilizing the large volume of excavated rock.

An alternative configuration was also proposed for the lower reservoir to reduce sedimentation. The alternative included a second dam within the lower reservoir, and the operation of a permanent diversion tunnel which could transport the sediment load from the upstream catchment to downstream of the dam. The added benefit would be to reduce the reservoir area by 50ha, and lower the reservoir height by 9m. This alternative was more costly, and therefore not recommended by the engineering designers.

The final selection of the scheme was based on technical, economic, environmental and social considerations, mainly minimizing the need for resettlement.

**Alternative Access Roads**

Three alternative access routes were evaluated during detailed design. The selected route presents the least environmental and social impacts and the least cost. During the project preparation, under the advice of the World Bank team, PLN reviewed the possibility of further reducing the width of right of way required for the new section of the access road based on detailed technical requirements. On the basis of a 20 m width design rather than 40 m, the required land acquisition needed for the selected route was further reduced to only about 27.5 ha and the resettlement required was reduced by about 500 households.

**Alternative Quarries**

A review of suitable material sources for the concrete aggregate was undertaken during detailed design. Eight potential sites were reviewed and the Gunung Karang, the existing quarry used for the Saguling hydropower plant built in early 90s by PLN was selected due to the suitability of the rock types, the availability of the resources and the relatively small environmental or social impacts.
**Alternative Transmission Line Routes**

Four alternative routes were investigated in the supplementary design study (2007). The four options were:

- Original suggestion from the PLN Detailed Design report (2002) - Four single circuit connections from Cisokan to Saguling, Cibinong, Depok and Tasikmalaya;
- Alternative 1 - Double connections each with Cibinong and Saguling lines to the north;
- Alternative 2 - A single connection with Cibinong and Saguling lines to the north; and
- Alternative 3 - A double radial connection with Saguling only.

The Alternative 1 connection design was considered the best in terms of stability of supply for the Java-Bali network. The decisions were based on reviewing issues and costs with the number of lines, upgrades to substations, maintenance, and on reviewing the reliability of supply and risks of black outs if a line or substation was taken out of operation for maintenance or during an emergency.

In late 2007, a supplementary EIA (2007) confirmed the final configuration, two separate lines north to the Cibinong-Saguling line.

**VIII. Anticipated Environmental and Social Impacts and their Mitigation**

**Construction Phase**

**River Habitats and Water Quality:** Water quality and in-stream habitats are at risk from the discharge of sediment, working in the river beds, vegetation clearance and the storm water run-off from cement/fly-ash batching plants, asphalt plants and work areas. Water quality is also at risk from the deliberate discharge of pollutants (oils, fuel, wet cement), including workers using the river to clean equipment and as a toilet.

The key potential impact of erosion is sediment discharges into the river systems. Sediment can affect habitat and aquatic organisms while in suspension in the water and as deposited material on the streambed and banks. Mitigation and management of sediment discharges and works in the river beds are required to maintain the existing quality of the environment. A number of mitigation measures are proposed in the Environmental Management Plan and sub-plans, such as:

- Management controls to reduce, retain and treat soil erosion;
- Diverting river flow away from work areas, and minimizing the amount of work within the wetted area of river channels;
- No deliberate discharge of materials into water ways;
- Rapid re-establishment of exposed work areas with suitable vegetation; and
- The retention of riparian vegetation adjacent to the watercourses where possible to act as buffer zones to assist in trapping sediments before reaching the watercourse.
Water quality and habitat monitoring, and the supervision and monitoring of erosion and sediment control measures during construction, will assist with identifying and responding to the risks associated with sediment discharges.

**Tunnel and power house excavation dewatering:** The construction of the tunnels and the underground power house will involve dewatering operations because the tunnels and excavations are expected to intersect water seeps within the rock and then form a conduit for that water to flow out to the surface. The extent of dewatering required is unknown and so adaptive management is required during the construction process to control the dewatering process. Particles of pollutants will be entrained in any resulting drainage waters and any discharge of these to the rivers could cause adverse impacts on the habitat and biodiversity.

The main mitigation option available is to provide settlement ponds at the exit of the tunnel portals prior to discharge to the Cisokan River. These will be sized appropriately for the incoming flows and particle sizes and aim to settle out the majority (75%) of incoming suspended sediments. Settlement ponds should be designed to contain all the incoming waters. Consideration should be given to settling methods such as the use of flocculants if necessary (to be decided during construction and under the approval of supervision engineer).

**Other potential discharges:** Cement and fly-ash are highly alkali, and any discharge of dry or wet cement or fly-ash from batching plants or work areas into water can kill fish and invertebrates. All storm water runoff from these areas will be captured and treated to reduce the pH prior to discharge to the river. No concrete work will be carried out in the wet area of rivers and there should be no deliberate discharge of dry or wet cement or fly-ash into the rivers. Fuel storage, asphalt manufacturing, explosives and other potentially polluting activities must occur away from rivers and have adequate pollution control measures. The Construction and Workers Camp Management Plan provides mitigation measures and procedures to avoid direct discharges.

**Land Based Biodiversity:** The major land use types within the project area consist of settlements and cultivation areas; rice fields, mixed plantation and forest, settlements and yard gardens. All of these areas are not significant habitats for biodiversity. The land use types are similar to those found throughout the wider hill country area, and therefore there are opportunities for fauna species to migrate and find alternative refuge in similar habitats during construction, land clearance and inundation.

The remnant of secondary growth forest habitat is potentially at risk from construction disturbances (mainly workers’ activities). The entire forest is approximately 1ha. Any impact on this forest remnant is significant as it provides refuge to endangered, threatened and vulnerable species, as well as several endemic mammalian species. **However, the remnant forest is not within the footprint of the scheme and so will remain intact following construction, although part of it will be located within the greenbelt zone and very close to the high water level for the lower reservoir.**

Construction-related impacts on land-based biodiversity will be managed through the Construction and Workers Camp Management plan, and include:
• A ban on workers killing or trapping wild animals, for food or trade.
• A ban on workers collecting firewood, or cutting down trees outside of the designated land clearance areas.
• Minimizing the land clearance areas for construction purposes.
• An education campaign with the workers that the remnant forest is protected, and not to be entered for any purpose.
• Sediment and erosion control measures to mitigate the effects of construction on river water quality.

Because of the close proximity of the remnant of secondary growth forest habitat to the lower reservoir, it is proposed to fence off the forest area, and provide warning signs not to remove any vegetation during the land clearance and reservoir preparation. All workers and locals involved in the land clearance will be provided with instructions to avoid any activities within the forest area. These practical measures should minimize any additional pressures on the habitat or species from construction and land clearance activities.

Further survey and assessment work is proposed during the pre-construction and construction phases to determine the significance and sustainability of the forest. This will be managed through the Biodiversity Management Plan.

A final mitigation measure is the re-vegetation of the greenbelt area with habitat with the intention of extending the viable habitat and range of species within the forest.

**Physical Cultural Resources, Religious Buildings and Graves:** All physical cultural resources, religious buildings and graves identified in the 2009 survey can either be relocated or protected during the construction process. Any incidental finds will be protected through Chance Find Procedures in the Physical Cultural Resources Management Plan.

**Air Quality:** Air quality may be affected by dust emissions, particulates and gaseous emissions from exhaust. Dust emissions will primarily come from road use, exposed soil and riverbeds in working areas and during reservoir clearance, material stockpiles, quarry operations, aggregate crushing, blasting at the quarry and work sites, and cement manufacturing. Particulates (other than dust) and gaseous emissions will arise from vehicles, heavy machinery, diesel generators, and the asphalt plant. Such particulates can also affect people's health. The communities most at risk are those immediately adjacent to the access road and close to the quarry, as those locations are most likely to be exposed to dust and vehicle emissions.

Key mitigation measures are contained in the Environmental Management Plan and relevant sub-plans, and include managing dust emissions and exposed soil and materials, maintenance of vehicles and equipment to control emissions, avoiding the burning of vegetation and waste, and maintaining a complaints system and action process. The severity of dust issues is otherwise reduced by the lack of regular strong winds at the project site.

**Noise and Vibration:** The main noise sources are the heavy vehicles and machinery used to clear land and for quarrying and construction purposes, blasting at the quarry, waterways, lower
dam and power station locations, the aggregate crushers, cement and asphalt plants, diesel generators, and trucks and other vehicles using the access road and internal site roads. While most noise will occur during daylight hours, noise emissions from the two dam sites will continue through the night because of the continuous nature of RCC dam construction. All of these noise emissions will cause disturbances to local households, workers, livestock and wildlife species. Noise may interfere with daily activities of local communities and lead to displacement of wildlife species, particularly from the remnant secondary growth forest habitat.

To mitigate impacts in the construction areas, several measures are proposed in the Environmental Management Plan and relevant sub-plans. Blasting and tunneling activities and access road traffic shall occur only during daylight hours. Blasting should take place at set times each day, and/or warning shall be issued prior to blasting. Other mitigation measures include sound the installation of noise barriers between the access road and schools, and traffic controls to reduce the noise (and speed) of traffic through settlements. Ambient noise will be monitored during the construction process, and the contractor will operate a complaints process.

**Socio-Economic Impacts from Land Acquisition:** The land acquisition and resettlement activities are the principal adverse socio-economic impacts arising from the project. The issues and impacts are managed through the Land Acquisition and Resettlement Process (LARAP) process. The total number of households affected by the project is expected to be approximately 2201 households including 733 households of which are expected to be relocated because of losses of residential and/or business structures. The remaining 1468 households will be economically affected by loss of some or all of their land and/or income sources. The final number of affected households will be verified through the Land Acquisition Committee notifications and consultation throughout the resettlement process.

The resettlement sites have not yet been confirmed, but project affected people have been consulted on their relocation preferences and nine sites have been assessed. Three sites are under detailed study and require more investigation, including further consultations with those to be relocated and discussions with local government. Relocation site selection and design issues to be planned in consultations include:

- Water supply, sanitation and waste;
- Changes to land habitats and land uses, including biodiversity impacts; and
- Socio-economic impacts for the resettled and the host communities in the resettlement area.

Three land acquisition and resettlement action plans (LARAPs) have been drafted and disclosed to address project impacts in compliance with both GOI and World Banks’ relevant policies for (a) access roads and quarry; (b) lower and upper dams and reservoirs; and (c) associated transmission lines. The LARAPs detail the socioeconomics in the project areas, resettlement planning activities, project impacts, entitlement policies and packages, resettlement and rehabilitation approaches and packages, including a recommendation to do feasibility and design for three relocation sites (out of nine sites considered), implementation arrangements, institutional, monitoring and grievance redress mechanisms, cost and financing arrangements.
**Socio-Economic Impacts on the Host Communities:** A large number of households will not be resettled, but will remain in the project area along the access road route, close to the construction areas and along the transmission line. These households are at risk from construction-related effects, but may also gain the benefits of employment or of providing goods or services during the construction period, which may contribute to their economic wellbeing. Key impacts include road safety risks from traffic hazards, employment and enterprise opportunities, disturbances to lifestyle, health, and culture from an influx of migrant workers and competition for community services and natural resources.

**Inundation Phase**

While the inundation phase is a small part of the entire project, there is potential for a discrete set of impacts on river hydrology, habitat and biodiversity, downstream river uses, river access and community connectivity. The Operational Environmental Management Plan (with sub-plans) is the key tool to assist PLN to implement the proposed mitigation measures during this phase, as part of the overarching Upper Cisokan Hydropower Scheme Environmental Management Plan.

**Hydrology, River Habitat and Biodiversity:** Reservoir filling will occur during the rainy season (December to May). Using the annual average river flow, reservoir filling will take approximately 92 days, or three months. The potential impacts from retaining much of the river flow, reducing the downstream flow, and creating a constant flow during this period are:

- Reducing the available wetted habitat for biodiversity;
- Creating a supportive environment for algal growths;
- Reducing the ability of the rivers to move sediment and boost algal growths;
- Changing the 'rainy season signals' to fish to start migrating or spawning. This can lead to reduced spawning success;
- Reducing the water supply/flow to the riparian habitat, affecting amphibian breeding success; and
- Reducing the capacity of the river to dilute discharges from agriculture and settlements, leading to increased concentration of pollutants.

The primary mitigation measures will be to change the rate of discharges from the bottom outlets periodically, to mimic natural fluctuations in river flow, and to delay the start of filling until the first of the wet season floods have passed, therefore providing fish with the signals required to start the breeding process.

Monitoring of water quality, fish and river habitat will be undertaken prior to filling and during filling, to measure any impacts and to change the residual flow discharge arrangement if required. Flow management, water quality and habitat monitoring during inundation will be documented in detail in the Operational Environmental Management Plan. With these measures in place, the potential impacts on the in-stream biodiversity should be minimized.

**Downstream River Uses in the Cisokan River:** The potential impacts on downstream river uses in the Cisokan River include:
- Lack of water availability due to reduced river flow;
- Reduced risk of flooding beyond the river banks;
- The river bed users and adjacent landowners not being able to predict river flows or floods based on rainfall, as they may have done previously. High rainfall will not correspond with a rise in river levels necessarily; and
- Reduced water quality and dilution effects.

The availability of water to the Cihea Irrigation Scheme should not be impacted during the inundation phase. The river will have a reduced flow, but the lower dam will maintain a minimum release during inundation phase of 7m³/s which will ensure the required flow of 6m³/s is available for the irrigation scheme, drinking water, fishing and transport.

All downstream warning signals/sirens for flooding or emergencies will be operational prior to inundation and will be used during inundation when necessary. Prior to inundation, PLN will communicate with and inform all downstream river users, downstream to, and including, the farmers in the Cihea Irrigation Scheme, about the changes to river flows during inundation.

**Operational Phase**

The potential impacts from the operational phase of the Upper Cisokan pumped storage project are the following:

- Peaking electricity capacity benefits;
- changes to hydrology downstream of the scheme, changing water availability, flood flows and low flows;
- reduction in sediment movement through the river systems;
- water quality within the reservoirs and downstream of the scheme;
- changes to river, riparian and land-based ecology and biodiversity;
- land instability around the perimeter of the reservoirs;
- greenhouse gas emissions;
- changes to the availability of water to downstream uses;
- an influx of settlers in the area and along the access road,
- changes to the connectivity of communities across the lower reservoir, and
- electro-magnetic frequency interference and health impacts.

These impacts arise from:

- the daily cycling of water between two reservoirs to generate electricity;
- the two dams creating in-stream barriers to fish movements, sediment movement and natural water flow within the Cisokan and Cirumamis Rivers;
- the change from the run-riffle-pool river environments of the Cirumamis and Cisokan Rivers, to lake environments once inundated;
- lack of public access to the reservoirs and greenbelts;
• increased access to the area from the new access road; and
• the operation of 500kV high voltage transmission lines.

The Operational Environmental Management Plan is the key tool to assist PLN to implement the proposed mitigation measures during this phase, as part of the overarching Upper Cisokan Hydropower Scheme Environmental Management Plan. In addition to the Environmental Management Plan, sub-plans include: Social and Community Relations Plan, Biodiversity Management Plan, and the Dam and Reservoir Management Plan.

**Hydrology:** There will be minor attenuation of flood flows depending on the timing of the flows with the timing of the generation or pumping. The assessment of impacts on low flow periods is difficult with the available hydrological data. With the available data, it appears that at times there may not be enough inflow to provide for evaporative losses. This indicates that if evaporative losses are replenished during these flow conditions, the system inflow may not be sufficient to provide suitable residual flow to maintain ecological systems or provide for downstream water uses.

To ensure that the flow is maintained downstream as close as possible to natural flows, and to protect the river ecosystem during extended periods of low flow, the following monitoring and mitigation measures are proposed:

• Monitor river flow upstream of the scheme (in the Cirumamis and Cisokan Rivers) and water levels in the two reservoirs, on a continuous basis. Monitoring stations should be installed as soon as possible to enable the longest possible record of flows;
• Use the flow monitoring and water level data on a daily basis to adjust the bottom outlet valves of both dams so that outflow is equal to inflow, minus the water retained to make up evaporative losses;
• Use water from the lower reservoir to top up the upper reservoir during low flow periods, to ensure a natural flow regime (where inflow equals outflow) is maintained downstream of the upper dam at all times;
• Provide a minimum flow from the lower dam of 0.2m³/s, until an alternative flow suitable to the river ecosystem and flow regime is determined from the new monitoring stations;
• Survey low flow conditions in the Cirumamis and Cisokan Rivers, to understand the potential biodiversity impacts of further reducing the wetted areas during dry periods;
• Operate the flood emergency procedures to minimize downstream risks; and
• Educate downstream users regarding the potential for attenuation of flood flows, flood emergency procedures, and regarding the low flow regime.

**Water Quality:** Water quality is currently moderate to poor due to land use practices, water uses and discharges in the catchments. Further degradation is likely to occur following inundation and operation. Initially BODs, COD and nutrient concentrations may be elevated, and dissolved oxygen concentrations lowered, due to the decomposition of any vegetation that remained following reservoir clearance and releases from the inundated soil. It is also likely that the shoreline sediments will be disturbed during the daily filling and emptying of the reservoirs for
some time after inundation creating a turbid environment at the edges.

A series of mitigation measures are proposed to reduce the potential impacts of the reservoirs on water quality, and in some cases may improve water quality:

- The clearance of vegetation, removal of contaminants and other reservoir preparation tasks;
- Stabilization of potential landslides prior to inundation to minimize the contribution of sediment;
- Forest replanting within the greenbelt, reducing the potential discharges and impacts from settlements and agriculture along the edge of each reservoir;
- The constant inflow and outflow of water through both reservoirs, reducing the water quality issues related to stagnant water;
- The prohibition of fisheries in the reservoirs, reducing the water quality issues with elevated nutrients;
- The daily transfer of water from the upper and lower reservoir, aerating the water, reducing the residence time and mitigating oxygen and temperature stratification in both reservoirs; and
- Provision of sanitation and the (at least short term) reduction in human population in the catchment, reducing the use of the rivers as lavatories and the consequential discharge of fecal coliforms, \textit{E. coli} and metals such as zinc and copper.

**Sediment movement:** The two dams will create a barrier to natural sediment movement. Some suspended sediment will be passed through the bottom outlets and continue downstream, however the majority of the bed load will not be moved. The primary impact will be that the river will have increased energy to move bed-load downstream of the lower dam in the Cisokan River. This is likely to result in some changes to river morphology, primarily erosion of beds and banks, and alterations to river channels within the river bed that may not have occurred previously. At the most serious, could be the loss of private land adjacent to the river.

Adaptive management by PLN during the scheme operation is recommended, through the Operational Environmental Management Plan, using the following process:

- Surveying the downstream riverbed and banks at key locations, every 4-5 years for changes river morphology;
- Investigate complaints from downstream landowners and river users; and
- Based on surveys and / or complaints, adjust discharge flows, and otherwise consider other management methods with dam operations, or commission further research and study into options to mitigate the changes to channels, banks etc.

The secondary impact is the contribution of sediment to the reservoir environments. To reduce the potential for the contribution of additional sediment into the catchments, the identified landslide areas in the upper reservoir will be stabilized through engineering works prior to reservoir filling, reducing the potential for major earth movements and sediment discharges.
**Aquatic and Riparian Ecology:** Fish species that rely on swift, clear flowing waters for habitat and spawning will have their range reduced following inundation. The upstream and side catchments are available as possible alternative refuge. The reservoir will provide habitat for fish that can adapt to lake environments, including the carp, tilapia and barb species. Because the reservoir environments are not suitable for aquaculture, local communities do not have a substitute for wild fish. For this reason, and to maintain biodiversity within the Cisokan River, it is considered appropriate to periodically monitor fish presence/absence and fish population numbers. Where a decline in a food species or a substantial change in local fish communities is identified, mitigation measures should be explored.

Riparian river habitat will also be lost along the length of the rivers that will be inundated. This habitat is important for amphibians, reptiles and some birds. This will not be replaced by the reservoir, because water levels will vary so dramatically over short periods of time due to the nature of the pumped storage operation that the riparian areas will be inhabitable. These species may find alternative habitat in the side streams and upper tributaries. Mitigation measures may include enhancing the side stream habitats within the greenbelt areas. Further measures may be established through the adaptive management program detailed in the Biodiversity Management Plan.

**Land Based Biodiversity:** Once the reservoirs have been filled, the remnant of secondary growth forest will be located on the southern margin of the lower reservoir, and will extend through the greenbelt up to the Cirumamis River catchment. The inhabitants of the forest are potentially at risk from the scheme once operational, due to the flooding of the adjacent river valleys and the improved access to the area from the new road.

Without further assessment of the viability of the habitat, and the range, ecosystem niches, and viability of the populations of species, the potential impacts are difficult to predict. Particular questions are whether this habitat or the populations of species are self-sustaining and would continue to be productive and viable without any disturbances or intervention, and what type of protection or mitigation is required to ensure the sustainability of the habitat or its inhabitants.

The objective is to avoid the loss of functioning forest habitat, and minimize the loss of individuals or populations of species that are endangered, threatened or vulnerable. Some protection and enhancement measures could include:

- Relocating individuals or populations of endangered species to sanctuaries;
- Protecting the remnant forest with signage and/or providing legal protection through ownership and management by PLN or a charitable organization;
- Education of the locals and PLN employees about the significance of the forest and the requirements for protection from logging and hunting; and
- Extending the forest habitat by replanting forest habitat, along the greenbelt and into adjacent hillsides and hilltops.

**Land Stability and Hydrogeology:** Land stability has been recognized as a potential issue, and the engineered stabilization works have been recommended to avoid landslides in the upper
reservoir. Routine monitoring of land stability is recommended in the Operational Environmental Management Plan, with engineering solutions implemented where risks are identified.

Groundwater levels are anticipated to rise with the reservoir level. To assess whether this will impact on domestic water supplies, septic tanks or building stability, water level and water quality monitoring of at least two domestic groundwater wells, for at least two years following inundation, is recommended in the Operational Environmental Management Plan. Along with a complaints process, the monitoring should identify any adverse impacts, and alternative water supplies, sanitary systems or other solutions should be provided by PLN in such cases.

**Downstream River Uses in the Cisokan River**: The potential impacts on downstream users include the changes to water availability and the risks from changes in flood flows. Access to water by the Cihea Irrigation Scheme downstream should not be impacted by the operation of the hydropower scheme. There will remain times when the natural river flow cannot provide enough water for the irrigation scheme, as is currently the case. There are likely to be many small users who rely on the Cisokan River for irrigation supplies, stock drinking water, and for fishing. Similar to the irrigation scheme, these users are not expected to be affected because of the small volume of 'top up' water that the scheme will consume compared to average river flows, and the minimum flows that will be discharge during low flow periods. All downstream users will be consulted prior to inundation regarding the expected changes to river flows, how the scheme will be operated and how inflows and discharges will be monitored.

The possible co-incidence of flood inflow and generation necessitates flood warning safety measures downstream for the purpose of increasing the safety to local people. While the attenuation of flood flows is not as significant as conventional reservoirs due to the lack of storage, the peaks will be delayed and be longer than locals may have experienced prior to the scheme. All downstream warning signals/sirens for flooding or emergencies will be operational prior to inundation and will be used during operation whenever necessary. All procedures will be documented in the Operational Environmental Management Plan.

**River and Land Access within the Reservoir Areas**: There will be a loss of river and land access within the reservoir areas to the people who will remain in the Cisokan area. Prior to filling, access to the river beds and the cleared reservoir areas will be prohibited. The reservoir environments will be very hazardous during filling and operation, due to the steep, un-vegetated shorelines and the rapid rise and fall of the water level. There is a risk of drowning or injury from people who attempt to access the reservoir. The reservoir security and protection measures have been detailed to ensure that the public are not at risk from rising water levels during initial filling or during operation. Alternatives to sanitation have been proposed, such as ensuring that all houses/villages in the area have access to sanitary systems. This will allow people to bath and wash clothes in the village rather than in the river. Alternative fishing and swimming locations will be upstream of the lower reservoir, downstream of the lower dam, and in the side tributaries and smaller streams of the lower reservoir.

**Community Connectivity**: Community connectivity via the traditional swing bridge routes across the Cisokan River will no longer be possible however the new bridges will provide
alternative access across the lower reservoir. The new bridge to connect the villages will be built and operational prior to inundation, to avoid the potential for community isolation from the markets, schools and other communities. The upgrade to the existing road, and the construction of the new road, will assist the local population with better access to markets and services outside of the area.

**Induced Development along Access Road:** It is possible that the new road will increase settlement in the area. After the Saguling Dam road was constructed, many households moved into the area and occupied road edges owned by PLN. The potential for adverse impacts on the existing communities is low, as the area is already heavily developed and populated, and land tenure is in community or private ownership. Land would need to be purchased, or a lease agreement entered into, in order for migrants to settle. A policy on roadside settlement should be developed by PLN (as road owners) to ensure that this activity does not create an adverse impact on the existing communities.

**Electro-magnetic Field:** There is the potential that people living or working near the new transmission lines will be impacted by the electro-magnetic fields from the transmission lines, either for health reasons or by interference with electrical equipment. Electro-magnetic field (EMF) is well regulated, with the designated free space conforming to Indonesian standards. The Transmission Line Management Plan provides measures to monitor the EMF regularly to confirm that the transmission lines are within the national emissions standards. Compliance regarding real or perceived health issues and other impacts can be addressed through PLN's complaints process.

**IX. Environmental and Social Management Plans**

A stand-alone Environmental Management Plan (EMP) has been developed based on the findings of EIA report. The EMP details the environmental management and supervision organizations and responsibilities, mitigation measures, capacity training plan, monitoring plan, and budget estimates for implementation. Relevant elements of the EMP will be incorporated into bidding documents and contracts to ensure effective implementation throughout the preconstruction, construction and operation phases of the UCPS Project.

EMP implementation will be managed by the PLN Java Bali Hydropower Generation Principal Project Office (PHJ), the project implementation unit for the UCPS Project. An environmental and social management task force will be established in the PHJ with dedicated environmental staff prior to the initiation of any construction of the main works. Qualified environmental staff will be required to be assigned in the selected Contractors and Supervision Engineer teams to ensure effective implementation of EMP. The overall hierarchy is shown below in Figure 1.

As the main element of the EMP, the *Construction and Workers’ Camp Management Plan* will address all issues regarding the management of construction activities, monitoring of mitigation measures, and management of the workforce during project construction. These issues are required to be addressed by contractors, by producing detailed earthworks management plans and site operation plans outlining the measures to minimize, mitigate, and/or manage the effects, for the duration of the construction works. The Plan will include:
• The control the adverse impacts associated with erosion and sediment discharges from earthworks activities.
• The operational controls on various aspects of the project including traffic management, noise and vibration management and operation of the workers camps.
• The management of social impacts stemming from the installation and operation of workers camps in the area.

Under the guidance of PLN, the supervision engineer will be responsible for developing a Social and Community Management Plan that addresses how the potential social impacts will be managed to minimize adverse impacts and promote beneficial impacts. The Guidelines for the social and community management plan is included in the EMP. The plan will detail all necessary activities, institutional arrangements and budget requirements, to ensure maximization of benefits to local communities. This will not include the processes for grievances, compensation and resettlement that will be dealt with through the LARAP process. The implementation of this plan will be delegated to the Supervising Engineer or Contractors.

The plan will include the following programs:

• Cultural and Environmental Education and Awareness Program
• Health Program
• Traffic Management

The Project EMP includes a Biodiversity Management Plan (BMP). The BMP covers the management of endangered species and indigenous forest habitats within the project area of the upper Cisokan Hydropower Scheme. The plan documents an adaptive management approach to biodiversity conservation/protection, which included a phased approach to:

• Further evaluating the sustainability and vulnerability of the remnant indigenous habitat and its inhabitants.
• Identifying suitable management methods to achieve self-sustaining habitats and populations of endangered species.
• Implementing appropriate management methods, particularly during construction and pre-inundation (with a monitoring and review process to continue appropriate management during the inundation and operational phase).

A reservoir ‘greenbelt’ or riparian management area will be demarcated around the entire perimeter, to 5 m height above the high water level, at each reservoir. This strip will be re-vegetated to achieve three purposes: a barrier to access by the public to the reservoirs, habitat restoration and erosion control. Vegetation for restoration will be indigenous species that can provide habitat for indigenous fauna and stabilize soils to prevent erosion.

Strict workers behavior rules regarding poaching, hunting, and illegal logging will be enforced. Enforcement of regulation of all contractors’ activities during construction will be implemented
during construction: run-off control programs, management and prevention of oils and fuels and spills.

The *Physical Cultural Resources Management Plan* documents the physical cultural resources, private graves, and religious buildings in the Upper Cisokan Hydropower Scheme project area, and includes methods and responsibilities to:

- Protect resources during construction
- Relocate/remove graves and religious buildings as part of the resettlement and reservoir preparation process.

The plan also includes Chance Find Procedures which identify what measures should be taken in the event that physical cultural resources are encountered and will be included in bidding documents and contracts.
During the Inundation and Operational Phase, the Operational Environmental Management Plan (OEMP) is the single overarching plan that will control all other plans and programs during inundation and operation. In addition to the sub-plans, there are procedures relating to OEMP implementation, and quality assurance, including a comprehensive environmental monitoring program.

PLN, the Supervising Engineer, the Contractors and the Independent Review Panel will all have responsibilities for supervising, implementing, reviewing and / or revising the various sub plans, as shown in Table 1.
Table 1: List of Plans, Tasks, Sub-Plans and the Roles and Responsibilities for Supervision, Review, Revision, and Implementation

<table>
<thead>
<tr>
<th>Plan</th>
<th>Key tasks or sub-plans</th>
<th>PLN Project Management Team (Environmental Unit)</th>
<th>Supervising Engineer (Environmental Unit)</th>
<th>Contractor</th>
<th>Independent Review Panel</th>
</tr>
</thead>
<tbody>
<tr>
<td>UCPS Environmental Management Plan</td>
<td>Supervision</td>
<td>Implementation</td>
<td></td>
<td></td>
<td>Review and expert advice</td>
</tr>
<tr>
<td>Capacity Training</td>
<td>Supervision</td>
<td>Implementation</td>
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<tr>
<td>Plan Monitoring and Review</td>
<td>Supervision</td>
<td>Implementation</td>
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<tr>
<td>Communication / Reporting to external agencies</td>
<td>Supervision</td>
<td>Implementation</td>
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<tr>
<td>Environmental Monitoring</td>
<td>Supervision</td>
<td>Implementation</td>
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<tr>
<td>Construction and Workers Camp Management Plan</td>
<td>Supervision</td>
<td>Implementation</td>
<td></td>
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<tr>
<td>Reservoir Land Clearance Plan</td>
<td>Supervision</td>
<td>Implementation</td>
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<tr>
<td>Social and Community Management Plan</td>
<td>Supervision</td>
<td>Implementation</td>
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<tr>
<td>Connectivity management</td>
<td>Supervision</td>
<td>Implementation</td>
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<tr>
<td>Physical Cultural Resources Management</td>
<td>Supervision</td>
<td>Implementation, Supervision of Contractor</td>
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<tr>
<td>Management of Grievance processes</td>
<td>Supervision</td>
<td>Implementation</td>
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<tr>
<td>Community Relations</td>
<td>Supervision</td>
<td>Implementation, Supervision of Contractor</td>
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<tr>
<td>Biodiversity Management Plan</td>
<td>Supervision</td>
<td>Implementation</td>
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<tr>
<td>Access Road Construction Environmental Plan</td>
<td>Supervision, Revision</td>
<td>Implementation</td>
<td></td>
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<tr>
<td>Transmission Line Environmental Management Plan</td>
<td>Supervision of Supervising Engineer</td>
<td>Implementation, Supervision of Contractor</td>
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<tr>
<td>Quarry Environmental Management Plan</td>
<td>Supervision</td>
<td>Implementation</td>
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<tr>
<td>Land Acquisition and Resettlement Action Plan</td>
<td>Implementation</td>
<td>Review and expert advice</td>
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<td></td>
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<tr>
<td>Access Road &amp; Quarry LARAP</td>
<td>Implementation</td>
<td>Independent Monitoring, Relocation Site</td>
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<tr>
<td>Upper and Lower Reservoir LARAP</td>
<td>Implementation</td>
<td>Development, and Livelihood Restoration</td>
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<tr>
<td>Tower and ROW Transmission Line LARAP</td>
<td>Implementation</td>
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<tr>
<td>Operational Environmental Management Plan</td>
<td>Supervision</td>
<td>Review and expert advice</td>
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<td>Capacity Training</td>
<td>Implementation</td>
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<tr>
<td>Environmental Monitoring</td>
<td>Implementation</td>
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</tbody>
</table>
Plan | Key tasks or sub-plans | PLN Project Management Team (Environmental Unit) | Supervising Engineer (Environmental Unit) | Contractor | Independent Review Panel
---|---|---|---|---|---
Revision
Social and Community Relations Plan | Implementation | | | | |
Revision
Biodiversity Management Plan | Implementation | | | | |
Revision
Dam and Reservoir Management Plan | Implementation | | | | |
Revision

**Panel of Experts**

An environmental and social Panel of Experts (PoE) has been established to provide independent review and guidance on the treatment of environmental and social issues associated with the Upper Cisokan Pumped Storage project. Among other duties, the PoE will provide reports to ENV and PLN on the status and compliance with EMP and Resettlement Action Plan requirements.

**Safety of Dams**

The project triggers the World Bank’s OP 4.37 Safety of Dams as two dams at heights of 98 meters (Lower dam) and 75.5 meters (Upper dam) will be built under the proposed project. Both dams will be constructed using the roller-compacted concrete (RCC) method. The dams have been designed to the Japan National Committee on Large Dams (JAN-COLD) standards. They are both designed to accommodate a 1 in 10,000 year flood over the spillway, and are designed to the Seismic Zone 4 seismicity rating for the area. A Panel of Experts on dam safety has been established to review designs and management of contingencies downstream. A dam safety plan has also been developed by PLN and approved by the Bank.

**X. Public Consultation and Disclosure**

Several rounds of focus group and public consultation meetings have taken place. The meetings and the issues raised are discussed in this section.

*Summary of Consultation Efforts and Methods*

<table>
<thead>
<tr>
<th>Year</th>
<th>EIA Phase</th>
<th>Consultation Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>Additional Environmental Investigation for the Detailed Design (PT PLN, 2001)</td>
<td>Stakeholder meetings were held in Cibeber sub district hall, Campaka sub district hall, Gununghalu sub district hall, Cipongkor subdistrict (at Cibenda village). Stakeholder meetings were held at the regency level at Cikongdang Village (Cianjur Regency) and at Sirmajaya Village (West Bandung Regency). Invitees included government officials, village representatives and non-</td>
</tr>
<tr>
<td>Year</td>
<td>Event</td>
<td>Description</td>
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<td>------</td>
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<tr>
<td>2006</td>
<td>TOR EIA for ANDAL application (PLN/Newjec Inc., 2007b)</td>
<td>Consultation was carried out on an informal basis during interviews with the villagers as part of the social impact study. One stakeholder meeting was held at Rongga, West Bandung Regency with government officials, village representatives and non-governmental organizations.</td>
</tr>
<tr>
<td>2007</td>
<td>EIA for ANDAL application</td>
<td>Consultations were held in the Environmental Impact Control (BPLHD) office in Bandung with government officials, environmental center of universities, representatives form communities from Rongga and Bojongpicung subdistricts, NGO Walhi West Java, and PLN.</td>
</tr>
<tr>
<td>2007</td>
<td>Transmission line EIA (PLN/Newjec Inc., 2007a)</td>
<td>Detailed interviews with community representatives, related institutions, heads of sub-district, heads of villages, village administraters, and entrepreneurs.</td>
</tr>
<tr>
<td>2007</td>
<td>Transmission Line Supplementary EMP (PLN/Newjec Inc., 2007e)</td>
<td>PLN held a public consultation meeting in the Office Auditorium of Haurwangi Village, Bojongpicung Sub-District, Cianjur Regency.</td>
</tr>
<tr>
<td>2009</td>
<td>LARAP</td>
<td>In addition to individual household census and sample survey respondents, consultation (Focus Group Discussion - FGD) was conducted for road &amp; quarry LARAP in the villages of Sarinagen (existing road), and Cijambu, Sirmagalih, Cibitung, and Sukaresmi (new road) Karang Nunggal village (lower reservoir), Rongga (upper reservoir). Transmission line consultations were carried out at Cipongkor Sub-District Office, West Bandung District Sub-District Rongga, Sub-district Haurwangi.</td>
</tr>
<tr>
<td>2010</td>
<td>TOR Revised EIA (AMDAL application)</td>
<td>Consultations were held in the Environmental Impact Control (BPLHD) office in Bandung with government officials (land agency, housing, environment, and sub districts and villages government), environmental and geological center of universities, representatives form communities from Cipongkor, Rongga, Campaka, and Cibeber subdistricts, NGO Walhi, and PLN Hydo Java.</td>
</tr>
<tr>
<td>2011</td>
<td>Revised EIA (AMDAL application)</td>
<td>Consultations were held in the Environmental Impact Control (BPLHD) office in Bandung with government officials (land agency, spatial planning, housing, environment, and sub districts and villages government), environmental and geological center of universities, technical EIA team, community representatives from Cipongkor, Rongga, Campaka, and Cibeber subdistricts, NGOs, and PLN Hydo Java.</td>
</tr>
<tr>
<td>2011</td>
<td>Consolidated EIA and EMP</td>
<td>Consultations was held in Horizon Hotel Bandung with provincial government representatives, district and sub districts government representatives (planning, community unity, representatives for Rongga, Cipongkor, Cibeber, Campaka, Bojongpicung, and Haurwangi sub districts, universities (ITB, Padjajaran University, UPI), regional medias (Pikiran Rakyat, Radar Bandung, Tribun Jabar), NGOs (local and nationals), Upper Cisokan Development Community Watch, representatives of PLN from central and regional.</td>
</tr>
</tbody>
</table>

The purpose of each meeting or interview was to first convey information to the people regarding the project, and secondly to seek feedback to gain an understanding of their perceptions of the project, their aspirations and to receive their comments on how the project may affect them. Written documentation on the project was provided, as well as oral
presentations and discussions with the meeting attendees or interviewees.

To summarize, the key points from the feedback from the communities, government institutions and NGO’s and the responses from PLN are as follows:

<table>
<thead>
<tr>
<th>Issue</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adequate compensation for lost land and economic opportunity, including the landless. People asked for clear information concerning compensation procedure, and transparency. The feedback was also that people should not be made worse off through the process.</td>
<td>PLN’s response was that compensation rates will be based on standardized land and properties prices, and those problems, conflicts and misunderstandings would be met through negotiation and consensus.</td>
</tr>
<tr>
<td>As far as possible, to recruit local labor.</td>
<td>It was confirmed that priority would be given for recruitment of local people, based on abilities and qualifications. Periodical evaluation/measurement and notice board to communicate progress and issues to the community. Conduct Corporate Social Responsibility</td>
</tr>
<tr>
<td>Damaging effects of heavy vehicles on village roads.</td>
<td>There was discussion that the roads would be upgraded where heavy vehicles would be in use. The construction of a new access road should be considered a benefit for local people, to open up the isolated area.</td>
</tr>
<tr>
<td>Dust and noise generation during access road construction and transport to quarry from construction activities and safety to villagers</td>
<td>The response was that measures to reduce these impacts are addressed in the EMP through installation of noise barriers, tree plantings, landscaping, traffic safety measures, complaints system, and warning signs.</td>
</tr>
<tr>
<td>The Fisheries Service requested details about the potential for developing aquaculture activities in the reservoirs</td>
<td>The PLN’s response was that the reservoirs restrict aquaculture activities due to the rapid rise and fall of the water level.</td>
</tr>
<tr>
<td>Changes in cultural and social conditions that would arise. Local NGO’s were concerned about the adjustments from farming to aquaculture for example, after resettlement.</td>
<td>The response was that the resettlement program will involve training and pilot demonstrations to assist in the transition.</td>
</tr>
<tr>
<td>Impacts on groundwater</td>
<td>The response was that reservoirs may result in a local rise in groundwater levels.</td>
</tr>
<tr>
<td>The impacts on the use of the Cisokan River for irrigation via the Cihea scheme.</td>
<td>The response was that the scheme will not change the natural flow regime under operation and controlled discharges will meet downstream demands during filling of the reservoir.</td>
</tr>
<tr>
<td>Potential impacts on water quality from the reservoirs.</td>
<td>The response was to explain that there may be more scouring in the downstream channel due to the reduced sediment load, however higher nutrient status could be beneficial for irrigation.</td>
</tr>
<tr>
<td>The 500 kV transmission line will be dangerous for houses or land located underneath. People are concerned about air pollution and health problems</td>
<td>It was explained that 500 kV transmission lines are not dangerous for health.</td>
</tr>
</tbody>
</table>
The general conclusions in 2006 (PLN/Newjec Inc., 2007b) was that people are very aware of the project, because it has been planned since 1992, however through the long process of field studies and social surveys, there has not been a lot of certainty amongst the community about the project details. When people were interviewed or attended meetings and received detailed information, they were generally supportive of the project, and wished to remain informed and involved, and to receive adequate compensation for any losses they may suffer.

Consultation plans will continue during project implementation.

**XI. Budget**

Estimated costs for the implementation of the EMP are presented below in Table 2.

<table>
<thead>
<tr>
<th>No</th>
<th>EMP Component</th>
<th>Estimated Cost (US$)</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>Main Contractor - Implementation of Environment mitigation measures</strong></td>
<td>Estimated at 8% of total contract</td>
<td>To be built into Main Contractor's contract</td>
</tr>
<tr>
<td></td>
<td>• Safety &amp; Traffic Management</td>
<td></td>
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<td></td>
<td>• Grievance processes</td>
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<td></td>
<td>• Community Relations</td>
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<td></td>
<td>• Environmental quality monitoring</td>
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<td></td>
<td>• Capacity Training</td>
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<td>• Plan Monitoring and Review</td>
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<td>• Communication / Reporting to external agencies</td>
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<td>• Dam and Reservoir Management</td>
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<td></td>
<td>• Chance Finds Procedures and Cultural Property Salvage</td>
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<tr>
<td></td>
<td>• Biodiversity, Protected Areas and Revegetation</td>
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<tr>
<td></td>
<td>• Social and Community Relations</td>
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<tr>
<td></td>
<td>• Construction and Workers Camp Management</td>
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<td></td>
<td>• Transmission Line Environmental Management</td>
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<td></td>
<td>• Quarry management</td>
<td></td>
<td></td>
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<tr>
<td>2</td>
<td><strong>Engineering Supervision – environment aspect</strong></td>
<td>Estimated at 20% of total supervision costs</td>
<td>To be built into the contract for Engineering Supervision.</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>No</th>
<th>EMP Component</th>
<th>Estimated Cost ($US)</th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Safety &amp; Traffic Management</td>
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<td>Implementation &amp; Supervision</td>
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</tr>
<tr>
<td>3</td>
<td>Environmental Unit of PLN PHJ</td>
<td>$750,000</td>
<td>(5 years)</td>
</tr>
<tr>
<td></td>
<td>• Salary and bonuses</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Allowances and transports</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Institutional Strengthening, Training and Capacity Building</td>
<td>$200,000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• PMB environmental unit</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Local authorities, communities and other stakeholders</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• On-site training</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Offsite training</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Local capacity building</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Equipment and logistics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Technical Assistance to PMB environmental unit</td>
<td>$200,000</td>
<td>(2 years)</td>
</tr>
<tr>
<td></td>
<td>• Provision of outside consultants</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Manual of functions and procedures</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Assist in development of environmental database</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• EMP protocols and procedures</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Assist in development of PMB Environmental Unit</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Assist in implementation of updated management plans</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Contractor liaison</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• TORs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Independent Environmental Panel</td>
<td>$120,000</td>
<td>(4 years)</td>
</tr>
<tr>
<td>7</td>
<td>Chance Finds Procedures and Cultural Property Salvage</td>
<td>$20,000</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Biodiversity and Protected Areas</td>
<td>$300,000</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>EMP Component</td>
<td>Estimated Cost (US$)</td>
<td>Note</td>
</tr>
<tr>
<td>----</td>
<td>------------------------------------------------------------------------------</td>
<td>----------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>9</td>
<td>Watershed Management Plan</td>
<td>$200,000</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Additional Biodiversity Assessment (including River Habitat Management)</td>
<td>$80,000</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Additional Studies of river water discharge</td>
<td>$90,000</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Reservoir Land Clearance</td>
<td>Included in the LARAPs for reservoirs</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total EMP Costs (not including recurrent costs)</strong></td>
<td><strong>$1,960,000</strong></td>
<td></td>
</tr>
</tbody>
</table>

The total cost of the land acquisition and resettlement is estimated at US$74.46 million. PLN will finance all resettlement costs. The key cost categories are compensation for lost personal and public property, allowances for resettlement and relocation, site development, rehabilitation and livelihood improvement assistance, and the contractors and consultants costs needed to facilitate management, monitoring and grievance redress. Compensation rates are expected to be equivalent to replacement cost, as they are to be decided on the basis of independent appraisal valuations, through consultation with those affected, and be open to grievance redress. Site development cost estimates are being refined by an ongoing site assessment and design study. Total costs include a 5%, (3% for physical, and 2% for price) contingency.