SUMMARY INITIAL ENVIRONMENTAL EXAMINATION

January 2006

The Second Power Transmission and Distribution Project (Kampot to Sihanoukville 230 kV Transmission Line) in Cambodia

Asian Development Bank

CURRENCY

(as of 30 November 2005)

Currency Unit	–	riel/s (KR)
KR1.00	=	$0.00024
$1.00	=	KR4,120

ABBREVIATIONS

ADB	–	Asian Development Bank
AP	–	affected people
ASEAN	–	Association of Southeast Asian Nations
asl	–	above sea level
CITES	–	Convention on International Trade in Endangered Species of Wild Fauna and Flora
DCC	–	design and construction contractor
EDC	–	Électricité du Cambodge
EC	–	environmental coordinator
EMF	–	electromagnetic field
EMP	–	environmental management plan
IBA	–	important bird area
IEE	–	initial environmental examination
IMO	–	independent monitoring organization
IPP	–	independent power producer
IRC	–	Interministerial Resettlement Committee
IUCN	–	World Conservation Union
KCWMP	–	Kbal Chhay Watershed Management Project
KV	–	Kilovolt
MIME	–	Ministry of Industry, Mines and Energy
MOE	–	Ministry of Environment
NGO	–	nongovernment organization
NR	–	National Route
PDGMS	–	Power Distribution and Greater Mekong Subregion Project
PMO	–	project management office
ROW	–	right-of-way
RP	–	resettlement plan
SIEE	–	summary initial environmental examination
TA	–	technical assistance
UXO	–	unexploded ordnance

WEIGHTS AND MEASURES

km	–	kilometer
ha	–	hectare
MVA	–	megavolt-ampere (1,000 kilovolt-amperes)
kV	–	kilovolt (1,000 volts)
kWh	–	kilowatt-hour
MW	–	megawatt
GWh	–	gigawatt-hour

NOTE

In this report, “$” refers to US dollars.

CONTENTS

I. INTRODUCTION

1. Electricité du Cambodge (EDC) is investigating the feasibility of constructing a 230-kilovolt (kV) transmission line from a proposed substation at Kampot to Sihanoukville. The 77.7-kilometer (km) transmission line would be built under the proposed Second Power Transmission and Distribution Project (the Project), thereby underpinning local economic development. In the short to medium term, this line would deliver power from the national grid to Sihanoukville, improving the reliability of the supply. In the long term, it would enable the export of power from large generating plants planned near Sihanoukville to the capital, Phnom Penh. The proposed Project aims to facilitate international power transfers and stimulate equitable economic growth across the country.

2. Consultants, with the assistance of EDC, conducted the initial environmental examination (IEE) for the Project under technical assistance (TA)[1] financed by the Asian Development Bank (ADB). The Project is classified as environment category B.

3. Fuelwood is the primary source of energy for domestic use in Cambodia, while imported petroleum products are the main source of energy for commercial activities. The ASEAN Centre for Energy estimated that Cambodia's installed capacity was 145 megawatts (MW) in 2003, with annual production of electricity from all sources estimated to be 472 gigawatt-hours (GWh). Electricity supply is restricted to 22 small isolated power systems, divided between (i) Phnom Penh (150,000 customers) and six provincial towns served by EDC; and (ii) the remainder of the country served by the Ministry of Industry, Mines and Energy (MIME), or private companies under contract to MIME with unreliable supply and limited distribution. Cambodia imports only small quantities of electricity over medium-voltage electricity lines from Thailand and Viet Nam to border areas. Within Phnom Penh, EDC distributes 110 MW from its own generators and from independent power producers (IPP). Aside from electricity produced by the 12 MW Kirirom hydroelectric plant, EDC distributes power generated by imported heavy fuel oil or light diesel oil. As a consequence, electricity consumption is constrained by supply availability and price, with a high cost of mains electricity ranging between $0.09-0.27c/kWh across the country.

II. DESCRIPTION OF THE PROJECT

4. The high-voltage Kampot-to-Sihanoukville transmission line (Figure 1.1) component of the Project will facilitate the importation of electricity from Viet Nam to Sihanoukville. Viet Nam will supply electricity to this line via the Viet Nam-Phnom Penh line and the proposed Takeo-Kampot line. Electricity also will be supplied to selected villages near the proposed Veal Renh and Sokimex ridge substations, which are not serviced by mains electricity. Villages along the transmission line route probably will be supplied with electricity by a lower-cost single wire earth return line.

5. The high-voltage transmission line will consist of a 230 kV, double-circuit transmission line connecting to a 9.8 km, 22 kV distribution line that will provide the final connection into the city. Substations will be installed at Veal Renh and on Sokimex ridge, north of Sihanoukville.

6. The double-circuit, 230 kV line will comprise single aluminum steel-reinforced conductors, recommended to be hung from self-supporting steel lattice towers. The towers are likely to be between 34–40 meters (m) high, with an average span of around 350 m. The

[1] ADB. 2003. *Technical Assistance to the Kingdom of Cambodia for the Preparing the Power Distribution and Greater Mekong Subregion Transmission Project.* (TA 4078). Manila

conductors will be selected to provide 200 megavolt-amperes (MVA). The 230 kV line will be set within a 30 m wide right-of-way (ROW), where no structures will be permitted and vegetation will be restricted to 3 m high.

7. The conventional three-wire, 22 kV distribution line will be constructed on concrete poles. Poles will be about 13 m high and spaced at an average distance of 100 m.

8. Alternative options were considered for the transmission line route, line design, easement width, and line clearance, as well as the substation site, based on economic, engineering, environmental, social, and safety factors. The selected design options avoid environment impacts where possible, significantly minimizing the likely cumulative harm of the Project.

III. EXISTING ENVIRONMENT

A. Physical Resources

9. The proposed route crosses three types of landscape: coastal plain, riverine floodplain, and low hills. The initial 51 km of the route from Kampot is flat, ranging in elevation between 2 and 20 m above sea level (asl), while the final 27 km through the hills ranges in elevation from 5 to 120 m asl.

10. The climate of the project area is dominated by monsoons, described as tropical wet and dry due to a distinct seasonal variation. Approximately 70–80% of annual rainfall occurs during the southwest monsoon from mid-May to late September or early October, followed by a pronounced dry season from December to early May. Annual reported rainfall for Kampot is 2,148 millimeters (mm,) while Sihanoukville receives an average of 3,397 mm.

11. Geology along the transmission line route consists of Cenozoic pediments from Kampot to Kampong Chen (39 km); Cenozoic coastal plains on the Kampong Smach River floodplain (10 km); and generally Mesozoic sandstone above 10 m asl through the hills, with the lower sections of four valleys having Cenozoic tidal flat deposits and pediments. Within the Veal Renh to Stueng Hav valley are dispersive and highly erodible subsoils.

B. Ecological Resources

12. Land use/cover within the ROW is largely a function of soil type, and consists of grassland (41.4%), shrubland (16.1%), degraded/regrowth forest (17.4%), paddy (20.2%), riverine features (4.1%), roads and rail (0.5%), and settlement (0.3%). Grassland primarily consists of ground cover species on slopes of 0–5%, though it also supports low-growing shrubs of thin density, light dryland field cropping, and degraded land. Shrubland generally consists of dense shrubs between 1–3 m in height, commonly on footslopes where the forest has been removed or severely degraded. Degraded/regrowth forest ranges from highly degraded forest with scattered remnant trees among regrowth, to immature regrowth forest around 4–5 m in height containing only two forest layers and little species diversity. Paddy land is mainly used to grow a single annual crop of lowland rain-fed (wet season) rice, with fields left fallow for the remainder of the year.

13. More than 20 km of the proposed transmission line route crosses the southern part of the buffer zone of Bokor National Park (established in 1993) up to 1,100 m inside the park. This traversed landform consists of coastal plain and the lower end of three slopes of foothills.

Managed by the Ministry of Environment (MOE), Bokor National Park is classified as the equivalent of World Conservation Union Category II[2] or "a protected area managed mainly for ecosystem protection and recreation."

14. Diverse and endemic biota inhabit the southern half of the park, supporting three major vegetation zones: (i) tropical evergreen forests dominated by Dipterocarpaceae, from sea level to 500 m; (ii) tropical evergreen oak and tree fern (*Cibotum*) forest from 500 to 800 m; and (iii) short-montane evergreen forest above 800 m dominated by gymnosperms (*Dacridium* and *Podocarpus*), Myrtoceae, and Ericaceae (*Vaccinium*), interspersed with occasional sphagnum bogs or fens (Dy Phon, 1970). Land cover within the 60.9 hectares (ha) of the proposed ROW in the park consists of grassland (23.2 ha), degraded/regrowth forest (15.0 ha), shrubland (11.7 ha), dryland paddy (7.6 ha), and riverine features (3.4 ha).

15. Globally threatened fauna primate species found in the park are the Slow Loris (*Nycticebus coucang*), Pig-tailed Macaque (*Macaca nemestrina*), Pileated Gibbon (*Hylobates pileatus*), Asian Elephant (*Elephas maximus*), Guar (*Bos gaurus*), and Southern Serow (*Naemorhedus sumatrensis*).

16. Illegal forest harvesting and hunting continue to threaten the conservation values of the park. This includes cutting saplings for seaweed growing, extracting timber for construction, and burning wood to make charcoal. Some of these activities are highly organized, commonly using chainsaws. In 1997, IUCN estimated that 97% of the land use within the park was natural or seminatural, though this proportion appears to be diminishing Seng Kim Hout et al.,2003. Illegal commercial timber extraction has affected 80% of the park, according to some estimates. Air photo interpretation, recent site inspections, and discussions with park officers and local people suggest that forest degradation has occurred along the southern edge of the park over the past 10–13 years.

17. MOE, with the assistance of the nongovernment organization Wildaid, is enforcing land use restrictions in Bokor National Park. The enforcement program consists of active and systematic policing within the park by 50 full-time rangers equipped with essential equipment. This program is succeeding—111 people were caught harvesting forest products illegally in the park in 1 month (March 2005)—though substantial threats remain.

18. Two Important Bird Areas (IBA) Seng Kim Hout et al., 2003 are in the area. The Phnom Bokor IBA is within Bokor National Park, comprising semi-evergreen and evergreen forest above 400 m asl, thought to be the lower altitudinal limit of the Chestnut-headed Partridge (*Arborophila cambodiana*). Lower elevations along the Tuek Chhu River support the Lesser Fish Eagle (*Ichthyophaga humilis*). This IBA is also known to support the Green Peafowl (*Pavo muticus*) and Great Hornbill (*Buceros bicornis*). All four species are listed as globally threatened. The Stung Kampong Smach IBA consists of the Kampong Smach River estuary and adjacent foreshore areas, extending along the coast from 3 km east of Preak Thnot (eastern end) to Kaoh Khyang village (western end). Approximately 10 km of the proposed route crosses the northern (inland) side of this IBA. This IBA does not have protected area status. However, it is important habitat for migratory birds, including the Asian Dowitcher (*Limnodromus semipalmatus*), as well as large waterbirds during nonbreeding season, such as the Lesser Adjutant (*Leptoptilos javanicus*), Painted Stork (*Mycteria leucocephala*), Milky Stork (*M. cinerea*), and Spot-billed Pelican (*Pelecanus philippensis*). All are listed as globally threatened.

[2] *National Environmental Action Plan 1998-2002*, 1998.

Much of the bird habitat within the IBA, including mangroves and intertribal mud flat, has been converted into use for human activities, such as agriculture or fish ponds.

19. The transmission line ROW has relatively little native wildlife, primarily due to the low habitat value of the vegetation. No rare or endangered mammals or birds are known to inhabit the ROW. The field survey observed 20 common bird species along or near the proposed transmission line route, while seven globally threatened bird species were reported in the area. Villagers commonly hunt and fish in the area.

C. Economic Development

20. Land along the route is primarily rural, with small areas of urban settlement near the route on the outskirts of Kampot and at Veal Renh. Farming includes dryland paddy on a limited area of land with better soil (one crop per year of lowland wet season rice on approximately 20% of the ROW), dryland field cropping, and grazing. Coastal fishing is the main source of income source for villages along the coastal plain, while some practice fish farming in man-made ponds in the area.

21. The local economy is rurally based, except in Kampot, Veal Renh, and Sihanoukville. Fishing and farming are the primary occupations. Annual household incomes are low, averaging a reported $2,560. The average number of years of school attended was about 5.

22. Rural villagers near the route have no mains electricity supply. However, many households consume a small amount of electricity derived from recharged wet cell batteries. The main source of energy is biomass, dominated by the burning of fuelwood, charcoal, and agricultural residue.

23. Road transport in the project area is primarily on national routes 3 and 4 (NR3 and NR4), the main arteries in the region. NR3 runs from Phnom Penh via Kampot to Prey Nob, where it terminates at an intersection with NR4. NR4 runs from Phnom Penh via Kampong Speu to Sihanoukville. From Veal Renh to Sokimex ridge, the transmission line route stays within 2 km of Oil Factory Road, an dirt road that has been under construction since 2001.

D. Social and Cultural Resources

24. The proposed transmission line route crosses Kampot Province (31 km) and Sihanoukville Province (47 km), traversing four districts and 11 communes. The settlement pattern in rural areas crossed by the transmission line route consists of (i) scattered houses on the outskirts of Kampot and along Oil Factory Road; (ii) some major villages along NR3 (e.g., Kilou Dabpir, Kaoh Touch, Changhaon, Preaek Tnaot, Trapeang Ropov) or nearby (Tuek Llak, Sameakki); and (iii) linear settlement on both sides of NR4 at Veal Renh. The major population centers of Kampot and Sihanoukville have 37,000 and 176,000 people, respectively.

25. The transmission line route is not near any historic sites. Thom Da Wat, the only significant temple near the route, is 400 m south of the route and more than 500 m southwest of the Veal Renh substation site.

IV. SCREENING OF POTENTIAL ENVIRONMENTAL IMPACT AND MITIGATION MEASURES

26. The rapid environmental assessment checklist for power transmission projects (ADB, 2003) was used to indicate environmental impacts that are likely to result from line construction or operation the main impacts identified are for the project partly within a protected area (in the Bokor National Park buffer zone); project crossing mangroves; project crossing estuarine areas; and involuntary resettlement and land acquisition of project affected people (AP).

A. Land Acquisition

27. The transmission line will require the acquisition of an estimated 4.0 ha of land, comprising 2.2 ha for tower sites, less than 0.1 ha for pole sites, and 1.7 ha for the two substation sites. Permanent land use will change on approximately 2.2 ha (0.4 ha for tower footings, 0.1 ha for pole sites, and 1.7 ha for substations). Affected households generally will lose a relatively small area of the household cultivatable landholding (estimated at around 4%) through land acquisition. However, the two affected landowners of the substation sites will lose 30% (Veal Renh) and 0.4% (Sokimex ridge) of their reported large site landholdings, respectively. Compensation for acquired land will be at replacement cost at current market value based on land capability. Cropping on tower sites will be permitted to continue.

B. Resettlement

28. The transmission line ROW was selected to avoid settlements, though 12 houses will require relocation. Seven of these structures probably will be relocated outside the ROW on the same parcel of land, while five will relocate to other sites within the same villages. Therefore, the host communities will not be impacted. Compensation for houses, other buildings, and facilities will be at replacement cost, in cash or in kind, for materials and labor, with no deduction for depreciation or salvageable materials. Affected households can reuse salvaged materials. Relocating households also will be paid a disturbance and transportation allowance to cover the cost of moving possessions and new and salvaged materials, as well as a cost of living allowance during the transition period. Further, vulnerable households will be provided with a special allowance and other assistance, as needed, to help them to improve their preproject socioeconomic status.

C. Tree Removal

29. Trees above 3 m height within the ROW, as well as large trees immediately adjacent to it that could fall and damage line structures, will be removed or pruned to establish safe line clearance distances. This will involve the removal or pruning of 40.5 ha of degraded/regrowth forest within the ROW, as well as the cutting of shrubs above 3 m high on 37.5 ha of shrubland. Trees that can survive pruning to less than 3 m height will be retained and pruned. Vegetation removal by hand is preferable to clearance by machine, because of the job creation. Pruning will be done by hand. Seedlings will be provided to replace lost trees. Compensation for removed timber and fruit trees will be calculated based on tree type, age, and annual produce value, multiplied by a 5-year factor to compensate for loss of income until the newly planted seedlings bear fruit. Pruning of trees will be favored over removal where appropriate. Cleared vegetation will be made available to the owner for use.

D. Land Use Restrictions and Disruption

30. Land use will be restricted on all land within the ROW. Rural land capability will be reduced by restricting trees to 3 m height in the ROW and to appropriate heights adjacent to it, while urban land capability will be reduced by prohibiting structures. Compensation will be paid

to offset the devaluation of land within the ROW due to reduced land capability as a result of building prohibition, based on current or future land capability

31. During construction and maintenance of some lines, farming will be disrupted and crops, bunds, canals, and drains will be disturbed along the route where permanent roads do not exist (primarily on the Kampong Smach River floodplain). Established roads and tracks will be used wherever possible, though a temporary 3–4 m wide accessway will be required to most tower/pole sites during construction. Where paddy land does not have any tracks, short sections of paddy bunds and drain/canal embankments will be removed temporarily or filled, then reinstated once construction has been completed. Temporary concrete batching plants will be set up on disturbed or lower-value production land (e.g., grassland), where possible. Construction on cropping land will be timed to avoid the disturbance of field crops within 2 months before harvest, where possible. Compensation will be paid for the loss of any crops not harvested, and based on opportunity lost at current market value during the period of temporary acquisition. Land will be returned fully restored or improved.

E. Habitat Loss and Impact on Wildlife

32. Habitat removal will entail mainly the clearing of 40.5 ha of degraded/regrowth forest (15 ha within the Bokor National Park buffer zone) to a height of 3 m or less within the ROW, as well as the removal of some large adjacent trees within 15 m of the ROW. The forest to be removed is highly degraded, with few mature trees (due to continual forest use) and generally only two forest layers. Existing forest regrowth is unlikely to reach maturity due to ongoing harvesting and periodic burning. The clearing of forest will have a minor adverse impact on local vegetation communities and biodiversity. No species identified in the ROW were listed on the IUCN Red List of Threatened Species, although four species identified as immature specimens meet CITES[3] criteria for Appendix I. *Calophyllum calaba* (local name = *Pha-Ong,* belonging to the mangosteen family)*, Dehaasia cuneata* (local name = *Nieng Phaek), Diospyros bejaudi (*local name = *Ongkot-Khmao,* belonging to the Ebony family)*, Peltophorum dasyrrhachis (*local name = *Trasek), Calamus spp.* (local name = *Phdav, Rattan), Diospyros pilosanthera (local name = Tra Yeung, belonging to the Ebony family), Shorea siamensis (local name = Rieng Phnom, belonging to the Meranti family), Swintonia pierrei (local name = Svay Kondor), Dehaasia cuneata, Diospyros bejaudi, Peltophorum dasyrrhachis,* and four other species meet CITES Appendix II criteria (*Calamus spp., Diospyros pilosanthera, Shorea siamensis,* and *Swintonia pierrei*).

33. The impact on wildlife within the ROW will be minor. No significant habitat will be removed, and relatively little native wildlife and no species of high conservation value are known to live within the ROW. The linear clearance of a 30 m wide strip of habitat allows most species to migrate to adjoining areas. Significant coastal bird species found in the study area are not known to inhabit sites along the proposed transmission line easement. Rare forest bird species, such as Great Hornbill, Green Peafowl, and Chestnut-headed Partridge, generally inhabit evergreen forest that grows at elevations above 400 m, which are at least 3 km from the proposed route. The one exception is on Phnum Roluos, which has a small area of forest above 400 m within 1 km of the route.

[3] The CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) Appendices I, II, and III are lists of species afforded different levels of protection. Appendix I lists species that are the most endangered and are threatened with extinction. Appendix II lists species that are not necessarily threatened with extinction but that may become so unless trade is closely controlled. The IUCN Red List Criteria is slightly different from the CITES Listing Criteria in using numerical valves (of population sizes, or changes of rate of decline) etc. as guidelines rather than thresholds, while the IUCN Red List of threathened species may have overlap with the CITES Appendix I and II species based on the uncertainty.

34. Fauna deaths from flight or electrocution are difficult to quantify, though losses of individual birds are unlikely to be detectable at the population level. Installation of screens to prevent monkeys and other arboreal mammals from climbing towers will be considered in the design. A monitoring program will be undertaken to determine the occurrence of fauna deaths during line operation, with additional measures implemented as necessary. Construction workers will be prohibited from harvesting fuelwood or other tree products in the project area during their employment.

F. Protected Area Impact

35. Detailed planning of the 230 kV route along the narrow coastal strip between the steep mountain slopes in Bokor National Park and the Gulf of Thailand resulted in the proposal for a low-impact transmission line route that is economically viable and has minimum biophysical and social impacts, despite a 20.3 km section crossing the edge of the Bokor National Park buffer zone. The route through the park was selected over alternatives across the coastal plain because it will (i) create the least visual impact, (ii) cross fewer tidal areas, (iii) involve the resettlement of the fewest households, and (iv) provide greater line reliability due to lower salt pollution of the line. The main adverse environmental impact of this section of the route will be the clearing of 15 ha of degraded/regrowth forest in the park buffer zone, which is considered insignificant. The visual impact will be minimized by locating the route close to the change of slope at the rear of the coastal plains, and by avoiding ridgelines whenever possible to allow the towers and conductors to be partially hidden by the backdrop of the vegetated Bokor mountains.

36. Approximately 3.1 km of the proposed 230 kV route will cross the upper Kbal Chhay watershed. The removal of vegetation above 3 m height within the ROW will affect 5.5 ha of land under trees, comprising 0.7 ha of forest plantations, 3.5 ha of evergreen forest regrowth, and 1.3 ha of medium-density evergreen forest. The removal of this vegetation is expected to have minimal impact on the watershed and downstream water quality, as most ground cover will remain intact and the area will be revegetated following construction with low-growing species.

37. Transmission line construction in the Bokor National Park buffer zone and Kbal Chhay watershed will require approval from the MOE and Forestry Administration, respectively. The Department of Nature Conservation and Protection of the Bokor National Park management and the Forestry Administration of Kbal Chhay Watershed Management Project (KCWMP) will continue to be consulted on the proposed location of the route, ROW vegetation clearance, compensatory tree planting, and revegetation species to be used within the ROW during project planning. All vegetation clearance and track construction in the Bokor National Park buffer zone and Kbal Chhay watershed will be undertaken in the presence of designated officers from the park and the KCWMP, respectively.

G. Greenhouse Gas Emission and Airborne Pollutant Reduction

38. Net greenhouse gas and airborne pollutant emissions will be reduced by replacing Sihanoukville fossil fuel generation with electricity generated largely by hydroelectric plants in Viet Nam. This will improve air quality near the generating plant in Sihanoukville, where emissions from the combustion of light diesel oil currently are released.

H. Soil Erosion

39. Soil erosion from project activities generally will be minor along the initial 50 km of the route due to the low slope of land. The disturbance of land through the hills might cause minor to moderate erosion due to greater slopes and highly dispersive subsoils. Construction activities that cause significant ground disturbance (i.e., substation land forming) will not be undertaken

during the monsoon season (mid-May to October), while care will be taken to ensure minimal ground disturbance. Topsoil will be added to substation banks, which will be revegetated immediately following land forming.

I. Pollution

40. Local water sources are susceptible to pollution from accidental spills of hazardous construction materials and from contamination by the workforce. In addition, the accidental release of transformer oil in substations can contaminate soil and water. Construction fuel and other hazardous materials will be stored securely above flood level and at least 20 m from any body of water, watercourse, canal, or storage pond. Substations will be constructed above flood level. Substation transformers will be within secure and impervious areas surrounded by bunds, with a storage capacity of at least 110% of the oil capacity in transformers and associated reserve tanks. Drainage flame traps with oil/water separators will be installed.

J. Noise

41. Construction will generate noise for only a short duration at any particular site along the transmission line route in predominantly rural locations. Therefore, the impact will be minor. Construction will be undertaken only during daylight hours, and local communities will be informed of the construction schedule in advance. Temporary concrete batching plants will be located away from residences where possible.

42. High-voltage transmission lines can develop a “corona effect” caused by the ionization of air around the conductors, insulators, and hardware, which produces low-level noise. Line design will comply with international standards on electromagnetic interference.

K. Historic and Religious Sites

43. No historic site is near the proposed route. The nearest significant religious site to the proposed route, Thmor Da Wat, is 400 m from the transmission line at the nearest point, and more than 500 m from the Veal Renh substation site.

L. Health Hazards

44. The temporary influx of 80 construction workers into the project area might create health hazards, potentially raising the number of cases of sexually transmitted disease in rural communities. The design and construction contractor (DCC) will distribute information on STDs, focusing on HIV/AIDS[4], to staff at the start of duties. General construction activities also pose safety risks, though this will be addressed in an occupational health and safety plan prepared by the DCC and by staff training. The ROW might have mines and unexploded ordnance (UXO), though they will be investigated and cleared before construction in each area. Where towers are close to settlements, fences, signs, and/or guard structures on towers will be used to dissuade people from climbing them. High-strength, low-frequency electrical and magnetic fields (EMF) generated by the line will be very low and well within an acceptably safe level. (National Health and Medical Research Council, Australia, 1989). The setback of dwellings to the substations will be designed in accordance with the standards of the International Non-Ionizing Radiation Committee of the International Radiation Protection Association (IRPA/INIRC) to ensure that EMF exposure is within safe limits.

M. Secondary Project Benefits

45. Secondary project benefits will include construction employment, peaking at around 80 people over 24 months, with the majority coming from the project area. The DCC will consider

[4] Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome

labor-intensive construction methods, and at least 50% of unskilled workers will be sourced from the project area. EDC will award ROW vegetation maintenance contracts to local village-based contractors where a time or cost penalty is not likely to be incurred.

N. Regional Impact

46. The construction and operation of the proposed high-voltage transmission line will not generate any significant adverse regional impacts. The main adverse regional impacts of the development are considered minor. In particular, the loss of 15 ha of high degraded habitat within the buffer zone of the 140,000 ha Bokor National Park is insignificant, as the compensatory tree planting defined in this IEE is undertaken to offset the loss of habitat.

47. The greater and more reliable electricity supply, at a cheaper price, will be a significant positive regional benefit of the Project. Improved electricity supply is likely to promote medium- to long-term economic activity in Sihanoukville, where population growth is expected to increase substantially.

O. Cumulative Impact

48. The transmission line will increase the cumulative impact of infrastructure and other developments in the area, though not significantly. The main recent and current local infrastructure developments are (i) the upgrading of NR3 between Kampot and Prey Nob; (ii) the construction of Oil Factory Road in the Veal Renh to Stueng Hav valley; and (iii) port development, other commercial development, and new housing in Sihanoukville. These developments have a combined estimated footprint exceeding 100 ha, and involve complete site disturbance. Although the transmission line ROW footprint is large (233 ha), most of this area will remain undisturbed and land use will not change.

49. The cumulative impact of the line, relative to current and proposed non-infrastructure activities in the area with similar impacts, will be minor. The clearing of 40.5 ha of degraded/regrowth forest and 37.5 ha of shrubland along the route is an insignificant addition to the overall degradation and net loss of forest that is occurring and proposed for land development within, and to the north and south of, the Veal Renh to Stueng Hav valley. For example, one proposed development in the Veal Renh to Stueng Hav valley is the clearing of more than 7,000 ha for plantation development. An estimated 60–75% of the development area is forest and shrubland.

V. INSTITUTIONAL REQUIREMENTS AND ENVIRONMENTAL MONITORING

50. The DCC will have primary responsibility for environmental management of the Project in accordance with the management measures proposed in the IEE and the construction environmental management plan (EMP). EDC will oversee implementation of the Project, and will implement the resettlement plan (RP).

51. The DCC will prepare the construction EMP, providing detailed practical and site-specific mitigation measures (e.g., identification of sources of fill for the substation areas and revegetation species to be used). These will be based on the measures contained in the IEE, which are summarized in Table 1. An environmental coordinator (EC) will be appointed with adequate qualifications to monitor the implementation of site-specific mitigation measures, such as (i) inspecting DCC-marked ROW clearance areas and trees to be cleared, and other vegetation clearance activities; (ii) conducting post-clearance inspection; (iii) inspecting each DCC-nominated access route before construction; (iv) conducting post-construction inspection on rehabilitation; and (v) carrying out other supervision tasks as described in the EMP.

Table 1. Summary of Mitigation Measures

Project Activity	Potential Environmental Impact	Proposed Mitigation Measure	Institution Responsible	Cost Estimate ($)[a]
Pre-Construction				
Transmission line and substation design	Fauna deaths (from line operation)	• Measures to minimize bird deaths associated with line operation near wetlands considered and, where appropriate, incorporated into final design. Measures considered will include silhouettes of birds of prey attached to conductors/earth wires, markers attached to wires to improve line visibility, and modifications to mitigate electrocution.	DCC	0
		• Screens to prevent monkeys and other arboreal mammals from climbing towers considered and, where appropriate, incorporated into the final design.	DCC	0
	Safety hazards	• All work sites certified as being clear of mines/unexploded ordnance before the start of construction activities.	DCC	80,000
		• Setback of dwellings to substations designed in accordance with IRPA/INIRC standards to ensure that electromagnetic field exposure is within safe limits.	DCC	0
			DCC	0
		• The use of marker balls on conductors considered and, where appropriate, incorporated in the final design to improve the visibility of conductors where air traffic is most likely (i.e., National Route 3 and National Route 4 crossings where an emergency landing might occur) and on longer spans (e.g., crossing watercourses), but not within or near Bokor National Park.	DCC	0
		• Preparation of an occupational health and safety plan, and provision of related training and instructions to all staff, before each person begins duties.	DCC	0
	Radio and TV interference	• Transmission line design to comply with the limits of electromagnetic interference from overhead AC power lines and high voltage Equipment Installations AS/NZS 2344: 1997 or an equivalent international standard.	DCC	0
		• All line conductor fittings, vibration dampers, tension clamps, and other line components designed to avoid sharp corners or projections that would produce high electrical stresses. Adjacent metal parts and mating surfaces designed to prevent corrosion of the contact surfaces and maintain good electrical contact under service conditions.	DCC	0
Acquisition of tower and substation sites	Loss of private land	• Fair compensation for acquired land based on land capability and current market rates.	EDC	148,200
Royalty for route crossing Bokor National Park	-	• Annual $15,000 royalty (indexed against inflation) paid to Bokor National Park over the first 10 years of transmission line life to offset impact. Royalty to be used for park management.	EDC	150,000

Project Activity	Potential Environmental Impact	Proposed Mitigation Measure	Institution Responsible	Cost Estimate ($)[a]
Construction				
Easement establishment	Removal of houses and loss/removal of assets located within the easement, relocation of households	• Replacement of houses, other buildings, and facilities with structures constructed to a similar standard of the existing facilities (including fences and wells).	EDC	74,900
		• Replaced structures located, in order of preference, on the existing landholding outside the right of way, on a replacement block of land in the vicinity of the original building, or at a similar site agreed on with the owner.	EDC	0
		• Relocated households to retain title over their existing ROW land (except tower and substation sites), despite being compensated with a house block and a tree and garden area, thereby gaining additional land for garden production or similar.	EDC	0
		• Relocation expenses and allowances paid to affected households to cover the cost of moving possessions, and the cost of living and disturbance during relocation.	EDC	18,100
		• Building materials from structures removed from the ROW made available to the relocating household for its use. Materials not wanted by the household to be disposed of at the request of the owner.	EDC	0
Easement tree clearance, line, and substation construction	Disruption to cropping activities, crop damage or loss, damage to bund walls, canals, and drains	• Construction techniques and machinery selection seeking to minimize ground disturbance.	DCC	0
		• Construction activities on cropping land timed to avoid disturbance of field crops within 1 month of harvest, wherever possible.	DCC	0
		• Compensation for lost production paid for crops disturbed before harvest based on area of disturbed crop, market price, and agreed yield.	EDC	12,000
		• Established roads and tracks used for construction and maintenance access to the line wherever possible.	DCC	0
		• New access ways restricted to a single carriageway width within the ROW unless more direct and lower impact access can be gained.	DCC	0
		• Temporary placement of fill in drains/canals not undertaken where impeded drainage could cause flooding or damage.	DCC	0
		• Fill temporarily placed in drains/canals removed and excavated drain/canal embankments reinstated immediately following the required construction access.	DCC	0

Project Activity	Potential Environmental Impact	Proposed Mitigation Measure	Institution Responsible	Cost Estimate ($)[a]
		• Temporary concrete batching plants located on disturbed sites/areas of low production potential (e.g. grassland) where possible, with only officially licensed plants permitted.	DCC	0
Easement tree clearance	Loss of, and damage to, trees and habitat loss	• Trees up to 3 m height retained within the ROW.	DCC	0
		• Trees that can survive pruning to less than 3 m height pruned instead of cleared.	DCC	0
		• Marking of vegetation to be removed before clearance, and strict control on clearing activities to ensure minimal clearance.	DCC	0
		• Felled trees and other cleared or pruned vegetation (wood, branches, and foliage) retained by owner of the vegetation for his/her use, or removed if requested by owner.	DCC	0
		• Compensation for tree removal or pruning paid at fair market value based on tree type and age.	EDC	100,600
		• Transmission line construction workers prohibited from harvesting or collecting fuelwood or other tree products in the project area during their employment, apart from locally employed staff continuing current legal activities.	DCC	0
Excavation of tower foundations	Land disturbance and reduced land capability	• Spoil from tower footings disposed of by placement along roadsides, or at nearby house blocks if requested by landowners, to improve these features.	DCC	0
Concrete batching	Airborne dust and noise in localized areas	• Temporary concrete batching plants located away from residences to reduce the potential for dust and increased in inhabited areas.	DCC	0
Construction activities	Erosion and sedimentation	• Construction activities involving significant ground disturbance (i.e., substation land forming) not undertaken during the monsoon season (mid-May to October).	DCC	0
		• Tree clearance for easement establishment to only involve cutting trees off at ground level or pruning as appropriate, with tree stumps and roots left in place and ground cover (i.e., grass and low shrubs) left undisturbed as far as possible.	DCC	0
		• Substation embankments provided with topsoil and planted with a cover crop and perennial ground cover species immediately following final land forming to stabilize the surface.	DCC	0

Project Activity	Potential Environmental Impact	Proposed Mitigation Measure	Institution Responsible	Cost Estimate ($)[a]
		• Fenced substation compounds to include fill embankments to ensure that ground cover is protected from overgrazing or harvesting.	DCC	0
		• Excess fill from tower foundation excavation disposed of at substation sites or by land forming next to roads or around houses, in agreement with the local community or landowner. All land formed areas provided with topsoil (if available) and seeded with a cover crop and perennial grass mix.	DCC	0
		• Borrow areas revegetated by seeding bare areas with cover crop and perennial grass.	DCC	0
	Water quality decline and soil contamination	• Fuel and other hazardous materials securely stored above flood level and at least 20 m from any body of water, watercourse, canal, or storage pond.	DCC	0
	Noise	• Construction only undertaken during the day, and local communities informed of the construction schedule.	DCC	0
	Safety hazards	• Public health information provided to the construction workforce before the start of on-site work, primarily covering the prevention of Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome.	DCC	0
		• Construction workforce facilities to include proper sanitation, water supply, and waste disposal facilities.	DCC	0
		• Safety fences and/or metal guard structures installed around/on towers to dissuade people and wildlife from climbing the towers. Warning signs installed on all towers.	EDC	0
Construction activities in protected areas	Impact on Bokor National Park	• Consultation with the Department of Nature Conservation and Protection/Bokor National Park management regarding the proposed location of the route, ROW vegetation clearance, compensatory tree planting, and ROW revegetation species. Compensatory plantings and ROW revegetation species approved by the park before implementation.	EDC	0
		• Marking of the ROW clearance area, any individual trees to be removed outside the ROW and temporary access track locations, then approval sought and gained from Bokor National Park management before start of clearing/track construction.	EDC & DCC	0
		• All vegetation clearance and track construction in Bokor National Park undertaken in the presence of a designated officer from the park.	DCC	0

Project Activity	Potential Environmental Impact	Proposed Mitigation Measure	Institution Responsible	Cost Estimate ($)[a]
		• No construction within the park during the monsoon season, from mid-May to early October, to minimize ground disturbance and erosion.	DCC	150,000-
		• Construction workers prohibited from hunting and collecting forest products at any sites.	DCC	0
		• Temporary access tracks kept to a minimum by the use of established tracks or across open grassland wherever possible.	DCC	0
		• ROW and temporary access tracks revegetated immediately following construction, using local vegetation species and a revegetation method approved by the Ministry of Environment.	DCC	0
		• Tower foundation spoil to be removed from the park and disposed of elsewhere.	DCC	0
		• No construction facilities (camps, workshops, concrete batching equipment, material stockpiles. etc.) permitted within the park.	DCC	0
		• No water drawn from streams inside the park.	DCC	0
		• Replanting of 15 ha of trees outside the ROW within the park to compensate for the loss of ROW trees, as approved by park management.	EDC	37,500
	Impact on Kbal Chhay watershed	• Consultation with Kbal Chhay Watershed Management Project regarding the proposed location of the route, ROW vegetation clearance, compensatory tree planting, and revegetation species to be used within the ROW.	EDC	0
		• Marking of the ROW clearance area, any individual trees to be removed outside the ROW, and temporary access track locations marked. Approval sought and gained from the KCWMP before the start of clearing or track construction.	EDC & DCC	0
		• All vegetation clearance and track construction in the Kbal Chhay watershed undertaken in the presence of a designated officer from the KCWMP.	DCC	0
		• Tree clearing within the Kbal Chhay watershed undertaken by hand, and ground disturbance minimized.	DCC	0
		• The revegetation of cleared areas within the ROW with species not exceeding 3 m height, and revegetation of temporary access tracks, as approved by the KCWMP.	DCC	0
		• Replanting of 5.5 ha of trees outside the ROW within Kbal Chhay watershed to compensate for the loss of ROW trees, as approved by the KCWMP.	EDC	13,800

Project Activity	Potential Environmental Impact	Proposed Mitigation Measure	Institution Responsible	Cost Estimate ($)[a]
Operation and Maintenance				
Maintenance of line clearances	Land use restriction	• One-off compensation payment paid to affected landowners to offset the devaluation of land within the ROW due to reduced land capability as a result of building prohibition. Payment based on current or future land capability, depending upon the site.	EDC	To be considered
Line operation	Permanent land use change beneath towers	• Landowners permitted to grow cereal crops under the 230 kilovolt towers.	EDC	0
	Fauna deaths	• Monitoring program undertaken to determine the occurrence of fauna deaths (birds and mammals) associated with the transmission line. Additional mitigation measures considered if fauna deaths unacceptably high.	EDC	0
	Radio and Television interference	• Care taken during the handling of conductors and fittings to ensure smooth surfaces are kept free of abrasion.	DCC	0
Substation operation	Soil and water contamination from equipment leakage	• Substations to be constructed on flood-free land.	DCC	0
		• Substation transformers located within secure and impervious areas surrounded by bunds, with a storage capacity of at least 110% of the capacity of oil in transformers and associated reserve tanks. Drainage flame traps with oil/water separators installed.	DCC	0

DCC = design and construct contractor; EDC = Electricité du Cambodge; EMF =electromagnetic field; HIV/AIDS= Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome; IRPA/INIRC = International Non-Ionizing Radiation Committee of the International Radiation Protection Association; KCWMP = Kbal Chhay Watershed Management Project; kv kilovolt; NR = National Route; TV = television; UXO = unexploded ordnance

[a] Land acquisition and compensation costs include a 20% contingency. All costs rounded to nearest thousand.

Source: ADB staff and consultants, 2005

52. Cost of the proposed environmental compensation, monitoring, and capability strengthening is estimated at $440,800, with a provisional budget of $51,300 for compensatory planting of trees confirmed by EDC, as summarized in Table 2.

53. EDC's current capacity to implement the EMP and RP requirements is limited due to the part-time staffing of the Environment and Social Unit on a needs basis. The staff also have limited experience in environmental management and resettlement. EDC will employ two trained technical specialists during the Project to manage the core specialist functions of the unit, environmental management and resettlement management, thus strengthening these technical competencies. The cost of hiring and training an environmental specialist to implement the mitigation and monitoring activities in the EMP by EDC is in Table 2.

Table 2: Cost Estimate for EMP Implementation and Monitoring

Item	Sub-Item	Number/ Period	Cost Per Unit ($)	Total Cost ($)
Implementation of Mitigation Measures	Bundling of substations and flame trap installation	2	13,000	26,000
	Mine/UXO inspection within ROW and clearance (if required)[a]	233 ha inspect	0	80,000
	Staff occupational health and safety training	6 days	120/day	700
	Provision of public health information	0	0	2,500
	Royalty to Bokor National Park	10 years	15,000	150,000
Monitoring[b]	Environmental Coordinator	1 x 12 months	80,000 pa	80,000
	Local environmental coordinator	1 x 24 months	3,500 pa	7,000
	Local authority subcommittees[c]	2 days/month x 26 months	80/day	4,200
	Commune councils[c]	2 days/month x 26 months	80/day	4,200
	Complaints and Grievance Committee[c]	2 days/month x 26 months	80/day	4,200
	Independent monitoring organization	6 days/month x 26 months	120/day	18,700
Capability Strengthening	EDC environment specialist	1 x 40 months	3,000 pa	12,000
Provisional Mitigation Measures	Compensatory planting of trees within Bokor National Park	15 ha	2,500/ha	37,500
	Compensatory planting of trees within Kbal Chhay watershed	5.5 ha	2,500/ha	13,800
Total				**440,800**

EDC = Electricité du Cambodge; ROW = right of way; UXO = unexploded ordnance.

[a] The extent of mine/UXO clearance required cannot be estimated accurately. Although no ordnance is known to be within the ROW, it might be present.

[b] Only the costs of positions solely or mainly relating to the implementation of environmental or social measures or DCC staff have been estimated. project management office as these inputs are primarily for line construction, while the Interdepartmental Committee does not incur a cost.

[c] Committees and councils are assumed to consist of four members, with each member receiving a payment of $15/day.

Source: ADB staff and consultants, 2005

54. The environmental coordinator will monitor the principal biophysical impacts relating to project construction before, during, and after construction to approve proposed works and ensure compliance with EMP conditions. The impacts include clearance/pruning of trees, temporary establishment of site access, and disturbance within the Bokor National Park buffer zone and the Kbal Chhay watershed. The DCC's construction activities on any section of the line will not start until the environmental coordinator has issued the necessary approvals, including approval to undertake tree clearance/pruning along each section of the ROW and the construction of each temporary access way.

55. Project monitoring will be undertaken in accordance with the requirements summarized in Table 3. The DCC will conduct internal construction EMP compliance audits monthly, while the Independent Monitoring Organization (IMO) will conduct formal external construction EMP audits every 2 months. These will be attended by the DCC, which will identify any nonconformance and provide appropriate corrective actions, as applicable. The IMO comprises 2–3 professional experts appointed by EDC to monitor and verify the implementation of the EMP and RP, especially verifying that compensation and mitigation measures have been implemented correctly. The IMO also will handle the grievance procedures to ensure concerns of the APs are addressed, and will report to the EDC/ADB through the EC.

56. The EC will provide the initial EDC and IMO staff training. Early in the preconstruction phase of project development, the EC will prepare and carry out a 3–4 day workshop, covering standard environmental management requirements and resettlement principles, policy, planning, and implementation procedures. The EC will prepare a summary operational manual covering the workshop subjects for field use by EDC staff and the IMO. Further, the EC will monitor and provide supervising comments to EDC and ADB on the performance of the DCC, and what management tools and capacities that EDC environmental specialists need.

Table 3: Summary of Mitigation Requirements

Proposed Mitigation Measures	Parameter To Be Monitored	Location	Measurement	Frequency	Institution Responsible	Cost Estimate ($)
Pre-Construction						
• Measures to minimize bird deaths associated with line operation near wetlands considered and, where appropriate, incorporated into the final design. Measures considered will include silhouettes of birds of prey attached to conductors, markers attached to wires, and modifications to mitigate electrocution.	Line design	Office	Measures incorporated into design or rationale for not incorporating	Once	DCC	0
• Screens to prevent monkeys and other arboreal mammals from climbing towers considered and, where appropriate, incorporated into the final design.	Line design	Office	Measures incorporated into design or rationale for not incorporating	Once	DCC	0
• All work sites certified as being clear of mines/UXO before the start of any construction activities.	Mine/UXO survey and clearance	ROW & substations	Certification and proof of clearance	Once	DCC	80,000
• Setback of dwellings to substations designed in accordance with International Non-Ionizing Radiation Committee of the International Radiation Protection Association (IRPA/INIRC) standards to ensure that EMF exposure is within safe limits.	Substation location	Office & substations	Setback distances to nearest houses	Once	DCC	0
• The use of marker balls on conductors considered and, where appropriate, incorporated in the final design to improve the visibility of conductors where air traffic is most likely and on longer spans.	Line design	Office	Measures incorporated into design or rationale for not incorporating	Once	DCC	0
• Preparation of an Occupational Health and Safety Plan and provision of related training and instructions to all staff before each person starts duties.	OH&S Plan and staff training	Office and field	OH&S Plan satisfactory and adequate training received by all staff	Every month prior to/ during construction	DCC	0
• Transmission line design to comply with the limits of electromagnetic interference from overhead AC power lines and high voltage equipment installations AS/NZS 2344: 1997 and equivalent international standards.	Line design	Office	Line design compliance with relevant standards	Once	DCC	0

Proposed Mitigation Measures	Parameter To Be Monitored	Location	Measurement	Frequency	Institution Responsible	Cost Estimate ($)
• All line conductor fittings, vibration dampers, tension clamps, and other line components designed to avoid sharp corners or projections that would produce high electrical stresses. Adjacent metal parts and mating surfaces designed to prevent corrosion of the contact surfaces and maintain good electrical contact under service conditions.	Fitting designs	Office	Designs avoiding sharp corners and projections, preventing corrosion, and maintaining good electrical contact	Once	DCC	0
• Fair compensation paid for acquired land based on current market rates, taking into account land capability.	Affected landowners received payment	Field	100% of affected landowners have received payment	All affected landowners once	EDC	351,000
Construction						
• Replacement of houses, other buildings, and facilities with structures constructed to a similar standard to the existing facilities.	Replacement structures	Resettlement locations	Type and quality of materials, floor space, quality of construction	Once for each replacement structure	EDC	706,000
• Replaced structures located, in order of preference, on the existing landholding outside the ROW, on a replacement block of land in the vicinity of the original building, or at a similar site agreed upon with the owner.	Replacement structures and owner satisfaction	Resettlement locations	Location of structures against indicated preferred location	All APs once	EDC	0
• Relocated households to retain title over their existing ROW land (except tower and substation sites) despite being compensated with a house block and a tree and garden area, thereby gaining additional land for garden production or similar.	Household land title	Field	Possession and use of ROW land (except tower and substation sites)	Random	EDC	0
• Relocation expenses and allowances paid to affected households to cover the cost of moving possessions and the cost of living and disturbance during relocation.	Signed record of payment receipt	Office and field	Receipt of all allowances		EDC	27,000
• Building materials from structures removed from the ROW made available to the relocating household for its use. Materials that are not wanted by the household to be disposed of at the request of the owner.	Household ownership of materials	Field	Household use of materials	Every 2 weeks	EDC	0

Proposed Mitigation Measures	Parameter To Be Monitored	Location	Measurement	Frequency	Institution Responsible	Cost Estimate ($)
• Income restoration strategy implemented for affected persons and local communities.	Affected persons and local community representatives	Field	Successful operation of restoration strategy	Every month	EDC	480,000
• Compensation to a business for lost income and structure relocation.	Full payment to business owner	Field	Record of compensation	Once	EDC	60.000
• Construction techniques and machinery selection seeking to minimize ground disturbance.	Construction techniques and machinery	Field	Construction techniques and machinery creating minimal ground disturbance	Once at the start of each construction season	DCC	0
• Construction activities on cropping land timed to avoid disturbance of field crops within 1 month of harvest wherever possible.	Timing of start of construction	ROW and substations	Crop disturbance within 1 month of harvest	Once per site	DCC	0
• Compensation for lost production paid for crops disturbed before harvest based on area of disturbed crop, market price, and agreed yield.	Payment of crop damage compensation	ROW	Record of payment	Once each site	EDC	601,000
• Established roads and tracks used for construction and maintenance access to the line wherever possible.	Access way routes	Field	Use of established roads wherever possible	Every 2 weeks	DCC	0
• New access ways restricted to a single carriageway width within the ROW unless more direct and lower impact access can be gained.	Access way width	Field	Access ways restricted to single carriageway width within ROW	Every 2 weeks	DCC	0
• Temporary placement of fill in drains/canals not undertaken where impeded drainage could cause flooding or damage.	Temporary fill placement	ROW and access ways	Absence of fill in sensitive drainage areas	Every 2 weeks	DCC	0
• Fill temporarily placed in drains/canals removed, and excavated drain/canal embankments reinstated immediately following the required access.	Removal of temporary fill	ROW and access ways	Absence of temporary fill in drains/canals following related construction	Every 2 weeks	DCC	0
• Temporary concrete batching plants located on disturbed sites or areas of low production potential (e.g., grassland) where possible, with only officially licensed plants permitted.	Batching plant location	Batching plant sites	Location on disturbed sites or low productivity areas	Once each site	DCC	0

Proposed Mitigation Measures	Parameter To Be Monitored	Location	Measurement	Frequency	Institution Responsible	Cost Estimate ($)
• Trees up to 3 m mature height retained within the ROW by pruning.	Species-specific tree retention	ROW	Presence of target species in ROW following vegetation clearance	Every 2 weeks	DCC	0
• Marking of vegetation to be removed before clearance, and strict control on clearing activities to ensure minimal clearance.	Vegetation marking and clearance control	ROW and substations	Clearance strictly limited to target vegetation	Every week	DCC	0
• Felled trees and other cleared or pruned vegetation (wood, branches, and foliage) retained by the owner of the vegetation for his/her use, or removed if requested by the owner.	Availability of cleared vegetation to owners	ROW	Use or intended use of vegetation by owners	Every week	DCC	0
• Compensation for removed or pruned trees paid at fair market value based on tree type and age.	Signed record of payment and AP satisfaction	Office and ROW	Evidence of payment of full entitlement to all APs	Every 2 weeks	EDC	234,000
• Construction workers prohibited from harvesting or collecting fuelwood or other tree products in the project area during their employment, apart from locally employed staff continuing current legal activities.	Illegal vegetation harvesting	Near camps and construction sites	Complaints by local people or other evidence of illegal harvesting	Every 2 weeks	DCC	0
• Spoil excavated from tower footings disposed of by placement along roadsides, or at nearby house blocks if requested by landowners, to improve these features.	Spoil disposal locations	Disposal sites	Acceptable spoil disposal sites	Every 2 weeks	DCC	0
• Fill for the substation foundations obtained by creating or improving local water supply ponds or drains, with the agreement of local communities.	Site of borrow	Borrow areas	Acceptable borrow areas that provide a benefit	Every 2 weeks	DCC	0
• Temporary concrete batching plants located away from residences to reduce the potential for dust in inhabited areas.	Location of batching plants	Batching plant sites	Batching plants located at least 80 m from nearest house	Once per new plant site	DCC	0

Proposed Mitigation Measures	Parameter To Be Monitored	Location	Measurement	Frequency	Institution Responsible	Cost Estimate ($)
• Construction activities involving significant ground disturbance (i.e., substation land forming) not undertaken during the monsoon season (mid-May to October).	Seasonal start and finish of major earthworks	Substations and other major disturbance Areas	Timing of major disturbance activities	Once at start and finish of monsoon	DCC	0
• Tree clearance for easement establishment only to involve cutting trees off at ground level or pruning as appropriate, with tree stumps and roots left in place and ground cover (i.e., grass and low shrubs) left undisturbed as far as possible.	Ground disturbance during vegetation clearance	ROW and substations	Amount of ground disturbance	Once a week	DCC	0
• Topsoil placed on substation embankments and planted with a cover crop and perennial ground cover species immediately following final land forming to stabilize the surface.	Topsoil and seeding of substation embankment	Substations	Topsoil and seeding within 2 weeks of land forming	Once each site	DCC	0
• Fenced substation compounds to include fill embankments to ensure that ground cover is protected from overgrazing or harvesting.	Fencing around substation embankment	Substations	Presence of security fence around embankments	Once each site	DCC	0
• Excess fill from tower foundation excavation disposed of at substation sites or by land forming next to roads or around houses, in agreement with the local community or landowner. Topsoil provide for all land formed areas (if available) and seeded with a cover crop and perennial grass mix.	Location of fill disposal and revegetation of sites	Field	Appropriate fill disposal locations and rehabilitation with topsoil and seeding	Every 2 weeks	DCC	0
• Borrow areas revegetated by seeding bare areas with a cover crop and perennial grass mix.	Revegetation of borrow areas	Borrow areas	Seeding of borrow areas completed	Once each borrow area	DCC	0
• Fuel and other hazardous materials securely stored above flood level and at least 20 m from any water body, watercourse, canal, or storage pond.	Location of hazardous material storage	Field	Storage at least 20 m from water bodies	Every month	DCC	0
• Construction only undertaken during the day, and local communities informed of the construction schedule.	Timing of construction	Field	Daytime construction only	Every 2 weeks	DCC	0

Proposed Mitigation Measures	Parameter To Be Monitored	Location	Measurement	Frequency	Institution Responsible	Cost Estimate ($)
• Public health information, primarily covering the prevention of HIV/AIDS, provided to the construction workforce before the start of on-site work.	Public health information to workforce	Construction sites	Information received by staff before starting duties	Once a month during first 6 months	DCC	0
• Construction workforce facilities to include proper sanitation, water supply, and waste disposal facilities.	Workforce facilities	Field	Presence of proper sanitation, water supply, and waste disposal facilities	Once each new facility	DCC	0
• Safety fences and/or metal guard structures installed around/on towers to dissuade people and wildlife from climbing the towers. Warning signs installed on all towers.	Tower safety structures and warning signs	All 230 Kilovolt towers	Presence of safety structures and signs	Once	EDC	0
• Consultation with the Department of Nature Conservation and Protection/Bokor National Park management regarding the proposed location of the route, ROW vegetation clearance, compensatory tree planting, and revegetation species to be used within the ROW. Compensatory plantings and ROW revegetation species approved by the park before implementation.	Record of consultation and approval	Office	Detailed record of consultation and letter of approval	Once	EDC	0
• Marking of the ROW clearance area, any individual trees to be removed outside the ROW, and temporary access track locations, then approval sought and gained from park management before the start of clearing/track construction.	Vegetation marking and clearance control	ROW and substations	Marking limited to the minimum areas required	Once at each site	EDC & DCC	0
• All vegetation clearance and track construction in the park undertaken in the presence of a designated officer from the park.	Vegetation clearance and track construction	Field	Presence of park officer during activities	Twice a week	DCC	0
• No construction activities within the park during the monsoon season, from mid-May to early October to minimize ground disturbance and erosion.	Construction during monsoon	Field	Absence of activities in park during monsoon	Once a month	DCC	0

Proposed Mitigation Measures	Parameter To Be Monitored	Location	Measurement	Frequency	Institution Responsible	Cost Estimate ($)
• Construction workers prohibited from hunting and collecting forest products at any sites within the park.	Worker hunting and collection of forest products	Field	Complaints by local people or other evidence of illegal harvesting	Once a week	DCC	0
• Temporary access tracks in the park minimized by the use of established tracks or across open grassland wherever possible.	Planned and constructed access	Field	Minimal number and length of temporary access tracks	Once a week	DCC	0
• ROW and temporary access tracks in the park revegetated immediately following construction, using local vegetation species and a revegetation method approved by the Ministry of Environment.	ROW and access track revegetation	Field	Species and method of planting	Every 2 weeks	DCC	0
• Tower foundation spoil removed from the park and disposed of elsewhere.	Spoil disposal location	Field	Spoil disposal sites	Once a week	DCC	0
• No construction facilities (camps, workshops, concrete batching equipment, material stockpiles, etc.) permitted within the park.	Location of facilities	Field	Camp locations	Once a month	DCC	0
• No water drawn from streams inside the park.	Water extraction	Field	Water extraction points	Every week	DCC	0
• Replanting of 15 ha of trees outside the ROW within the park to compensate for the loss of ROW trees, as approved by park management.	Replanting	Field	Species, method, and area of planting	Every 2 weeks	EDC	37,500
• Consultation with KCWMP regarding the proposed location of the route, ROW vegetation clearance, compensatory tree planting, and revegetation species to be used within the ROW.	Record of consultation	Office	Detailed record of consultation and letter of approval	Once	EDC	0
• Marking of the ROW clearance area, any individual trees to be removed outside the ROW and temporary access track locations, then approval sought and gained from the KCWMP before start of clearing or track construction.	Marked clearance areas and trees, and approval	Field	Marking limited to the minimum areas required	Once at each site	EDC & DCC	0

Proposed Mitigation Measures	Parameter To Be Monitored	Location	Measurement	Frequency	Institution Responsible	Cost Estimate ($)
• All vegetation clearance and track construction in the Kbal Chhay watershed undertaken in the presence of a designated officer from the KCWMP. Tree clearing undertaken by hand and ground disturbance minimized.	Vegetation clearance and track construction	Field	Presence of a KCWMP officer during activities, hand clearance/minimal disturbance.	Twice a week	DCC	0
• Revegetation of cleared areas within the ROW with species not exceeding 3 m height, as approved by the KCWMP.	Species planted in ROW	Field	Species and method of planting	Once a month	DCC	0
• Replanting of 5.5 ha of trees outside the ROW within Kbal Chhay watershed to compensate for the loss of ROW trees, as approved by the KCWMP.	Replanting	Field	Species, method, and area of planting	Every 2 weeks	EDC	13,800
Operation and Maintenance						
• One-off compensation payment might be paid to affected landowners to offset the devaluation of land within the ROW due to reduced land capability as a result of building prohibition. Payment based on current or future land capability, depending upon the site.	Payment received by affected landowners	Field	100% of payments received	All affected landowners once	EDC	TBA
• Landowners permitted to grow cereal crops under the 230 kV towers.	Cropping beneath towers	230 kV tower sites	Presence of crop or intent to crop	Random along line	EDC	0
• Monitoring program undertaken to determine the occurrence of fauna deaths (birds and mammals) associated with the transmission line. Additional mitigation measures considered if fauna deaths unacceptably high.	Dead fauna	Indicative sites along the line	Presence of dead fauna near line or as reported by local people, attributable to the line	Every 6 months over initial 3 years of operation	EDC	0
• Care taken during manufacture of conductors and fittings, and during subsequent handling, to ensure smooth surfaces free from abrasion.	Conductors and fittings	Field	Conductors and fitting free of abrasion	Random	DCC	0
• Substations constructed above at least the 1:10 year flood level by raising the foundation pad.	Substation designs and base heights	Substations	Base height as per flood design	Once	DCC	0

Proposed Mitigation Measures	Parameter To Be Monitored	Location	Measurement	Frequency	Institution Responsible	Cost Estimate ($)
• Substation transformers located within secure and impervious bunds with a storage capacity of at least 110% of the capacity of oil in transformers and associated reserve tanks. Drainage flame traps with oil/water separators installed.	Substation bunds and flame traps	Substations	Capacity and permeability; presence of flame traps	Once	DCC	0

DCC = Design and Construct Contractor; EDC = Electricité du Cambodge.

[a] Land acquisition and compensation costs include a 20% contingency. All costs rounded to nearest thousand.
Sources: ADB Staff and Consultants, 2005

VI. PUBLIC CONSULTATION AND DISCLOSURE

57. General consultation with stakeholders was undertaken during preparation of the IEE and RP to predict impacts and develop management measures (Table 4). The key Government agencies consulted were the Department of Nature Conservation and Protection (MOE), Forestry Administration (Ministry of Agriculture, Forestry & Fisheries), Inter-Ministerial Resettlement Committee (Ministry of Economics and Finance), and Department of Land Management, Urban Planning and Construction. NGOs consulted included Wildaid, Danida, and American Friends Service Committee (Quakers).

Table 4: IEE and RP Consultation

Organization	Person and Title	Subject	Date
Department of Nature Conservation and Protection (Ministry of Environment)	Chey Yuthearth, Director, Bokor National Park	Proposed route, potential impact on Bokor National Park and appropriate mitigation measures	April 2005
	Serey Rotha Ken, Deputy Director		February–May 2005
	Yen Mouny, Assistant Director, Bokor National Park	Proposed route, conservation, and land use issues within Bokor National Park, and potential impact of line on the park	February–May 2005
Environment Impact Assessment Department (Ministry of Environment)	Ngoug Kong, Deputy Director Leang Mengleap, Chief of Project Review Office	Introduction of the project and clarification of IEE/IEIA requirements and the approval process	April 2004
Forestry Administration, (Ministry of Agriculture, Forestry & Fisheries)	Ung Sam Ath, Deputy Director	Catchment boundaries, tree plantations, and possibility of the line traversing Kbal Chhay watershed	March 2005
	Lao Sethaphal, Deputy Chief of Community Forestry	Forest use in the Veal Renh to Stueng Hav valley and nearby	February 2005
	Sout Oun, Chief of Sihanoukville Containment		April 2005
Inter-Ministerial Resettlement Committee (Ministry of Economy & Finance)	Chhorn Sopheap, Head, Resettlement Unit Sun Sokny, Deputy Head, Resettlement Unit	Explanations of TL Project, IRC makeup, policies, and involvement in project	March 2005
Investment & Cooperation Department, Debt & Bilateral Aid (Ministry of Economy & Finance)	You Phirum, Deputy Director	Compensation policy and land prices for ROW, approaches, and houses for NR3 road project	July 2005
Department of Land Management, Urban Planning, Construction & Land Titles	Chou Chaudara and staff, Deputy Director, Kampot Province	Land ownership, extent of titles, tree plantation locations, and compensation policies	March 2005
	Hun Phy and staff, Deputy Director, Kampot Province	Land ownership, extent of titles, subdivision development plans, and local compensation policies	March 2005
Sihanoukville Province	Say Hak, Governor	Introductions to planning units, development plans, and TL project local impacts	March 2005
Kampot Province	Puth Chandara Rith , Governor of Kampot Province	Introductions to planning units, development plans, and TL project local impacts	March 2005
Royal Railways of Cambodia	Ly Borin, Director of Permanent Way Department	Railroad ROW widths in various zones and TL route implications	March 2005
Cambodian Mine Action Centre	Khun Ratana, Chief of Secretariat	Mines and unexploded ordnance mapping	February 2005

Organization	Person and Title	Subject	Date
WildAid	Tim Redford, Country Director (Thailand)	Proposed route, potential impact on Bokor National Park, and appropriate mitigation measures	April/May 2005
Danida	Etienne Baijot, Project Team Leader Kbal Chhay, Watershed Management	Proposed route, potential impact on Kbal Chhay watershed, and appropriate mitigation measures	April/May 2005
	Ven Virak, Co-ordinator, Environmental Management of the Coastal Zone Gorm Jeppsen, Project Team Leader, Environmental Management of the Coastal Zone	Coastal zone use, issues and project initiatives for forestry and fisheries, and Danida's long-term program and support for two provinces	April 2005
American Friends Service Committee (Quakers),	Uch Samphan, IFS Component Manager	Integrated Sustainable Livelihood Program (ISLP) - integrated farming, tree crop compensation rates, and general issues	May 2005
Sihanoukville Autonomous Port	Ma Sun Hout, Deputy Director General	Port land acquisition and development plans, use of land and ROW for TL, and road locations	April 2005
ALCEDA Bank Plc., Sihanoukville	Chan Vandy, Chief of Credit Office	Port program for land acquisition and local land prices	April 2005
	Various villagers living along/near the ROW	Local bird life, vegetation species and land/forest use	April 2005
Multiple	Representatives (23) from: - Electricite du Cambodge - Ministry of Industry, Mines & Energy - IRC- Ministry of Economy & Finance - Kampot Province - Sihanoukville Province	Resettlement workshop at Sihanoukville covering ADB resettlement policies, land inventory for the line ROW, and feedback on local development and compensation policies	28 June 2005

Asian Development Bank, IEE = Initial Environmental Examination, IEIA= Initial Environmental Impact Assessment, IRC= Interministerial Resettlement Committee, NR = National Route, ROW = right of way, TL = Transmission Line.
Sources: ADB Staff and Consultants, 2005

58. Two public consultation sessions were held to introduce and discuss the findings of the draft IEE before its finalization. The sessions were held in Kampot and Prey Nob on 7 November and 8 November 2005, respectively. Each session took approximately half a day, and minutes were kept of the meeting (Appendix 1 and 2 for details). Participants included representatives of the provincial governor, other local authorities, local villages and communes, NGOs, and the media (newspapers and television).

59. The head of EDC in Kampot or Sihanoukville, along with an EDC representative from the head office (Phnom Penh), introduced each consultation session. The IEE consultant made a presentation on the IEE. Participants then commented and posed questions that the IEE consultant and EDC responded to, as appropriate.

60. The participants comments focused mainly on:

(i) **Line ownership**. Who will own the transmission line?

(ii) **Specific line design features**. Location of towers, date of connection, etc.?

(iii) **Impact of line on Bokor National Park and Kbal Chhay Watershed**:

(a) Could the line be diverted around these areas to avoid any impact?

(b) What specific methodologies were used to assess the impacts?

(c) What specific mitigation measures will be implemented?

(d) Who will manage the transmission line ROW through these protected areas?

(e) Will compensation be paid for the loss of vegetation etc. from the park?

(f) Will transmission line resettlement occur in Bokor National Park?

(iv) **Safety hazards of the line**. What measures are proposed to prevent line hazards?

(v) **Information disclosure**. Provide detailed maps of the proposed line to allow government authorities to prevent land titles being issued for this land, and to prevent encroachment onto these sites.

(vi) **Additional impact assessment studies requested**.

61. Most of the questions posed by participants were answered based on the content of the draft IEE. A commitment was made to raise outstanding issues with EDC and ADB, and to ask EDC to provide detailed maps of the proposed route.

62. Proposed public consultation during project implementation will involve (i) general information dissemination about the project and the construction program to local communities by the PMO; (ii) consultation relating to specific construction activities by the DCC; and (iii) consultation with affected persons regarding land acquisition, compensation, and resettlement by the PMO. The public also will participate in project monitoring and post-project evaluation.

63. Before project appraisal, the RP will be publicly disclosed through the distribution of public information booklets, which will describe the most important sections in Khmer. The RP, or its summary, also will be posted on ADB's resettlement Web site. Summary RPs will be released publicly, with Summary Initial Environmental Examination (SIEE), where relevant. New notices will be circulated and additional public meetings convened, in accordance with ADB policies. A public information booklet has been prepared in English and Khmer for dissemination among affected people and other stakeholders. Further, announcements will be in English- and Khmer-language newspapers, as well as on Khmer-language radio and TV.

VII. FINDINGS AND RECOMMENDATIONS

64. No significant adverse environmental impacts are likely from the construction and operation of the proposed 230 kV transmission line and 22 kV distribution line.

65. The adverse impact on the two IBAs near the line will be negligible. The Phnom Bokor IBA, which is set back at least 900 m from the route at a higher elevation, will be unaffected. Although approximately 10 km of the line will cross the Stung Kampong Smach IBA, the area crossed is considered a low-value habitat set back from the higher-value areas.

66. To offset the impact of constructing the line through the park, a provisional budget for tree planting, as well as an annual compensation royalty to be paid by EDC to Bokor National Park for the first 10 years of the line's operation, has been proposed. The royalty would be used strictly for park management.

67. The proposed route generally crosses sparsely settled land with a low production value. No major settlements are crossed, and no historic sites are near the proposed route.

68. The majority of adverse environmental impacts are likely to occur during construction (i) when land is acquired; (ii) households within the ROW are resettled locally; (iii) the ROW is cleared of trees higher than 3 m; and (iv) towers, poles, and substations are constructed. During operation, the line and substations will have minimal adverse impact, with most activities restricted to standard, minor maintenance.

69. The main adverse project impacts will involve (i) the clearing of 40.5 ha of degraded/regrowth forest, (ii) the visual impact of the towers and conductors on the landscape, (iii) acquisition of 4.0 ha of private land, (iv) relocation of 12 households, and (v) land use restrictions within the 233 ha ROW. Major mitigation measures that will be implemented before and during construction will include land acquisition at fair market value; replacement of houses, other buildings, and facilities to outside the ROW; compensation for cleared and pruned trees; and payment of a relocation allowance.

70. The primary benefits of the Project will be increased electricity supply with improved reliability to Sihanoukville. Eventually, this should lower the cost of electricity and promote industry by making production more reliable and cost effective. Secondary benefits of the Project include electrification of some rural villages, construction employment for approximately 80 people, and a reduction in carbon dioxide emissions in Sihanoukville.

VIII. CONCLUSIONS

71. The proposed Project will not cause significant adverse environmental impacts that are sensitive, diverse, or unprecedented; nor will it have any significant effect on areas outside the sites or facilities subject to physical works. While the transmission line will cross 20.3 km of the buffer zone of Bokor National Park, the adverse impact on this protected area will be minor to moderate, and lower than the cumulative impact of alternative routes outside the park. The implementation of the comprehensive land acquisition, compensation, and resettlement measures proposed in the RP will mitigate adequately the related potential impacts, while biophysical management measures contained in the IEE will mitigate effectively these adverse impacts.

72. An environmental impact assessment or additional specific studies are not deemed to be required for this Project, given the low significance of all residual adverse impacts that are unavoidable and will result from project construction and operation, including adverse biophysical impacts on the Bokor National Park buffer zone.

REFERENCES

Asian Development Bank. 1997. Involuntary Resettlement. *Operations Manual.* Manila.
———. 1998. *Environmental Assessment Requirements of the Asian Development Bank*. *Environment Division, Office of Environment and Social Development*. Manila.
———. 2002. *Environment Policy of the Asian Development Bank*. Manila.
———. 2003. *Environmental Assessment Guidelines*. Manila.
ASEAN Centre for Energy. 2003. Available: www.aseanenergy.org.
Lekagul, Boonsong, and P.D. Round. 1991. *A Guide to the Birds of Thailand*. Saha Karn Bhaet Co. Ltd., Bangkok.
Brown, K.A., and J. Gurevitch. 2003. *Long-Term Impacts of Logging on Forest Diversity in Madagascar*. Stony Brook, NY: Department of Ecology and Evolution, Stony Brook University. 11794–5245.
Cambodian Mine Action Centre. 2005. Mine and Unexploded Ordnance Mapping. Sihanoukville and Kampot 1:100,000 map sheets. March.
Danish Ministry of Foreign Affairs/Danida. 2001. *Sustainable Management of the Kbal Chhay Watershed, Sihanoukville - Project Document.* Danish Ministry of Foreign Affairs/Danida, Cambodia.
Dy Phon, Pauline. 2000. *Plants Used in Cambodia*. Ed. by Pauline Dy Phon. Phnom Penh, Cambodia..
Électricité du Cambodge. 1999. *Establishing Environmental Management Capabilities - Phnom Penh Power Rehabilitation Project: Technical Assistance Component*. SMEC. Cooma, Australia.
Forestry Administration—Danida. 2004. *Land Cover Map of Kbal Chhay Watershed*. 1:40,000 scale. Kbal Chhay Watershed Management Project.
Government of Cambodia. 1998. Draft Management Plan for Preah Monivong National Park (Bokor). Working Document. Strengthening of the Protected Areas System of the Royal Kingdom of Cambodia.
Helland-Hansen, E., T. oltedahl, and K.A. Lye. 1995. *Environmental Effects*. Volume 3 Hydropower Development. Oslo: Norwegian Institute of Technology.
ICEM. 2003. *Cambodia National Report on Protected Areas and Development*. *Review of Protected Areas Development in the Lower Mekong River Region.* Indooroopilly, Queensland, Australia.
Japan International Cooperation Agency (JICA) and Ministry of Public Works and Transport (MPWT). 1999. *Kampot (5830 UTM)* and Krong Preah Sihanouk *(5730 UTM)* 1:100,000 topographic map sheets.
Ministry of Agriculture, Forestry and Fisheries. 2002. *Agricultural Statistics 2001–2002*. Agricultural Productivity Improvement Project. Kingdom of Cambodia: Statistics Office, Department of Planning, Statistics and International Cooperation.
Ministry of Environment. 1998. *Kingdom of Cambodia National Environmental Action Plan 1998–2002*. Phnom Penh, Cambodia.
Ministry of Environment/Food and Agriculture Organisation/Ynited Nations Development Programme/Global Environment Facility. 2002. *National Biodiversity Strategy and Action Plan*. Phnom Penh: Royal Government of Cambodia.
Ministry of Environment. 2004. Community Protected Area Development Profile (draft). Community Protected Areas Development Office, Department of Nature Conservation and Protection.
Ministry of Public Works and Transportation. 1999. *Cambodia Reconnaissance Survey Digital Data*. *Kingdom of Cambodia*. Japan: JICA.
Ministry of Public Works and Transportation and Cambodian National Mekong Committee. 1993–94. 1:25,000 black and white aerial photography.

National Health and Medical Research Council (NHMRC, Australia). 1989. *Interim Guidelines on Limits of Exposure to 50/60Hz Electric and Magnetic Fields*. Australian Radiation Laboratory on behalf of the National Health and Medical
Research Council. Canberra, Austalia. This incorporates guidelines developed by International Non-ionizing Radiation Committee of the International Radiation Protection Association (IRPA/INIRC).
National Institute of Statistics. 2000. *General Population Census of Cambodia 1998*. Phnom Penh, Cambodia: Ministry of Planning.
National Institute of Statistics. 2002. *Cambodia Statistical Year Book 2001*. Phnom Penh, Cambodia:.Ministry of Planning.
Richards, P.W. 1952. *The Tropical Rain Forest: An Ecological Study*. Cambridge: Cambridge University Press.
Seng Kim Hout. 2001. *Directory of Important Bird Areas in Cambodia*. Phnom Penh: Department of Forestry and Wildlife, Conservation Society Cambodia Program.
Seng Kim Hout et al. 2003. *Directory of Important Bird Areas in Cambodia: Key Sites for Conservation*. Phnom Penh: Department of Forestry and Wildlife, Department of Nature Conservation and Protection, Bird Life International in Indochina and the Wildlife Conservation Society Cambodia Program.
Solbrig, O. 1991. *From Genes to Ecosystems: A Research Agenda for Biodiversity*. Cambridge Mass.: International Union of Biological Scientists, Monograph Series No.7.
SPEC and DNCP. 1998. Draft Management Plan for Preah Monivong (Bokor) National Park.
Standards Australia. 1997. *Limits of Electromagnetic Interference from Overhead AC Powerlines and High Voltage Equipment Installations—AS/NZS 2344.*
Tan Setha and C. Poole. 2003. *A Field Guide to the Birds of Cambodia*. Phnom Penh: Department of Forestry and Wildlife and Wildlife Conservation Society Cambodia Program.
World Conservation Monitoring Centre. 1998. *Contribution to an Evaluation of Tree Species Using the New CITES Listing Criteria*. Unpublished report compiled on behalf of the CITES Management Authority of the Netherlands. WCMC, Cambridge.

LIST OF PARTICIPANTS AT INITIAL ENVIRONMENTAL EXAMINATION PUBLIC CONSULTATION SESSIONS

Table A1.1: Kampot Consultation Session (7 November 2005)

	Name	Position	Phone Number
1.	Meas Sean	Head of Koh Touch Commune	012 307 967
2.	Phang Phanith	Chief of Administration Office of Kampot Governor	012 708 407
3.	Yen Mouny	Deputy Director, Bokor National Park	011 881 540
4.	Som Phakkdey	Representative of DANIDA-CZM	012 632 309
5.	Mao Thoeung Touch	Deputy Head of Kilo 12 Village	011 707 354
6.	Sathieng	Head of Boeung Touk Commune	012 769 432
7.	Seng Ngi	Head of Prek Chek Village	011 730 759
8.	Kong Bo	Head of Ou Touch Village	
9.	Toek Sun	Chief of Social Work Office of Kampong Bay District	
10.	Hang Sien	Council of Angdoung Khmer Commune	
11.	Dak Som Orn	Head of Angdoung Khmer Village	
12.	Oung Vuthy Chen	Chief of EIA, MOE Office	011 947 775
13.	Sophanna	EDC Representative	012 884 115
14.	Bab Yith Thong	Chief of Administrative Council Office, Kampong Bay District	
15.	Bunnarith	Supervisor of Electrical Network, Kampot	016 762 691
16.	Sam Phon	Deputy Director, Provincial Information Dept.	011 934 467
17.	Long Sreng	Deputy Director, Provincial Environment Dept.	012 862 946
18.	Sy Hay	Deputy District Governor, Kampong Bay District	016 899 543
19.	Nget Savoeun	Deputy General Director, Sihanoukville Governor's Cabinet	016 935 116
20.	Mao Visal	Office Chief of Social Environment of EDC	012 623 459
21.	Chin Rompich	EDC, Kampot	
22.	Sao Sothin	EDC, Kampot	012 813 635
23.	Hing Sreymom	EDC, Kampot	016 331 334
24.	Sun Sotheary	EDC, Kampot	016 606 676
25.	Chhim Konthy	EDC, Kampot	016 328 030
26.	Heng Kim Horn	EDC, Kampot	
27.	Bou Chenda	EDC, Kampot	
28.	Touch Naro	EDC, Kampot	
29.	Neak Sovannary	Deputy Director, Provincial Land Management Dept., Kampot	012 820 446
30.	Ouk Sota	B N Consult	012 277 039
31.	Seng Bunly	B N Consult	012 858 571

B N Consult = Name of the Consulting Organization; EDC = Electricité du Cambodge; EIA = Environmental Impact Assessment; MOE = Ministry of Environment.
Sources: ADB Staff and Consultants, 2005

Table A1.2: Prey Nob Consultation Session (8 November 2005)

	Name	Position	Phone Number
1.	He Hy Chhorn	Deputy Director General, Sihanoukville Governor's Cabinet	012 757 048
2.	Hun Phy	Deputy Director, Provincial Land Management Department	011 340 007
3.	Prak Visal	Representative of Sihanoukville Governor	016 348 017
4.	Sao Chin	Representative of Sihanoukville Information Department	012 439 325
5.	Hak Sann	First Deputy Head of Commune	012 755 762
6.	Yuk Kin	Head of Boeung Veng Village	
7.	Seing Khin	Head of Chamkar Kaosou Village	
8.	Phorn Sin	Deputy Head of Samaki Commune	
9.	Suon Sakhan	Head of Ou Trochak Chit Village	
10.	Kun Sieng	Deputy Head of Somrong Commune	012 214 572
11.	Doeur Sout	Head of Ta Oan Thom Village	
12.	Suos Gna	First Deputy Head of Chheung Kor Commune	
13.	Kiev Tom	Head of Toul Village	
14.	Ma Ban	Head of Chrolong Village	
15.	On Sok	First Deputy Head of Veal Rech Commune	012 484 228
16.	Li Diel	Head of Prek Sangke Village	
17.	Yim Neng	Head of Prek Pros Village	
18.	Sath Phat	Head of Kampong Chin Village	
19.	Sin Say Chhay	Representative of Toeuk Thla Commune's Admin Council	
20.	Sokunthea	Deputy Governor, Stoeung Hav District	012 888 453
21.	Nou Sokhom	Representative of Soeung Hav District Governor	
22.	Man Mao	Journalist from National TV, Sihanoukville	
23.	Huy Chan Thun	Koh Santepheap Newspaper	
24.	Prum Buny	Chief of Administration Office, Prey Nob District	016 343 737
25.	Koe Som Oun	Representative of District Planning Office, Prey Nob District	
26.	Dy Sophy	Assistant, Kbal Chhay Watershed Project	016 880 436
27.	Prak Vanny	District Environment Officer of Prey Nob District	012 470 126
28.	Uong Chanthea	District Governor's Officer, Prey Nob District	
29.	Prak Sophan	District Governor's Officer, Prey Nob District	
30.	Mom Samuth	District Governor's Officer, Prey Nob District	
31.	Preap Somnang	Deputy Director, Prey Nob District	012 601 736
32.	Van Chhoun	Administration Officer	
33.	Ork Pok	Administration Officer	
34.	Hem Sophat	District Governor's Office	
35.	Oung Vuthy	Office Chief of EIA Dept., MOE	011 947 775
36.	Chen Sophanna	EDC Representative	012 884 115
37.	Khiev Vuthy	Head of Village 2, Ou Treas	011 205 310
38.	Mok Man	Head of Village 1, Ou Treas	011 681 046
39.	Kim Bun Sim	Representative of Ou Treas Commune Council	
40.	Chhann Sreng	Deputy Director, Prey Nob District	012 180 8373
41.	Sam Sophan	Chief of Social Work Office	016 936 321
42.	Ouk Sota	B N Consult	012 277 039
43.	Seng Bunly	B N Consult	012 858 571

EIA = Environmental Impact Assessment ; MOE = Ministry of Environment ; TV = television.
Sources: ADB Staff and Consultants, 2005

MINUTES OF INITIAL ENVIRONMENTAL EXAMINATION PUBLIC CONSULTATION SESSIONS

Kampot Public Consultation Session

Date: 7 November 2005
Time and Venue: 8:30 a.m.–2:00 p.m. at ASHAC Center (Opposites Provincial EDC Department).

Participants in the Kampot public consultation session to discuss the findings of the draft Initial Environmental Examination (IEE) included representatives from the provincial governor, other local authorities, Electricite du Cambodge, local villages, and communes, nongovernment organization and the media (newspapers and television).

The head of EDC in Kampot, followed by a representative from EDC's head office (Phnom Penh), introduced the consultation session. Seng Bunly The consultant representative, then made a presentation on the IEE, which was followed by comments and questions.

Summary of main points discussed:

The discussion commenced with a request for clarification from EDC that the IEE was based on ADB principles, not EDC principles. Seng Bunly responded that APW had applied the Government of Cambodia's principles for resettlement and environmental impact assessment, per the relevant Governmental agencies.

Comment 1. Ministry of Environment representative:

(i) When and how was the IEE data collected?
(ii) Who collected this data?
(iii) Can you provide the section of the IEE report on the environmental impacts on Bokor National Park in English and Khmer?

Response, Seng Bunly:

(i) APW conducted the study, which was funded by Asian Development Bank. BN Consult (BNC) was subcontracted for data collection on the land and socioeconomic survey. APW hired other local researchers for specific studies.
(ii) BNC worked closely with local authorities and EDC to collect information on the land and socioeconomic condition in project area.
(iii) The reports belong to EDC. We are going to discuss the disclosure of these reports with EDC. However, disclosure will be undertaken in accordance with the policies of EDC and ADB.

Comment 2. Bokor National Park representative:

(i) How many towers will be located in the Bokor National Park for 20.3 kilometer of line?
(ii) How far is the route located from the railway and the edge of Bokor Mountain?
(iii) Where is each tower located? Please illustrate each location on a map.
(iv) What was the method and standard used to ensure that the least number of waterbirds will be affected by the transmission line?

(v) Do you have an agreement or principal to ensure that the 12 resettled households do not settle within the National Park after they receive the compensation?
(vi) What protection will be provided in the National Park for hazards created by strong wind, lightning, airplane visibility at night, and similar.
(vii) Do you have any warning letter and label to inform people about transmission line hazards in the National Park?
(viii) Who will manage and control the determination of tree height in line right-of-way (ROW) through Bokor National Park?
(ix) Do you have any principal to compensate for the forest cleared within the ROW through Bokor National Park?
(x) Do you have any principal to compensate the park once EDC receives a profit from this project?

To avoid impacts on the park, EDC should select another route.

Response, Seng Bunly:

(i) About three towers will be constructed per km, so about 60 towers will be within the park.
(ii) The towers will be up to 750 meter inside the park.
(iii) The proposed route through the park has been mapped, but tower locations will only be determined during detailed design. We would discuss with EDC if we can disclose the mapped route.
(iv) The impact on waterbirds has been considered in a separate IEE study.
(v) ADB's resettlement principle is clear—affected people will not suffer from the Project. In general, ADB asks the Government to provide a relocation site for resettled people. However, for the 12 households affected along the 77 km route, setting up a single location site would be difficult to set up. As such, the issue might be best solved on a case-by-case, finding land near the original location but outside the National Park. We would invite the National Park to solve the problem with EDC in the future.
(vi) Line hazards are discussed in the IEE. Protection from such hazards will be incorporated into the detail project design.
(vii) EDC will adopt international standards regarding hazard signage. This will include appropriate signs illustrating the hazard.
(viii) EDC and the park in the future will discuss ROW vegetation maintenance.
(ix) Compensation is being considered, but this will be subject to further discussion and negotiation between EDC, MOE, and the National Park.
(x) This would be a subject for further discussion and decision making of the Government of Cambodia.

Route selection was based on balancing economic, social, and environment considerations, as well as optimizing project benefits.

Comment 3. Ministry of Environment representative:

(i) How will the project impact cultural and Buddhist places (big trees), and how will the effect of the transmission line on cultural sites be mitigated?
(ii) Can you place contours on the maps?

Response, Seng Bunly:

(i) The route was diverted to the north at Prey Nob to avoid the pagoda on the hill. We did not find any large trees of local significance along the route in our discussions with village heads. If any religious or cultural sites, such as Buddhist temples and large trees are found during detail design, the route will be adjusted to divert around these features.
(ii) We have mapped the contours, which will be provided to Ministry of Environment for the review of the IEE.

Comment 4. Local authority:

(i) How will the project compensate affected people?
(ii) Since most of the land along transmission line does not have a land certificate, can EDC provide an accurate map of the proposed route to prevent land certificates being provided for this area in the future?

Response, Seng Bunly:

(i) The compensation rate will be based on a replacement cost study, with input from project staff and local authorities. Compensation rates are always the main topic of discussion and debate between ADB and the Government of Cambodia. ADB is guided by the principle that affected people would not be left worse off by the Project. However, sometimes this principle is difficult to implement accurately.
(ii) We will discuss with EDC further disclosure of the information, which would be based on the policies of the Government and ADB.

Comment 5. Ministry of Environment representative:

Your presentation indicated that the line will be located between 2–120 m above sea level. The Ministry of Environment does not agree with the location of the line 2 m above sea level as it will create an electrocution and land use hazard.

Response, Seng Bunly:

The towers will be located on land between 2–120 m above sea level, with the electrical conductors strung above with safe clearances to the ground.

Comment 6. DANIDA representative:

(i) Could you provide us with the detailed study of some tidal and mangrove sections? I think there are many places of fishery and egg fish along the coastal zone. I also agree with the route option proposed by the consultant.
(ii) DANIDA is concerned that the affected people will be relocated to a protected area. Does the project have a plan to avoid this?

Response, Seng Bunly:

a. I will discuss this request with APW regarding any further disclosure of information.
b. As explained before, the relocation would be considered for the affected people and it would be discussed further with relevant stakeholders during implementation of the Project.

Comment 7. Provincial governor representative:

Will the project compensate for land along transmission line? Where will the project restrict people from growing fruit trees and cereal crops?

Response, Seng Bunly:

In principle, EDC should compensate for this land, but not the full purchase price. In Cambodia, we have not compensated for this kind of restriction, the Government of Cambodia and the ADB will discuss this further.

At the end of discussion, the representatives from the local authority and land authority expressed support for the Project, and requested that the Government provide a detailed map to ensure that new land certificates are not provided to people for this easement, and to restrict the construction of structures along the alignment.

Following the question and answer session, the EDC representative closed the meeting and thanked the participants for their involvement.

Prey Nob Public Consultation Session

Date: 8 November 2005
Time and Venue: 8:30 a.m.–12:00 a.m. at Prey Nob District Hall Meeting Room

Participants in the Prey Nob public consultation session to discuss the findings of the draft IEE included representatives from the provincial governor, other local authorities, EDC, local villages and communes, NGOs, and the media (newspapers and television).

The head of EDC in Sihanoukville introduced the consultation session, followed by representatives of the district governor and EDC's head office (Phnom Penh). Seng Bunly, APW representative, then made a presentation on the IEE, which was followed by comments and questions.

Summary of Main Points Discussed

Comment 1. Net Sophy, Water Fall National Park (Kbal Chhay Watershed):

The proposed transmission line will cross about 3 km of the Kbal Chhay watershed and affect 3 hectare of forest. Right-of-way vegetation clearance and the foundations of transmission line will impact water quality, land, and other issues in the main water supply catchment for Sihanoukville. If the watershed can be avoided, please change the proposed alignment. If unavoidable, conduct further detailed investigations.

Response, Seng Bunly:

A comprehensive IEE has been prepared, which includes economic, social, and environmental studies. The selected route balances these issues. However, we will report these issues to the Government and ADB, and try to avoid them where possible during the detailed design stage.

The net impact on the 6,000 ha Kbal Chhay watershed will be small, with only 3 ha to be cleared of trees. This vegetation includes plantations. However, we should take it in to consideration by reporting to Government and ADB to make final decision.

Comment 2. Sihanoukville governor representative:

According to the presentation, I think that the impact will be very small compared with the benefit. Now we have the problem of a high electricity price. With the Project, the price of electricity should decrease and be affordable to the people.

Response, Seng Bunly:

Thank you for your support.

Comment 3. Prak Visal, IOM representative:

Our project is responsible for the coastal area. According to the presentation, the Project will have little socioeconomic impact, affecting only 12 households. Even though the Project will only impact 12 houses, it needs to pay compensation at market price. Furthermore, crops and trees must be compensated at market price. I agreed with the representative from Kbal Chay that further investigation of impacts is required.

Response, Seng Bunly:

Thank you for your comment. We will discuss further detailed studies with EDC and ADB.

Comment 4. Deputy Head of Veal Reagn Commune Orn Sok:

(i) Who will own the transmission line, a private company or the Government?
(ii) When we will be able to use electricity from this connection?
(iii) When will the current private license expire?

Response, EDC representative:

(i) EDC will own the Kampot-to-Sihanoukville transmission line. EDC is owned by Ministry of Industry, Mines and Energy.
(ii) It will depend upon negotiations between ADB and the Government of Cambodia.
(iii) EDC and a private entrepreneur have a clear contract.

Comment 5. Net Sophy, Water Fall National Park (Kbal Chhay Watershed):

We do not oppose to the Project, but we need the study to carefully assess the impact of the Project on the park.

Comment 6. Ministry of Environment representative:

I do agree with the representative from the Kbal Chay National Park regarding the need to conduct further study to reduce the impact on the National Park, because the park is not only a protected area, but also the water source for Sihanoukville.

Response, Seng Bunly:

We will consider disclosure of the detailed study and further investigation.

Comment 7. Head of Ou Trachak Chet village:

I would like to express my idea—if it is not right, I am sorry. So far, our country is not developed. According to the study team, the route was 13 km and it was from 200–700 m from the road. The impact on resettlement to people is little except the impact on plantation of He Ke Kim Yan about 1 km long, but I believe that this will not be a problem.

To prevent future encroachment by people, EDC should provide us with a map so that we do not allow anybody to build a structure along the designed route, and we can plan to avoid commercial activities along the route.

Comment 8. Stung Hav Deputy District Governor Keo Sokhun:

In the meeting today, I would like to express my opinion about the issues. We have experience with landowners with land title and without title. We have solved problems by compromising between projects and landowners. To process the Project smoothly, we need to use our experience to solve these problems.

Comment 9. Prey Nob Deputy District Governor:

In our experience with the donor projects, we need to divert the transmission line route as much as possible to avoid social and environmental impacts. In case of a lot of impacts, ADB will not finance the project. It is suggested that the Project provide us with a map, so that we can prevent future encroachment by people onto project sites and thereby reduce the future resettlement impact.

Comment 10. Hun Ty, deputy director, Provincial Land Management and Urban Planning:

The Project needs to provide a map to the local authority to prevent future encroachment, and to provide information to authority not to provide land title to people along transmission line route. To avoid an impact on people, the Project has to move into Kbal Chay watershed. The Project needs to balance costs and benefits.

Response, Seng Bunly:

We are going to discuss with relevant government agencies the need to provide optional route of the transmission line, which would consider social, economic, and environmental parameters. Regarding the prevention of future encroachment, I supported the idea and will discuss this with the Government and ADB.