

# Environmental Impact Assessment

of Hotel Development in Siem Reap Town,  
Cambodia

by  
Canadian Universities Consortium  
Urban Environmental Management Project (CUC UEM Project)  
Training and Technology Transfer Program (TTTP)  
at Asian Institute of Technology, Bangkok, Thailand

presented to  
The Ministry of Environment, Cambodia

In fulfilment of the MoU signed between  
CUC UEM TTTP Project and the Ministry of Environment, Cambodia



The environmental impact assessment of hotel activity in Siem Reap was conducted by the **Canadian Universities Consortium Urban Environmental Management Project** at the Asian Institute of Technology, Bangkok.

The study and this report were prepared in partial fulfillment of the Memorandum of Understanding signed between the Minister of the Environment, Kingdom of Cambodia and the Canadian Universities Consortium Urban Environmental Management Project, on March 26, 1999.

It was presented to the Minister of the Environment, Kingdom of Cambodia on May 5, 2000  
Phnom Penh, Cambodia


## **PREFACE**

This document was developed with two objectives. The first was related to the Project's demonstration purposes and it is hoped that the report can be seen as an example of environmental impact assessment practice. It is also intended to identify a series of issues related to hotel development in Siem Reap and to highlight many of the issues that may be considered while conducting an Environmental Impact Assessment. Many of the recommendations and statements have been left as matters that should be considered for future planning and management interventions.

The report was carried out by students from the University of Calgary in Canada under the supervision of Professor Bill Ross of the same University and an international expert in EIA in three months. The western bias of the authors' perspective may have entered into the treatment of certain socio-cultural issues that were dealt with in this report.

It is hoped that this work will encourage further practice and research in implementing Cambodia's newly legislated Environmental Impact Assessment approaches.

The development of the EIA has been complimented by a number of training sessions in Cambodia.

A handwritten signature in black ink, appearing to be 'WJ', with a long horizontal line extending to the right.

Professor Walter Jamieson  
Director, CUC UEM Training and Technology Transfer Program

# **Preliminary Environmental Impact Assessment of Hotel Development in Siem Reap Town, Cambodia**

## **Executive Summary**

### **Project Description**

The Preliminary Environmental Impact Assessment Report of Hotel Development is the first component of a Canadian International Development Agency (CIDA) and Canadian Universities Consortium (CUC) project embarked upon in cooperation with the Royal Government of Cambodia (RGC). The CUC and the Cambodian Ministry of Environment have a Memorandum of Understanding that the CUC would undertake an EIA of hotel development in this area.

This preliminary report identifies the most important environmental and social effects of hotel development, and provides management recommendations for hotel owners and decision-makers. The report can serve as the basis for continued ongoing study of the effects of hotel development in Siem Reap.

### **Background**

Siem Reap Town is located 7 kilometers from Angkor Wat, a World Heritage Site and major tourist attraction in Cambodia. The Siem Reap region is presently undergoing rapid growth and expansion as the direct result of tourism and hotel development. It is attracting both international and Cambodian tourists, and is responding with investment by both local companies, and international hotel developers. In initiating the EIA of hotel development, the RGC recognizes the importance of addressing environmental and social impacts of tourism as part of a sound economic development strategy.

### **Methodology**

The report was written over a 10-week study period, which included a two-week site visit to Siem Reap Town. During this site visit, the research team conducted interviews and collected primary and secondary data. The visit coincided with a three-day EIA workshop for Cambodian government employees and other interested individuals. The remainder of the study period was used to prepare this report, which is an analysis of the observations, interviews, and data gathered during the site visit. Very little quantitative data were employed in this analysis.

### **Content of the Report**

The document covers three main areas:

1. Description of the current physical, regulatory, and social environment (Chapters 1-2, Appendix 2);
2. Assessment of the impacts of hotel development (Chapter 3-4);
3. Recommendations for mitigating those impacts (Chapter 4);
4. Recommendations for the continuation of the EIA process (Chapter 5).

## **Major Findings**

The research team surveyed hotel activities in order to create a list of present and future social and environmental impacts. In compiling this list, the assumption was made that hotel development will proceed in its current manner and at its present pace for the foreseeable future. Six criteria were applied to that list of impacts to narrow the report's focus. The issues were considered in terms of:

1. Seriousness of impacts
2. Ubiquity of activity
3. Importance to the community and decision-makers
4. Economic development
5. Aesthetics
6. Human Health

By these criteria, the impacts were narrowed down into the following four areas of focus:

1. ***Solid Waste Management:*** Solid waste refers to all the waste produced by a hotel, from construction, through operation, and maintenance, to demolition. Firstly, the volume of waste being produced by hotels must be reduced. Secondly, the waste must be disposed of in a safe way.
2. ***Water and Sewage Management.*** Water management refers to the reliable supply of clean drinking water. Sewage management refers to the disposal of dirty water and human waste.
3. ***Energy Consumption and Air Quality:*** The section on energy efficiency investigates the impacts of energy consumption on the environment and recommends measures to reduce energy use.
4. ***Socio-Economic Impacts.*** The human impacts of hotel development are directly related to the environmental impacts. As well, the report addresses some of the social, cultural, and economic impacts of tourism in general and hotel development specifically.

## **Recommendations**

In each of these four focus areas, recommendations were put forth that should help minimize the environmental and social effects of hotel development. Implementing these recommendations can enable tourism and hotel development in Siem Reap to become more culturally, environmentally, and economically sustainable.

These recommendations are divided into two types: those that can be undertaken by hotels, and those that can be undertaken by the government and by non-government organizations. Underlying all recommendations is the assumption that human life is of the utmost concern to decision-makers, hotel owners, and residents. A table of those recommendations follows.

## Mitigation Measures for Solid Waste

	<b>Hotel- level Measures</b>	<b>Government-level Measures</b>
<b>Management and Policies</b>		<ul style="list-style-type: none"> <li>• Require waste management policies for hotels.</li> <li>• Enact "polluter pays" legislation in conjunction with solid waste sub-decree.</li> </ul>
<b>Prevention, Minimization, and Management of Waste</b>	<ul style="list-style-type: none"> <li>• Use good design to allow for future expansion with a minimum of renovations; be flexible for future needs</li> <li>• Use durable materials</li> <li>• Purchase locally</li> <li>• Practice green purchasing</li> <li>• Use local labour</li> <li>• Use local cement batch plants</li> <li>• Implement purchasing guidelines</li> </ul>	<ul style="list-style-type: none"> <li>• Regulate dumping sites</li> <li>• Create proper landfill sites</li> </ul>
<b>Biodegradation</b>	<ul style="list-style-type: none"> <li>• Compost</li> <li>• Anaerobic digestion: on-site, cooperatively, or community-wide scale</li> </ul>	<ul style="list-style-type: none"> <li>• Implement or subsidize biodegradation or composting programs.</li> <li>• Expand market for biodegradation by-products</li> </ul>
<b>Recycling</b>	<ul style="list-style-type: none"> <li>• Work with community to establish market for recyclables.</li> </ul>	<ul style="list-style-type: none"> <li>• Levy surcharges on non-recyclables</li> <li>• Levy refundable deposits on recyclables.</li> <li>• Establish recycling program.</li> <li>• Encourage markets for recyclables</li> </ul>
<b>Education and Attitude Change</b>	<ul style="list-style-type: none"> <li>• Create visible, participatory systems</li> <li>• Provide training to staff</li> <li>• Attempt to change visitor attitudes</li> </ul>	<ul style="list-style-type: none"> <li>• Publish green guidelines for hotels</li> <li>• Establish demonstration projects</li> </ul>



## Mitigation Measures for Impacts of Water and Sewage Management

<b>Hotel- and Business-level Measures</b>	<b>Government-level Measures</b>	
<ul style="list-style-type: none"> <li>▪ Perform a water audit to learn more about present usage patterns and identify areas for improved water management</li> <li>▪ Develop water conservation plans for bathrooms and laundry services</li> <li>▪ Monitor and regulate water pressure throughout building</li> <li>▪ Adopt “Green Purchasing” guidelines for all business purchases</li> <li>▪ Investigate water treatment processes to improve hotel water quality</li> <li>▪ Pre-treat sewage before discharging</li> <li>▪ Consider alternative uses for treated sewage sludge</li> <li>▪ Investigate Waste Stabilization Ponds for long-term treatment and management of sewage sludge</li> <li>▪ Investigate use of natural or constructed wetlands for long-term treatment of sewage sludge</li> <li>▪ Develop monitoring programs to collect data on water and sewage, and to regularly evaluate effectiveness of mitigation measures</li> </ul>	<p><b>Direct Intervention Measures:</b></p>	<ul style="list-style-type: none"> <li>▪ Regulate flow rate of Siem Reap River</li> <li>▪ Subsidize hotels’ mitigation measures</li> <li>▪ Implement infrastructure development projects</li> </ul>
	<p><b>Policy Measures:</b></p>	<ul style="list-style-type: none"> <li>▪ Strengthen regulations concerning environmental and sanitation standards for hotels and businesses</li> <li>▪ Incorporate international standards into regulatory framework</li> <li>▪ Improve compliance monitoring and enforcement of regulations</li> <li>▪ Institute economic instruments for regulating sewage management</li> <li>▪ Draft a sewage management sub-decree</li> <li>▪ Set timelines for implementing mitigation measures and reaching environmental performance objectives</li> </ul>
	<p><b>Education and Training Measures:</b></p>	<ul style="list-style-type: none"> <li>▪ Use workshops and seminars to raise awareness and disseminate information</li> <li>▪ Publish educational information on water and sewage management for hotels, business, and the public</li> </ul>



### Mitigation Measures for Impacts of Energy Use

Hotel- and Business-level Measures	Government-level Measures	
<ul style="list-style-type: none"> <li>▪ Perform an energy audit to learn more about present usage patterns and identify areas for improved energy management</li> <li>▪ Continue with existing energy conservation measures, and evaluate these measures regularly to identify areas for improvement</li> <li>▪ Improve existing fuel storage practices by using high-quality storage tanks, installing secondary containment devices, developing procedures for maintenance and handling spills/leaks</li> <li>▪ Introduce energy-efficient lighting fixtures and consider energy-saving appliances for future purchases</li> <li>▪ Use existing appliances more efficiently</li> <li>▪ Future hotel development should incorporate energy efficiency into building design</li> </ul>	<p><b>Direct Intervention Measures:</b></p>	<ul style="list-style-type: none"> <li>▪ Subsidize energy audits of individual businesses or business sectors</li> <li>▪ Financial incentives for energy conservation</li> <li>▪ Subsidize equipment replacement or facility renovation</li> <li>▪ Upgrade and expand public power supply</li> </ul>
	<p><b>Policy Measures:</b></p>	<ul style="list-style-type: none"> <li>▪ Develop fuel tank and fuel storage regulations</li> <li>▪ Regulate use of CFCs</li> <li>▪ Specify minimum energy conservation requirements for new hotels and businesses being planned</li> <li>▪ Set target objectives and timelines for action for businesses and hotels</li> </ul>

	<b>Education and Training Measures:</b>	<ul style="list-style-type: none"> <li>▪ Sector-specific energy conservation education</li> <li>▪ Develop voluntary guidelines specifying a minimum level of energy conservation in all business sectors</li> <li>▪ Seek international development aid to assist in environmental management demonstration projects</li> <li>▪ Consult with local communities and businesses to obtain their participation in implementing environmental management initiatives</li> </ul>
--	---	--

### Socio-Economic Mitigation Measures

	<b>Hotel-level Measures:</b>	<b>Government-level Measures</b>
<b>Economic</b>	<ul style="list-style-type: none"> <li>• Provide training in all areas of operation to expand skill base</li> <li>• Encourage equal opportunities for local residents</li> <li>• Increase wages to reflect the profit margin</li> <li>• Create profit-sharing programs</li> </ul>	<ul style="list-style-type: none"> <li>• Encourage more small guesthouses</li> <li>• Regulate services within the informal sector--not always desirable, but can be</li> <li>• Encourage co-operative hotel enterprises</li> <li>• Encourage alternatives to large hotels such as bed and breakfasts and home-stays.</li> </ul>

	<ul style="list-style-type: none"> <li>• Hire locally</li> </ul>	<ul style="list-style-type: none"> <li>• Set up hotel school to build local capacity in hotel sector</li> </ul>
<b>Social</b>	<ul style="list-style-type: none"> <li>• Allow job sharing</li> <li>• Discourage 'immoral' activities</li> <li>• Allow staff input on hotel operations.</li> <li>• Consult the staff as to changes in their social environment</li> </ul>	<ul style="list-style-type: none"> <li>• Initiate community development activities that build community strength</li> <li>• Initiate economic development programs that can help residents take advantage of tourism</li> <li>• Consult the community about perceived changes in their social interactions</li> </ul>
<b>Cultural</b>	<ul style="list-style-type: none"> <li>• Have interpretive material available on non-Angkor related heritage</li> <li>• Initiate craft demonstrations within the hotel.</li> <li>• Create partnerships with local performers, artisans (e.g. offer a discount at a local cultural show rather than creating an exclusive one)</li> </ul>	<ul style="list-style-type: none"> <li>• Create community artists' guilds</li> <li>• Carry out heritage preservation awareness training in schools and education centres</li> <li>• Initiate artists' cooperatives for marketing</li> <li>• Conduct community consultation to monitor effects of tourism on the local population</li> <li>• Create oral history projects to record history, culture, craft methods</li> <li>• Create marketing opportunities for crafts</li> <li>• Encourage training in the arts</li> <li>• Encourage demonstration projects</li> <li>• Discourage the mass production of artifacts</li> <li>• Market local culture to the international tourist in a sustainable way</li> </ul>

<b>Health</b>	<ul style="list-style-type: none"> <li>• Apply labour standards</li> <li>• Update and repair equipment regularly</li> <li>• Meet international safety standards</li> <li>• Mitigate sound pollution with sound barriers, mufflers etc.</li> <li>• Minimize the use of toxic materials</li> </ul>	<ul style="list-style-type: none"> <li>• Standardize labour practices</li> <li>• Make safety equipment readily available</li> <li>• Provide public education regarding health and safety.</li> </ul>
<b>Physical</b>	<ul style="list-style-type: none"> <li>• Consult public to assess the validity of previous guidelines and to ensure they reflect current social beliefs and practices</li> <li>• Cooperate with all stakeholders including government bodies and other parties in the industry to ensure responsible practices are put in place</li> <li>• Use local architects to support local economy and bolster community profile</li> </ul>	<ul style="list-style-type: none"> <li>• Development of design guidelines that include site selection, relationship with adjoining uses, pedestrian oriented design, density, scale, circulation and architecture</li> <li>• Consult the public to assess planning issues and to examine the cultural relevance of completed designs</li> <li>• Appoint a review committee to ensure that guidelines are being implemented and hotel construction is being monitored</li> <li>• Establish monitoring strategies that include an inventory of indicators signifying successful site planning techniques, urban design and building design</li> </ul>

## Table of Contents

<b>1.0</b>	<b>PROJECT DESCRIPTION</b>	<b>0</b>
	<b>1</b>	
<b>1.1</b>	<b>Statement of Problem.....</b>	<b>1</b>
<b>1.2</b>	<b>The Project.....</b>	<b>1</b>
1.2.1	Memorandum of Understanding.....	2
<b>1.3</b>	<b>Objective of Study .....</b>	<b>2</b>
<b>1.4</b>	<b>Methodology.....</b>	<b>2</b>
1.4.1	Secondary Data.....	3
1.4.2	Primary Data.....	3
<b>1.5</b>	<b>Limitations of the Study .....</b>	<b>6</b>
1.5.1	Time.....	6
1.5.2	Technical Expertise.....	6
1.5.3	Modification of the Public Participation Process .....	7
1.5.4	Language Barriers .....	7
1.5.5	Cultural Barrier.....	7
<b>2.0</b>	<b>DESCRIPTION OF THE ENVIRONMENT</b>	<b>0</b>
	<b>8</b>	
<b>2.1</b>	<b>Natural Environment .....</b>	<b>8</b>
2.1.1	Climate .....	9
2.1.2	Vegetation.....	9
2.1.3	Siem Reap River.....	9
2.1.4	Tonle Sap Lake.....	9
<b>2.2</b>	<b>Built Environment.....</b>	<b>10</b>
2.2.1	Road System.....	11
2.2.2	Water Supply.....	12
2.2.3	Western Baray.....	15
2.2.4	Sewage Treatment.....	15
2.2.5	Electricity.....	15
2.2.6	Hotel Development.....	15
2.2.7	Commercial.....	17
2.2.8	Residential.....	17
2.2.9	Airport .....	18
2.2.10	Landfill.....	18

<b>2.3</b>	<b>Socio-economic.....</b>	<b>18</b>
2.3.1	Cultural.....	18
2.3.2	Social.....	19
2.3.3	Demographics.....	19
2.3.4	Education.....	19
2.3.5	Economic.....	20
<b>3.0</b>	<b>SCOPING</b>	<b>2</b>
	<b>2</b>	
<b>3.1</b>	<b>Scoping Methods .....</b>	<b>22</b>
3.1.1	Literature Review.....	22
3.1.2	Observation of the Scoping Exercise Carried Out by Workshop Participants.....	22
3.1.3	Site visits to guesthouses and hotels.....	23
<b>3.2</b>	<b>Issues .....</b>	<b>24</b>
3.2.1	Energy Consumption.....	24
3.2.2	Environmental Contaminants .....	25
3.2.3	Landscaping, vegetation, habitat destruction.....	25
3.2.4	Sewage Disposal.....	26
3.2.5	Storm water Disposal.....	26
3.2.6	Water Consumption.....	26
3.2.7	Solid Waste Disposal.....	27
3.2.8	Transportation.....	27
3.2.9	Human Impacts.....	28
<b>4.0</b>	<b>ASSESSMENT OF IMPACTS</b>	<b>3</b>
	<b>0</b>	
<b>4.1</b>	<b>Criteria for Significance .....</b>	<b>30</b>
4.1.1	Seriousness of Impacts.....	30
4.1.2	Ubiquity of the Activity.....	31
4.1.3	Importance to the Community and Decision-Makers .....	31
4.1.4	Economic Development .....	31
4.1.5	Aesthetics .....	32
4.1.6	Human Health.....	32
<b>4.2</b>	<b>Methodology.....</b>	<b>34</b>
4.2.1	Literature Review.....	34
4.2.2	Interviews.....	34
4.2.3	Water Sampling.....	34
4.2.4	Formulation of Mitigation Measures.....	34

<b>4.3</b>	<b>Solid Waste .....</b>	<b>36</b>
4.3.1	Current Practices .....	36
<b>4.3.2</b>	<b>Impacts .....</b>	<b>37</b>
4.3.3	Groundwater .....	38
4.3.4	Surface Waters.....	39
4.3.5	Future Impacts .....	42
4.3.6	Operational Mitigation Measures .....	43
4.3.7	Government-level Mitigation Measures.....	52
<b>4.4</b>	<b>Water and Se wage .....</b>	<b>57</b>
4.4.1	Current Practices and Conditions .....	57
4.4.2	Impacts .....	62
4.4.3	Operational Mitigation Measures .....	66
4.4.4	Government-level Mitigation Measures.....	76
<b>4.5</b>	<b>Energy.....</b>	<b>81</b>
4.5.1	Current Practices .....	81
4.5.2	Impacts .....	82
4.5.3	Operational Mitigation Measures .....	84
4.5.4	Government-level Mitigation Measures.....	89
4.6.1	Assessment of Impacts.....	94
4.6.2	Mitigation Measures.....	107
<b>5.0</b>	<b>RECOMMENDATIONS FOR THE EIA PROCESS</b>	<b>1</b>
		<b>15</b>
<b>5.1</b>	<b>Conduct Additional Research .....</b>	<b>115</b>
5.1.1	Primary Data.....	116
5.1.2	Secondary Data.....	116
<b>5.2</b>	<b>Conduct an Environmental Review.....</b>	<b>117</b>
<b>5.3</b>	<b>Formulate an Environmental Management Plan (EMP) .....</b>	<b>117</b>
<b>5.4</b>	<b>Formulate a Follow Up Study (Monitoring and Evaluation Strategy) .....</b>	<b>118</b>
<b>5.5</b>	<b>Define the Role of Participants .....</b>	<b>119</b>
<b>5.6</b>	<b>Disseminate Information.....</b>	<b>120</b>
<b>5.7</b>	<b>Consult the Local Population.....</b>	<b>120</b>
5.7.1	Filling in information gaps and verifying information.....	120
5.7.2	Developing the EMP .....	120
5.7.3	Designing EMP components .....	121
5.7.4	Monitoring and evaluating.....	121

5.7.5 Disseminating information.....	122
<b>Bibliography.....</b>	<b>122</b>
<b>Appendix I.....</b>	<b>128</b>
<b>Appendix II.....</b>	<b>145</b>
<b>Appendix III.....</b>	<b>168</b>
<b>Appendix IV.....</b>	<b>170</b>