

# Initial Environmental Examination

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March 2012

## BHU: Air Connectivity Transport Enhancement Project

Prepared by Department of Civil Aviation, Royal Government of Bhutan for the Asian Development Bank (ADB)

## **CURRENCY EQUIVALENTS**

(as of 14 March 2012)

Currency Unit	–	ngultrum (Nu)
Nu1.00	=	\$0.019978
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## **ABBREVIATIONS**

AAI	–	Airports authority of India
ADB	–	Asian Development Bank
ATCEP	–	Air Transport Connectivity Enhancement Project
BBSC	–	Bhutan Broadcasting Services Corporation
BHU	–	Basic Health Unit
BLSS	–	Bhutan living standard survey
CA	–	Competent Authority
CC	–	Construction Contractor
CDP	–	Capacity development project
CPS	–	Community Primary School
DA	–	Dzongkhag Administration
DC	–	Design Consultant
DCA	–	Department of Civil Aviation
DG	–	Diesel generator
DGM	–	Department of geology and mines
DOL	–	Department of the livestock
DYT	–	Dzongkhag Yargye Tshogdu
EC	–	Environmental Clearance
EIA	–	Environmental impact assessment
EMP	–	Environmental management plan
FMU	–	Forestry management unit
FNCA	–	Forest and nature conservation act
FNCR	–	Forest and nature conservation rules
GA	–	Geog administration
GLOF	–	Glacial lake outburst flood
GOI	–	Government of India
GRF	–	Government reserve forest
ICAO	–	International civil aviation organisation
IEE	–	Initial environmental examination
ILS	–	Instrument landing system
JSWNP	–	Jigme Singye Wangchuk National Park
mASL	–	Meter above sea level
MCT	–	Main central thrust
MOAF	–	Ministry of agriculture and forests
MOIC	–	Ministry of information and communications
NEC	–	National Environment Commission
NFFDP	–	National feed and fodder development programme
NRDCL	–	Natural resources development corporation limited
NSB	–	National Statistics Bureau

ORC	–	Outreach clinic
PAVA	–	Property Assessment and Valuation Agency
PHCB	–	Population & Housing Census of Bhutan
PPD	–	Policy and Planning Division
PPTA	–	Project Preparation Technical Assistance
R&R	–	Resettlement & rehabilitation
REA	–	Rapid environmental assessment
RGOB	–	Royal government of Bhutan
RMNP	–	Royal Manas National Park
RNP	–	Road Network Project
RNR-	–	Renewable Natural Resources Research and
RDC		Development Center
ROW	–	Right of Way
RWSS	–	Rural water supply schemes
SARPS	–	Standards and recommended practices
SPS	–	Safeguard policy statement
TNP	–	Thrumshingla National Park
TOR	–	Terms of Reference
WCP	–	Wangchuck Centennial Park

### **WEIGHTS AND MEASURES**

dB	–	decibel
Ha	–	hectare
km	–	Kilometer
km <sup>2</sup>	–	Square kilometer
m	–	Meter

### **NOTE**

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## **Executive Summary**

### **I. Introduction**

1. The Department of Civil Aviation (DCA) under Ministry of Information and Communications (MOIC), Royal Government of Bhutan (RGOB) has initiated a plan to improve current state of the country's domestic air transport system under the air transport connectivity enhancement project (ATCEP) with the assistance of Asian Development Bank (ADB). Three newly constructed domestic airports of Bumthang, Yongphula and Gelephu in the country have been identified for further upgrading and improvement, mainly based on the relative importance of these airports as domestic hubs for tourism and economic development on a regional basis.

2. An initial environmental examination (IEE) for the upgrading and improvement works was prepared under the Project Preparation Technical Assistance (PPTA) over a period of 5 months from July 2011 to Feb 2012 on behalf of the Department of Civil Aviation of RGoB. Field works were carried jointly with the social and resettlement assessment team.

3. The project has been classified as Category B in accordance with ADB's Environmental Assessment Guidelines (2003), and prepared in accordance with relevant laws and regulations of RGoB, including the Environmental Assessment Act (2000), the Regulation for the Environmental Clearance of Projects (2001) and with the ADB's Environmental Impact Assessment Guidelines, 2003; and the Safeguard Policy Statement 2009.

4. Upon completion of the detailed designs, the DCA will seek forestry clearances from the Department of Forests and Park Services if there any additional forest areas to be cleared. When these have been obtained, DCA will seek environmental clearance from National Environment Commission (NEC). The civil works will begin only when this has been received for relevant sub projects.

### **II. Description of the Project**

5. The proposed project will entail the upgrading and improvement of the existing domestic airports of Bumthang, Yongphula and Gelephu. The proposed airport improvement is designed to bring the facility to a level of development to fully meet international airport safety standards, and provide sufficient runway length to accept unrestricted operations of aircrafts like the Dornier 228, Beechcraft B200, Pilatus PC-12 and ATR42-500 as per Airport Reference Code 2B for all three airports. The proposed project will also include institutional strengthening and capacity building to support strategic management of the aviation development while improving environmental management.

6. The activities of three subprojects that are likely to be undertaken through ADB assistance is provided in table II-1. The proposed activities will be carried out within the designated airports boundaries.



**Table II-1: List of Work items that will be undertaken through ADB assistance**

<b>Subproject</b>	<b>Location</b>	<b>Work Items</b>
<b><i>Bumthang Airport</i></b>	Bathpalathang, Bumthang Dzongkhag	<ol style="list-style-type: none"> <li>1. Install perimeter fence</li> <li>2. New access road</li> <li>3. Final runway asphalt overlay</li> <li>4. General service vehicle</li> </ol>
<b><i>Yongphula Airport</i></b>	Yongphula, Kanglung, Trashigang Dzongkhag	<ol style="list-style-type: none"> <li>1. Install perimeter fence</li> <li>2. Remove hills NW(1/2) and SW obstructing the safe operation of the aircrafts</li> <li>3. Repair runway strip drainage</li> <li>4. General service vehicle</li> </ol>
<b><i>Gelephu Airport</i></b>	Bhur/Gelephu, Sarpang Dzongkhag	<ol style="list-style-type: none"> <li>1. Install 2.4km perimeter fence including security gate and guard house</li> <li>2. ARFFS support facilities (apron, housing for fire tender plus airport maintenance and airside access to runway)</li> <li>3. Airport Access Road</li> <li>4. Terminal expansion</li> <li>5. Apron and taxiway</li> <li>6. Drainage system for runway</li> <li>7. Flood protection structures</li> <li>8. Communications equipment</li> <li>9. DVOR/DME (1)</li> <li>10. General service vehicle</li> </ol>

Source: Revised scope of work, PPTA, ADB TA 7633-BHU, Feb 2012

### **III. Description of the Environment**

#### **A. Physical Environment**

##### **1. Geology, Soil and Seismology**

7. The Bhutan Himalaya can be tectonically divided into three east west trending belts: the southern frontal belt, which includes the lesser Himalaya and the foothills (Siwalik), the central crystalline belt, which includes greater Himalaya and the lesser Himalaya and the Tethyan belt, which includes portion of the greater Himalaya and portion of lesser Himalaya. Bumthang airfield falls in the Thimphu formation of the Higher Himalayan Belt. This formation is made up of pre-Cambrian metamorphic garnets and schist and granite gneiss, and is a prominent geological formation in Bhutan. Yongphula airfield lies on the boundary of Thimphu and Shumar formation. Shumar formation consists of metasedimentary rocks represented by phyllite, micaceous quartzite with rare limestone bands. Gelephu airfield falls in Quaternary formation of southern frontal belt borders with India in the south and comprises of boulder conglomerates, sand, silt and clay.

8. Bhutan falls within seismic risk zones IV and V. It is further divided into four hazard zones (very high, high, moderate and low). Bumthang airport falls under low earthquake hazard area. Gelephu and Yongphula airports lie in high and very high earthquake hazard zones respectively.

## **2. Meteorology and Climate**

9. The country can be divided into three distinct climatic zones corresponding to the three main geographical divisions. Bhutan's climate is as varied as its altitudes and, like most of Asia; it is affected by the monsoons. The climate is humid and subtropical in the southern plains and foothills, temperate in the inner Himalayan valleys of the southern and central regions, and cold in the north, with year-round snow on the main Himalayan summits. Bumthang and Yongphula airports fall within inner Himalaya while Gelephu airport is in the humid and southern foothill.

10. Bumthang, Yongphula and Gelephu receive an annual average precipitation of 711.7mm, 1060.4 mm and 5326.0 mm respectively. The maximum monthly rainfall takes place in the month of June, July and August while the minimum monthly rainfall occurs in the winter months.

11. August is observed as the hottest month of the year having mean daily maximum temperature of 22.5°C, 18.0°C and 30.4°C for Bumthang, Yongphula and Gelephu airport sites respectively. Similarly, January is the coldest month having mean daily minimum temperature of -3.5°C for Bumthang, 2.0°C for Yongphula and 13.2°C for Gelephu.

12. Wind direction is reported as the direction from which the wind blows and is based on surface observations. For Yongphula and Gelephu wind direction is predominantly from south-west where as for Bumthang it is predominantly from south-east direction.

## **3. Air Environment**

13. A site-specific background air quality data concerning PM<sub>10</sub>, SO<sub>x</sub>, and NO<sub>x</sub> was collected for all airport sites of pre monsoon season of 2011. The results ambient air quality show that the 24 hrs PM<sub>10</sub> values on the Bumthang exceed the Bhutan's ambient air quality standard. This may be on account of the ongoing construction activities at the project site and the anthropogenic activities at village in the vicinity of the site. PM<sub>10</sub> measurements of Yongphula and Gelephu are below national standards. SO<sub>x</sub> and NO<sub>x</sub> were not detected in all three project sites.

## **4. Noise Environment**

14. Baseline noise monitoring for all project sites were carried out by BHUCORE. The daytime noise level of Bumthang and Gelephu airports exceeded the permissible standard while the night time noise level was within the permissible standard. The major reason for exceedances of noise level during day is attributed to operation of heavy construction equipments during construction of the airports. On the other hand, the noise level for Yongphula airport site was within the permissible standard.

## **5. Hydrology and Water Quality**

15. Bhutan has four major river systems: the Drangme Chhu; the Punatsang Chhu; the Wang Chhu and the Amo Chhu. Each flows swiftly out of the Himalayas, southerly through the Duars to join the Brahmaputra River in India.

16. Chamkhar Chhu, which flow close to Bumthang airport, joins Mangde Chhu and Drangme Chhu to form Manas. Since the Chamkhar Chhu originates from the glacial lakes, there are risks of Glacial Lake Outburst Flood (GLOF) damaging the airport any time in future.

17. Drangme Chhu River falls within the 20 km radius of the Yongphula airport but there are no significant rivers or streams near the airport location.

18. Mao Khola and Bhur Khola are river systems that lie within 20 km radius of the Gelephu airport. However, the Paitha Khola and Aiepuwali Khola streams are the ones that actually traverse or intersect the airport. These streams are seasonal, flows only during monsoon.

#### **a) Surface Water Quality**

19. The water quality tests have been carried out for all three project sites. Interpretation of Bumthang and Yongphula water quality tests through physio chemical analysis of surface water samples suggests that quality of water is poor due to presence of coliform bacteria. However, it is adequate for irrigation purposes and can also be used for drinking purposes after conventional water treatment and disinfection. Since there is no permanent water bodies within Gelephu airport, drinking water of Majuwa under Bhur geog was tested and found to good without coliform bacteria and turbidity.

### **B. Biological Environment**

#### **1. Protected Areas**

20. Wangchuck Centennial Park (WCP) and Thrumshingla National Park (TNP) partly fall within 20 km radius of Bumthang airport. WCP and TCP lie approximately 6 km north and 13 km southeast respectively of the airport. The parks are at safe distances from the airport.

21. Similarly, Jigme Singye Wangchuck National Park (JSWNP) and Royal Manas National Park (RMNP) also fall within 20 km radius of Gelephu airport. JSWNP and RMNP lie approximately 16.5 km north and 13 km east respectively of the airport. These parks are also safe from the direct impacts of constructions of the airport.

22. There are no protected areas within 20km radius of Yongphula airport.

#### **2. Forest Resources and Land Cover**

23. As per Land Cover and Area Statistic 1997 of MoAF, about 67% of the Bumthang, 66% of Trashigang and 82% of Sarpang Dzongkhag are under true forest cover. Trashigang has the highest percentage of agriculture land (14.2) followed by Sarpang (12%). Blue Pine Forests are dominant in Bumthang whereas Sarpang Dzongkhag has almost 100% broadleaf forest.

24. Blue pine is the dominant land cover followed by the dry land agriculture in the vicinity of Bumthang airport. About 110.47 acres of Brown Swiss farm and its improved pasture land, 5.01 acres of government reserved forest land and 3.99 acres of dry land agriculture (Kamzhing) have been acquired for the construction of airport under RGOB financed component. The total affected land for Bumthang is 119.47 acres. No further land will be acquired under ADB financed Air Transport Connectivity Enhancement Project.

25. Yongphula Airport has been constructed in 1960s. Scrub forest is dominant in the immediate surroundings of the airport. However, warm broadleaf and chirpine forest are found towards Drangme Chhu valley and cool broadleaved forest above 2500 m. The change in land use is not significant as the airport has been in existences since 1960s.

26. Gelephu airport lie in the subtropical forest zone. The Airport has acquired about 282.93 acres of government reserve forest (GRF) and 235.48 acres of private agriculture land. Therefore total of 518.41 acres of land has been converted for airport development use under RGOB financed component. However, no further land will be acquired under ADB financed Air Transport Connectivity Enhancement Project.

### **3. Mammals and Birdlife**

27. Pine forests are extensive in and around the Bumthang airport area particularly the slope towards the Pedtsheling monastery. The bird species such as pheasants, partridges, common crow, magpie and mammals such as goral, Himalayan yellow marten are known to occupy these habitats.

28. The wildlife habitat immediately around Yongphula airport is poor due to the proximity to human habitat. However, further away from the human habitation, the abundance of wildlife (mammals and birdlife) is evident. Mammals such as Assamese Macaque, wild boar, barking deer, goral, Himalayan Serow, Sambar, leopard etc. are known to inhabit the areas further away from the human habitation. Although Yongphula area is quite rich birdlife there are no reports endangered or threatened bird species in the area.

29. The subtropical forest around Gelephu Airport area is known for the richness of wildlife both mammals and birdlife. Mammals such as elephant, barking deer, rhesus macaque, Bengal fox, hares, jungle cat etc inhabit the area. The area is also rich in bird species which includes the beautiful Indian Peafowl (peacock) and Great Hornbill.

### **C. Socio-economic Environment**

30. Socioeconomic information presented in the IEE is taken from the 2005 Census of Bhutan supplemented by various other sources noted in the text and field observations. Data have been compiled for dzongkhag and geog within the project area. The domestic airports projects fall under of three dzongkhags namely, Bumthang, Trashigang and Sarpang. The total population of the three dzongkhags was enumerated in 2005 at about 106,448 persons with an overall average sex ratio (male/female) of 1.08. Within the geogs where airports are located there are about 29,910 persons. The Small Area Estimation of Poverty in Rural Bhutan, August 2010, jointly carried out by World Bank & NSB, shows the number of poor in the three dzongkhags to be 18,594 with the poverty rate of 15.5% for Bumthang, 30% for Trashigang and 23% for Sarpang. *Poverty Analysis Report 2007* by NSB established the poverty line at Nu.1,096.94 per person per month.

31. The principal crops grown in the project area include wheat, buckwheat, barley and rye in Bumthang; maize, rice and millet in Trashigang; and paddy, maize, millet, pulses, oranges, areca nut and cardamom in Gelephu. The sale of livestock and livestock products is another important source of income for farmers who rear all types of domestic animals available in Bhutan.

32. Among all dzongkhag, 80% of households have piped water, while 9% of households have indoor flush toilets and 60% utilize pit latrines. The average literacy rate nationwide is nearly 60%, and with the exception of Bumthang, other two dzongkhags have literacy rates lower than the national average. The lowest literacy rate is found in Trashigang dzongkhag, with 56.2%.

33. Community and rural infrastructure constructed by RGoB include community schools, primary schools, basic health units, outreach clinics, renewable natural resources extension

offices and irrigation and rural water supply schemes. Most of the geogs and villages are now electrified through the Rural Electrification Project supported by ADB and other donors.

#### **D. Physical Cultural Resources**

34. Bumthang is the cultural and religious center in Bhutan with many temples and monasteries dotted around its four valleys. Bumthang Airport is located 1.3 and 2.5 km southeast of famous Jampa and Kurjey Lhakhangs respectively. From the Jakar Dzong (District Administrative center) it is located at around 1.15 km northeast.

35. Yulay Namgyal Chorten/Stupa was built in 1959, a year before the construction of the Yongphula airport by the Indian Military. Chorten is located within the airport boundary on small hillock east of airport terminal building. The chorten is considered sacred by the locals in the area and was built at the behest of Buddhist Master Dudjom Rimpoche by late Lam Karpo. Other important religious and cultural sites in the vicinity of airport are Ugyen Dongacholing Monastery and Shingchen Goenpa.

36. Apart from some newly built monasteries or temples under Gelephu and Sparpang, there are no important historical, spiritual or cultural entities in the vicinity of the Gelephu airport.

### **IV. Review of Environmental Impacts and Mitigation Measures carried out under RGOB Financed Components**

#### **A. Land Reclamation and River Protection Works**

37. The land reclamation through diversion of Chamkhar Chhu/River has increased the erosion on the banks on Dekiling and Wangdicholing side. River protection structures are inadequately designed and built to protect the river banks. Therefore, it is important to redesign and build the additional river protection structures for effective protection of river banks.

38. *Gelephu airport* is intersected by two seasonal streams, (Paitha Khola and Aiepuwali Khola streams) which usually flow during heavy downpour in monsoon season. The uncontrolled streams could damage the airport. Detail hydrological study of the area has to be carried out for designing of appropriate flood protection system.

#### **B. Loss of Land**

39. For Bumthang airport construction, there are no private land acquisition issues. A total of 110.47 acres of cattle farm and fodder development area under the National Brown Swiss Cattle Breeding Program and National Feed & Fodder Development Program has been acquired for the construction of the Airport. Because of the acquisition the program which liaises with the Department of Livestock under the Ministry of Agriculture has lost cattle farm and improved pasture land. It was agreed that the farm will be allowed to graze on the remaining pasture land till it is permanently relocated after the required farm infrastructures is developed at the new site in Lebi.

40. No private agriculture land has been acquired in Yongphula except for the 2.89 acres of institutional land belonging to Bhutan Telecom and Bhutan Broadcasting Services Corporation (BBSC). Land substitutions have been provided.

41. Gelephu airport project has acquired private land belonging to 135 persons. Land substitution and cash compensation has been provided to the affected persons. Further details are provided in the social due diligence report.

### **C. Demolition of Permanent and Temporary Structures**

42. Yongphula and Bumthang airport construction did not require demolition of any structures.

43. Gelephu airport construction will need to demolish at least 10 semi-permanent structures. Cash compensation at replacement cost has already been provided to the affected people.

### **D. Water Environment (Surface Water Resources)**

44. Construction of storm water drains alongside the Yongphula airport runway since 1960s have resulted in concentrated storm water flow towards Yongphula settlement causing erosion and landslides downstream. Hence, there is a need to study of existing drainage system of Yongphula airport to reduce effects of concentrated storm water flow.

### **E. Community Structures**

45. The community suspension or foot bridge at Bathpalathang has been demolished to make way for Bumthang airport construction. This has affected the people particularly school going children of Bathpalathang, Tamshing, Konchosum, Kharsum and Tekarzhong. The restoration of this bridge at an alternative site is important to reduce the walking distance or duration that people have to endure everyday without the suspension bridge.

46. The part of Yongphula airfield was used by locals (people of upper Udzorong) to commute between their village and the market centre at Yongphula. The closure of airfield to general public use has increased the walking duration by atleast 2 hours. The new footpath will have to be built outside the eastern side of the airport boundary to reduce the walking distance.

## **V. Environmental Impacts and Mitigation Measures Proposed for ADB Financed Air Transport Connectivity Enhancement Project**

47. This section discusses the potential environmental impacts of the proposed rehabilitation and upgrading works of the existing domestic airports and identifies mitigation measures to minimize the impacts in the design or pre-construction, construction and operational phases.

### **A. Preconstruction Phase Impacts**

#### **1. Environmental Impacts due to Project Design**

##### **a) *Slope Erosion***

48. The main embankment of the runway strip of Bumthang is located parallel to Chamkhar Chhu River with the possibility of slope and bank erosion.

49. Gelephu runway is built on the flat terrain with no slope erosion problem.

50. The Yongphula airport is built on the ridge top with potential slope erosion problem during constructions particularly in monsoon.

51. Potential slope erosion impact will be mitigated by designing slope erosion controls such as benching, retaining and breast walls, and bioengineering (plantation of locally available plant species) for Bumthang and Yongphula airports.

## **B. Construction Phase Impacts**

### **1. Land Environment**

52. **Construction Materials and its Transportation:** Quarrying can cause environmental damages such as slope failure, soil erosion, surface water pollution and siltation. The haulage of construction materials from the quarry to construction sites increases the pollution due to vehicular exhaust and to dust from exposed construction materials. Construction material for Bumthang and Gelephu will be quarried from the Gathak and Mao Khola quarries respectively. These quarries have already been operational for many years and supply materials to various construction projects within the locality. Quarry for sourcing construction materials for Yongphula airport will be identified during detailed design. Environment friendly quarrying through benching process will be carried out at Gathak quarry in Bumthang while only surface collection will be done at Mao Khola in Gelephu. Bioengineering will be applied for slope stabilizations. Regular maintenance of vehicle and covering the construction materials during haulage will be done to reduce dust pollution.

53. **Excavation, Filling and Levelling Works:** The construction of access road for Bumthang and Gelephu airport will require excavation, filling and levelling of earth to maintain the roadway gradient. Similarly, earthwork and excavation will be required for removing two small hillocks northwest of the airport terminal to improve air safety for Yongphula airport. These activities will generate excavated earth which can cause soil erosion and dust pollution. However, these impacts could be mitigated by way of using excavated material for filling works, disposal of spoil at designated sites, bioengineering for slope stabilization, construction of log and boulder barriers etc., to prevent damage of vegetation down slope.

54. **Waste disposal:** The wastes generated due to construction activities are likely to cause negative environmental impacts during its storage, transportation and disposal. At Bumthang and Gelephu waste could be generated during site clearance. Further, chemical and municipal waste will be generated during construction period for three airport sites. The waste will be managed by reducing the waste generation at source, re-using and recycling. The chemical (waste engine oil) and municipal solid will be collected and disposed off safely.

### **2. Water Environment**

55. During construction surface water resources may be affected by accidental spillage of hazardous substances into water bodies by inappropriate management practices. Construction of the river/flood protection works are another critical issues for Gelephu and Bumthang airports. Water pollution may arise due to the construction of river bank protection works. The impacts will be mitigated by actively preventing accidental spillage of chemicals, proper spoil disposal, avoiding dumping sewage into water bodies and through treatment of waste water.

### **3. Air Environment**

56. During site clearance and earthwork operations there will be a temporary negative impact on air quality in terms of increased dust suspension and gaseous emissions from the movement of heavy machinery and equipment. Dust will inevitably occur at and inside the construction corridor throughout that period. During the final stage of construction dust will also be generated alongside the haul route (Gathak Quarry to Bumthang Airport site and Maokhola

to Gelephu airport site) from the quarries from where aggregate for the upper layer of the runway will be obtained. In addition dust will be a health and safety issue for the workforce at the site. The dust pollution will be controlled by means of covering construction materials during transportation, regular maintenance of transport vehicles, sprinkling water twice a day to dampen dust at the construction sites and providing gasmask for the construction workers.

#### 4. Noise Environment

57. During construction noise will occur at and around the construction sites from the operation of heavy site equipment and construction vehicles. The impact will be temporary and local and generally decrease with the distance from the source. The settlements that will most likely be affected by construction noise are parts of Bathpalathang and Wangdicholing for Bumthang airport construction site. For Gelephu and Yongphula airport, noise pollution will not be of serious issue as the settlements are quite at a sufficient distance from the construction sites. However, the working hours will be limited to daytime period. The workers will be provided with noise protection earplugs and the contractors will be obliged to use construction equipment that produce less noise.

#### 5. Ecological Environment

58. **Site clearance** is the initial step of the construction phase which has already been carried out under the RGOB funded activities. The construction of access road for Bumthang airport will require approximately 340 trees to be felled. There will be no tree felling at Yongphula and Gelephu airports. Department of Forests and Park Services will survey and mark the trees that require felling. The felled logs will be harvested by Natural Resource Development Corporation Ltd. (NRDCL). Compensatory plantation (of 1:5) will be carried out under project.

59. **Wildlife Habitat:** Since the additional expansion and rehabilitation works will take place within the airport boundary area there will be no loss of habitat under the project. In addition a greenbelt development plan will be prepared during the detailed design phase of the project.

#### 6. Socio-Economic Environment

64. **Community Structures:** The rural water supply scheme (RWSS) with its pipeline and the storage tank catering about 70 households of Yongphula community is located within the airport boundary. Therefore, future airport expansion and upgrading works will be taken up in a manner as far possible to prevent damage to the water supply system. Necessity for relocation will further be studied during the detailed design stage and necessary consultations will be carried out with the communities of Yongphula.

#### 7. Health and Safety of Construction Workers

60. During construction the health and safety of the workforce is at risk due to an accident-prone working environment, long shifts and through accommodation at a campsite. To minimise the risks associated to these conditions DCA will be responsible to ensure that adequate health care arrangements are available at the site throughout the construction period. The contractors will ensure that first aid kits are available at work sites.

#### 8. Physical Cultural Resources

61. **Religious, Historical, Cultural and Archeological Sites:** Cultural or religious sites of Bumthang, Yongphula and Gelephu will have no direct impact during the construction of the airports as the sites are away from the immediate construction zone. However care must be taken



to avoid damage to the stupa (chorten) in Yongphula. If relocation is necessary in future, it will be decided jointly by Lam Jigme Tenzin, Kanglung geog and Dzongkhag Administration along with the Project officials. Based on consensus, the relocation of the chorten will be carried out with the assistance of the project.

### **C. Operational Phase**

62. Environmental impacts during operation stage will be insignificant and will be mostly with regard to wastes and pollution, noise and airport safety. There are risks where waste might not be managed properly and may escape to the environment, resulting in the pollution of surrounding land, air and water, particularly sewage; fuels, oils and other chemical; solid wastes; fire retardants/fire-fighting chemicals; and stockpiled materials.

#### **1. Air Environment**

63. The major air emissions expected during the operation phase of the airport project will be due to operation of aircrafts and vehicular traffic generated because of airport operations. However, the extent of air pollution will be minimal due to limited traffic of both air and vehicular. Nevertheless, the DCA and the future airport authority will ensure that aircraft engines shut down during idling periods, allow ICAO certified aircrafts and carryout appropriate plantation (greenbelt development) to check air pollution.

#### **2. Noise Environment**

64. During operation, noise associated with an airport can be attributed to a number of sources and activities such as aircraft take-offs and landings; aircraft flights over residential neighbourhoods; engine run-ups, which are tests performed on aircraft engines and systems after maintenance to ensure that they function safely; reverse thrust, which is used to slow down an aircraft when landing on the runway; and general noise from ground services equipment. The impacts noise cannot be eliminated entirely but can be reduced to acceptable limits by following the ICAO Balanced Approach<sup>1</sup> concept provides airports with an agreed methodology to be used to address and manage aircraft noise problems in an environmentally responsive and economically responsible way. The Balanced Approach to noise management encompasses four principal elements: reduction of noise at source; land use planning and management; noise abatement operational procedures; and operating restrictions on aircraft.

#### **3. Water Environment**

65. During operation phase, airport activities will produce substantial amount of wastewater. The wastewater if discharged untreated will pollute the surface as well as ground water. In general the amount of wastewater will be reduced through proper and efficient use of water. The wastewater treatment plant will be installed in future based on the wastewater production and the treatment requirement.

#### **4. Ecological Environment**

66. The protected areas that are within 20 km radius of the Bumthang airport site are Wangchuck Centennial Park to the north and Thrumshingla National Park south and south-east. However, level of disturbance to wildlife due to aircraft noise during landing and take-off on both the protected areas is expected to be minimal as park or protected areas located at away from the airfield and moreover the number of flights would be just few times in a week.

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<sup>1</sup> See: ICAO Airport Development Reference Manual, 9th edition, 2004

67. Similarly, the part of Royal Manas National Park (RMNP) to the east and Jigme Singye Wangchuck National Park (JSWNP) to the north of Gelephu airport site falls within 20 km radius. Impacts on wildlife due to noise pollution would be minimal as the RMNP lies 13 km and the JSWNP lies 16.5 km away from the airport.

## **5. Socio-Economic Environment**

68. During operation phase, it is expected that high decibel noise (65-70 dB) will be generated due to airplane landing and takeoff. However, noise impact will not be that serious as the noise exposure for communities at all domestic airports would be of short duration (approx. 5-10 minutes), further there will be limited number of flights per week. Hence negative impact may not be severe as expected. In addition, tree plantation (through greenbelt development programme) will be carried in the vicinity of the airports to absorb the noise as much as possible and to give relief to the surrounding communities.

## **6. Physical Cultural Resources**

69. During operation of Bumthang and Yongphula airports, there will be some impacts due to noise of aircraft landing and takeoff, on the religious and cultural assets located in the vicinity of the airports. For Bumthang; Jakar Dzong, Jampa Lhakhang, Kurje and Tamzhing monasteries while in Yongphula; Shingchen Goenpa, Mongling Goenpa and Yongphula monasteries are expected to be impacted in some way due to noise and vibration as a result of the aircraft operation. DCA will actively implement effective noise management programme through import of aircraft that make less noise; tree plantations; reduction of noise at source and certify airports based on the noise study as per ICAO Annex 16 procedures („Aircraft Noise’)

## **VI. Public Consultation, Disclosure and Grievance Mechanism**

70. Public consultations were carried out by DCA in various stages of the airport constructions. The consultations were also under current feasibility study of air transport connectivity enhancement projects.

71. Persons consulted included local residents, community leaders, local government officials (Geogs and Dzongkhags) and other important officials. The main purpose of the consultation were to present the proposed project, illicit issues and concerns that people in the impact area may have relevant to the proposed development. The participants of the public consultations at three airport sites were unanimous in their support for the proposed development and did not object the project implementation. They did raise some concerns on negative impacts on their land from inadequate river training works, poor drainage, potential impact on a stupa (in Yonphula) and impacts on community facilities such as footbridges/footpaths. Since the government funded component of the project comprised majority of the airport establishment works, most of these issues are directly linked to the government funded component. However, necessary due diligence has been carried out under the current project. It has been found that there are no major pending issues. Issues on drainage and river training works will be further studied during the detailed design and accordingly included in the project if found necessary and feasible.

## **VII. Environmental Management Plan**

### **A. Environmental Management Plan and Responsible Party**

72. The Environmental Management Plan (EMP) provided in chapter X of the main will serve as a guideline for incorporating environmental measures to be carried out by DCA, the project manager, contractors and other parties to mitigate possible impacts of the Project. The EMP needs to be updated at the beginning of implementation, especially during detailed design so that the locations and the frequency of monitoring can be defined in a more practical way.

73. DCA through the project manager is responsible for ensuring that (i) all required mitigation measures that need to be incorporated into the project design are passed onto the engineering consultants, (ii) the bidding document for contractor contains all required mitigation measures to be implemented during the construction period and contractors' obligations to implement the EMP during construction, (iii) the environmental clearance is obtained before commencement of civil work in the relevant section of project roads, (iv) implementation of EMP is monitored regularly as required and the annual report on implementation of the EMP is well documented, (v) other parties and government agencies implement the EMP at all stages of the Project, (vi) remedial actions are undertaken in response to unpredicted environment impacts, and (vii) additional environmental assessment is undertaken if any change in project design takes place.

74. To ensure that contractors comply with the provisions of the EMP, the following specifications should be incorporated in all construction bidding documents: (i) the environmental mitigation measures and environmental monitoring works that need to be implemented by the contractor; (ii) environmental clauses for contract conditions and specifications; and (iii) the IEE reports.

### **B. Environmental Monitoring and Reporting**

75. The Environmental Monitoring Plan is provided in chapter X section C. DCA will nominate Project Coordinators of respective subprojects to be the site level environment focal persons to ensure environmental compliance by the contractors. The site level environmental focal persons will report monthly on environmental compliance status of the project to the overall Environmental Monitoring In-Charge (in this case to the Joint Director of DCA), who will be responsible for compilation of the environmental monitoring reports and submit to annual report to ADB and other concerned stakeholders. Similarly, the contractors will have their environmental management officers who will be responsible for implementing mitigation measures in the construction specification. One environment specialist will be engaged as a member of the design consultant teams who will work with DCA. An environment specialist will also be engaged under the construction supervision consultants (CSC) to monitor EMP implementation and provide technical guidance to the contractor.

76. During construction and operations, DCA and other relevant government agencies such as Department of Forests and Park Services, NEC, the Environmental officers working for NEC at dzongkhags and Dzongkhag administrations will be involved in monitoring environmental performance of the project. DCA will ensure the submission of annual report on EMP implementation to ADB and the relevant government agencies.

## **VIII. Conclusion and Recommendation**

77. From the current study, it is concluded that the upgrading and improvement of the existing domestic airports under Air Transport Connectivity Enhancement Project (ATCEP) will have minimum impact on environment; as the overall construction activities will be limited and

carried out within the existing airport boundaries. However, as part of the IEE study, environmental impacts occurred due to the implementation of the RGOB financed domestic airports development project (namely Bumthang, Yongphula and Gelephu airports) have also been assessed. It has been observed that the major impacts were as a result of the implementation of these RGOB financed components.

78. The environmental impacts predicted for ADB components are insignificant. The predicted impacts are temporary, reversible and can easily be mitigated using available methods. The mitigation measures proposed in the IEE/EMP are sufficient. At the implementation stage, DCA and other relevant agencies such as Dzongkhag Administration, Department of Forests and Park Services, National Environment Commission will monitor the implementation of mitigation measures as specified under the monitoring programme. With these measures in place, it is predicted that all potential environmental impacts can be mitigated to insignificant levels, and therefore, no further impact assessment is considered necessary. It is also envisaged that environmental impacts identified by the study will not result in any residual impacts. Moreover, EMP will be updated during the detailed design stage to include any changes in scope of works and accordingly update the environmental impacts and the mitigation measures. Further during the project implementation, an annual report on EMP implementation will be submitted to ADB and the relevant government agencies.

## **I. INTRODUCTION**

### **A. Project Background**

1. The Royal Government of Bhutan (RGOB) has constructed three new domestic airports in the centre, east and south of the country. An important aspect of planned national policy towards civil aviation is to facilitate the development of domestic air services in Bhutan. Three airports of Bumthang, Yongphula and Gelephu are constructed by the Department of Civil Aviation (DCA), Ministry of Information and Communications (MOIC) with funding from RGOB. Of the three airports, Yongphula is upgradation of the existing airport built by Indian Army in 1960s. DCA has completed upgrading of Yongphula airport as well as the construction of Bumthang airport whereas Gelephu airport is under construction and expected to be completed by April 2012. These airports have been planned, and constructed for the operation of small aircrafts such as Dornier 228, Beechcraft B200 and Pilatus PC-12. However, all three domestic airports will require improvement and further upgrading to meet the international air safety standards.

2. Therefore, DCA has initiated a plan to upgrade and improve all three airports with financial assistance of ADB under the Air Transport Connectivity Enhancement Project (ATCEP). The upgraded domestic airports is expected to facilitate domestic traffic and expand the reach and travel flexibility for international tourists visiting the country.

### **B. Purpose of the Report**

3. The purpose of the report is to identify the environmental impacts directly related to the ADB component (ADB Project Number 44239-01) and conduct an audit of environmental safeguard activities carried out under the RGOB component. The investigative process involves characterizing activities related to development of the Bumthang, Yongphula and Gelephu airports and predicting impacts on environmental resources. The investigation encompasses the affected area of the Project in respect to the upgrading works being proposed, the various phases of project development from preconstruction through operations, and the types of environmental resources potentially affected. This report is a presentation of the findings resulting from this process. Mitigation measures are proposed for potential impacts and impacts that cannot be avoided, and within the context of the Environmental Management Plan (EMP), monitoring indicators are specified. The environmental assessment is carried out under the guidance of the ADB SPS 2009, EA guidelines 2003 and the Royal Government of Bhutan (RGoB) and includes chapters on description of the project, environmental resources, alternatives considered, environmental impacts and mitigation measures, mitigation and monitoring plan, and public consultation procedures. Appendix B contains the terms of reference for the IEE approved by the NEC..

### **C. Project Influenced Area (Study Area)**

4. The area that will be impacted by the Project during construction and operation does not coincide with its ultimate physical boundaries. The type and range of various expected direct and indirect environmental impacts therefore need to be fully understood at the earliest possible stages of the IEE study.

5. Based on the results of the initial scoping of potential environmental impacts and the identification of sensitive receptors we have identified the following geographical areas likely to be affected at the various stages of the Project:

6. During construction temporary and permanent impacts will occur both on- and off-site. The most direct physical impact will be on-site in the area of the actual physical interventions. To ensure that impacts related to the physical presence of the airport in the receiving environment will be appropriately addressed the study area includes further areas to the north, east, south and west of the airport boundary.

7. In Bumthang, the study area extends up to the boundary of RNR- RDC, Fodder Development Area and Brown Swiss Cattle & Horse Farm range land to the east. In the west the Chamkhar River (bordering Wangdicholing & Dekiling Township) forms the outer boundaries of this study. The Kurje and Tamzhing settlement forms North and north-west boundary. On the south and southeastern part, Bathpalathang Industrial area and Chamkhar town forms the boundary of the study area. Direct off-site impact will result from material extraction and the transport and perhaps the temporary storage of these construction materials. Therefore Gathak quarry which is the source of rock material for the airport construction located about 32 km from the construction site has been included in the study area.

8. In Yongphula the Samdrup Jongkhar – Trashigang highway forms the western and southern boundaries of the airport. The IMTRAT, RBA colony and Yonphu pam, Yongphula, Shingchen Gonpa villages forms the North and north-eastern boundary. The community forest of Yongphula forms the eastern boundary of the airport project.

9. In Gelephu, the Gelephu – Tsirang highway forms the southern boundary of the airport. Bhur, Jupray, Jaruwa, Lekithang settlements forms western, northern and eastern boundaries of the airport project respectively. Direct off-site impact will result from material extraction and the transport and perhaps the temporary storage of these construction materials. Therefore Mao khola quarry from which material will be sourced for the airport construction has been included in the study area.

10. During operation of the airport most impacts will be confined to the area that will be affected by construction impacts. This statement however, does not apply to off-site noise impacts due to operation of aircraft. 20 km radius has been considered in line with the NEC approved TOR for the study of possible noise impacts of aircraft. Off-site operational impact may affect protected area, which lies in the direct approach corridor of aircraft.

11. Further important aspects of the project are induced development, i.e. the expected impact on the socio-economic framework conditions and medium to long-term development perspectives of Bumthang, Trashigang, and Sarpang and other neighbouring Dzongkhags and potential cumulative impacts. In the context of a predominantly rural landscape and so far limited exploited tourism development potential economic growth will almost inevitably induce changes in land use and the social and socio-economic environment. Induced development is expected to be felt region-wide, but this effect cannot be quantified with a reasonable degree of certainty in the frame of this study. The present report therefore provides a qualitative description of the expected development scenario at the local, regional and national level and highlights the potential induced effects of such development on the natural resources and the human and socio-economic environment. Based on this scenario some proposals of strategic nature are proposed to ensure the sustainability of the development and thus the long-term success of the Project.

12. In the light of the above, the boundaries of the study areas vary according to the impacts expected at different phases of the Project.

#### **D. Data Sources**

13. Primary observation from site surveys and published information from DCA (EIA reports on Bumthang, Yongphula and Gelephu and the Progress Report No.1 from PPTA Engineering Team) are the three main types of source materials. Field data were obtained jointly with the Social and Resettlement team for the preparation of the IEE from Dzongkhags, Geogs and villages (Bumthang, Trashigang and Sarpang). A reference list of published information and web sources used in the IEE is provided in Appendix A.

#### **E. Status of IEE and Further Additions**

14. The IEE was prepared during the Project Preparation Technical Assistance (PPTA) over a 5 months period from July – February 2012 national environmental consultant<sup>2</sup> engaged directly by the ADB to work with the PPTA team.

15. The environmental assessment process was used to influence changes in project design, and can be further applied in an adaptive management sense to improve project construction and operation based on results of monitoring undertaken during implementation. The IEE should be reviewed and updated at the detailed design stage of the project. Mitigation measures, monitoring requirements and costs contained in the EMP shall be reviewed and adjusted based on updated information. Also, further public consultation on social and environmental issues and enactment of a grievance procedure for those affected by degradation of the living environment, resettlement and loss of assets, shall be undertaken during the detailed design and project execution stages.

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<sup>2</sup> Karma Chogyel prepared the IEE.

## II. ENVIRONMENTAL POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

### A. International Environmental Policy

16. Bhutan is party to twelve multilateral environmental agreements including those on biodiversity, climate change - Kyoto protocol, desertification, endangered species and hazardous wastes. Those with particular relevance to the domestic airports (Bumthang, Yongphula and Gelephu) development include:

- UN Framework Convention on Climate Change signed on 11 June 1992 and ratified on 25 August 1995.
- Kyoto Protocol to the United Nations Framework Convention on Climate Change. Instrument of accession signed on 26 August 2002, and a member after Kyoto came into force from 2005.

Relevance: Domestic airport development works are not carbon neutral, contributing to an increase in continuous CO<sub>2</sub> emissions due to aircraft operations and vehicular use, and one-time-only release of carbon due to removal of biomass in road and runway right-of-ways for the airport.

- UN Convention on Biological Diversity signed 11 June 1992 and ratified 25 August 1995.

Relevance: Project potentially has both beneficial and adverse impacts on biodiversity. Beneficial impacts stem from improved access to an area where biodiversity resources are found (Wangchuck Centennial Park, Thrumshingla National Park, Jigme Singye Wangchuck National Park and Royal Manas National Park) particularly bringing increased number of tourists for nature or ecotourism. Adverse impacts from improved access causing resource exploitation and land use changes that affect biodiversity.

### B. ADB's Safeguard Policy Statement

17. The ADB Safeguard Policy Statement, 2009 requires that an Environmental Assessment report (either an Initial Environment Examination or Environmental Impact Assessment) be prepared by the borrower in accordance with ADB EA requirements and that loans or grants are classified according to their potential impact on the environment. Since the proposed air transport connectivity enhance project is basically upgrading and rehabilitation of the existing domestic airports, it can be classified as Environmental Category B because of the minimal anticipated adverse environmental impacts than the new airport construction project. Accordingly the RGoB criteria, requires preparation of simple EIA (which is similar to ADB's IEE) for the project. The ADB Rapid Environmental Assessment (REA) Checklist for Roads and Highways has been completed for the project (**Appendix C**), which, for similar reasons, indicates that the project should be classified as Category B.

### C. RGOB Environmental Protection Legislation

18. The Royal Government of Bhutan has in place detailed policies regarding environmental assessment that are founded in the Environmental Assessment Act (2000). The National Environment Commission (NEC) through its Secretariat is empowered to implement the EA Act, which sets out the guidelines for obtaining an environmental clearance (EC) for a project. Article 9 states that if the activity is going to be implemented by a Competent Authority (CA), the Application for Environmental Clearance is to be forwarded to the NEC for approval. The application for an EC must include a description of potential environmental effects. The



Secretariat of the NEC determines if the information provided is sufficient to identify effects, and if not the Secretariat can request that environmental assessment documents be prepared, following approved terms of reference. Additional information may be required by the NEC Secretariat if the EIA is considered incomplete. The EC is issued when the Secretariat is satisfied that a) effects are foreseeable and acceptable, b) the applicant is capable of carrying out the terms of the EC, c) the Project is seen to contribute to sustainable development of the country, d) the interests of concerned people have been taken into account, and e) the project is consistent with the Nation's environmental commitments. Once a decision is made, the environmental terms, description of mitigation measures and non-technical summary of the EC are made available to the public. The Secretariat also controls and monitors compliance with the terms of the EC (Art. 34.2). The EA Act provides right of access to work sites for monitoring and penalty provisions in cases of offense under the Act, including providing false information, denying access and other infractions.(Art. 49). The EA Act contains rules for appeals, dispute resolution, and other provisions.

19. The Regulation for the Environmental Clearance of Projects (February 2001) provides further information to supplement the EA Act. Upon receipt of the application for the EC a total period of 1- 3 months will be taken by NEC for issuing the EC. Official clearance from other concerned agencies is required for Projects within sensitive areas (Art. 17). Only upon receipt of all other clearances and No Objection Statements as given in table IV-1 will the EC be issued. The EC is valid for a period of five years or less, but may be renewed in cases where the Project is in compliance with the EC. Minimum requirements for public consultation are set forth in Section 31 of the Regulation. These include written notice to local communities, newspaper notices, facilitation of consultation, and provision of a minimum period of time for the public to comment on the EIA. The Regulation specifies that the EC will contain binding mitigation and compliance measures and appropriate means for monitoring, recordkeeping and reporting. The EC Regulation sets out requirements and formats that are similar to those of ADB.

20. The Regulation requires that environmental units be established in agencies and projects. However there is no Environment Unit within the Department of Civil Aviation.

21. A further guideline document has been promulgated by the NEC, called the Guideline for Application for Environmental Clearance for Highways and Roads<sup>3</sup>. This guideline describes information needed for inclusion in an application for an EC, which according to the guideline is done preliminary to the preparation of an EA Report. Specific requirements for project information are consistent with what is provided in the current IEE Report. Among those requirements are no-objection certificates that are provided by affected parties, as listed in Table II -1.

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<sup>3</sup> National Environment Commission, Royal Government of Bhutan, August 2004.

**Table II-1: No Objection Statements under RGoB Policy**

<b>Agency/concerned people to issue NOC</b>	<b>Why/when</b>
Dzongkhag /City Corporation	Dzongkhag Administrative approval
DOF	Should the project damage or acquire Tsamdo or Sokshing
DOF	Should the project involve felling of trees, or riverside quarrying or small-scale quarrying
Department of Culture	Should the project be located within 50m of a cultural or religious site
Nature Conservation Division (DOF)	Should the project be located within boundary of a protected area
Municipal Authority	within 50m of a public park
Private property owners	Should the project acquire private property
Department of Health	within 50m of hospital
Department of Education	within 50m of school
Department of Energy	Should the project require the relocation of power transmission line
Bhutan Telecom Authority	Should the project require relocation of telephone lines
Department of Roads	Should the project require access from highways and feeder roads
National Environment Commission	All new road construction projects need an environmental clearance from NEC. However, the EC will be issued only upon receipt of all necessary No Objection statements enlisted above.

#### **D. Nature Conservation Legislation**

22. The Forest and Nature Conservation Act 2005 (FNCA) includes policies for activities that are prohibited in forested areas and stipulates activities that need special permits from the Department of Forestry. Clause 10 (a) i) – x) describes types of activities such as forest clearing, tree felling, hunting and polluting that are not allowed in Government reserved forests. Clause 22 mentions that all wild animals whether enlisted under Schedule I (totally protected species) or not cannot be killed, injured, captured or collected unless under special conditions of self protection and other genuine reasons.

23. Further to the FNCA, the Forest and Nature Conservation Rules of Bhutan updated in 2006 provides rules for many of the activities that will be undertaken in the project, such as clearing and felling of trees, blasting and others. Clause 14 1) and 2) describes activities that are prohibited and restricted in forested areas. Clause 55 outlines procedures for sourcing stone, sand, gravel, rock, peat and surface soil from forested areas. Clause 61 1) – 5) provides an account of various forms of prohibitions within protected areas and special requirements necessary for carrying out specific development activities. Clause 64 provides information on activities prohibited for the purpose of wildlife protection/conservation.

24. Biodiversity protection provides an additional framework within which the Project must develop due to the presence of national parks and wildlife sanctuaries within range of the project area. These management areas were established to enable protection of the rich biodiversity resource of the region.

## E. Land Acquisition Regulations

25. The basis for land tenure is the Land Act 1979 (**Last amended in 2007**). Under this act, the acquisition of any land, constructions or other property occurs in accordance with the procedures established. Land use of the project area assists in identifying land ownership. Land use is classified under Chuzhing<sup>4</sup>, Kamzhing<sup>5</sup>, Tseri<sup>6</sup>, Tsamdo<sup>7</sup>, Sokshing<sup>8</sup>. Forest land can be classified under broad leaf, coniferous, scrub land and wetland. The ownership can be either (a) “private” or (b) “public”. For private land, the number of affected families needs to be identified. This data will be used to work out resettlement requirements and compensation payable. **“Affected Families”** are those who own or occupy the area and are dependent on it for their livelihood. They may or may not be the actual landowner. The key points of the Act applicable for the project are:

- As far as possible the government shall provide land substitution instead of cash compensation while acquiring land.
- Allotment of all substitute land shall be from the same Dzongkhag.

26. In case the project acquires a house, the compensation for any category of house whether built with RCC/brick/stone masonry or in traditional style, shall be paid on the basis of evaluation carried out in each case by a qualified engineer appointed by a competent authority.

27. The Land Compensation Rate, 2009 governs the compensation.

## F. ICAO Standards and Recommendations

### 1. General

28. The International Civil Aviation Organisation (ICAO) is a specialized agency of the United Nations charged with coordinating and regulating international air travel. The ICAO was established in 1947 by the Convention on International Civil Aviation, also known as the Chicago Convention. This Convention establishes rules of airspace, aircraft registration and safety, and details the rights of the signatories in relation to air travel.

29. DCA is a signatory of the Chicago Convention of the ICAO and thus has an international obligation to meet standards and recommended practices (SARPS) enshrined in the eighteen annexes to the Convention on International Civil Aviation. In the context of the present EIA the most relevant ICAO annexes are:

### 2. ICAO Annex 14: Aerodromes

30. ICAO Annex 14 contains standards and recommended practices (specifications) that prescribe the physical characteristics and obstacle limitation surfaces to be provided for at airports, and certain facilities and technical services normally provided at an airport. Most of the specifications for individual facilities detailed in Annex 14 have been interrelated by a reference code system and by the designation of the type of runway for which they are to be provided, as specified in the definitions. The document sets forth the minimum specifications for those aircraft types that are planned to operate at the site. Volume I of Annex 14 also contains several specifications aimed at enhancing the level of security of an airport.

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<sup>4</sup> Chuzhing: Paddy fields (Wetland)

<sup>5</sup> Kamzhing: Dryland Agriculture

<sup>6</sup> Tseri: Shifting Cultivation through slash and burn technique

<sup>7</sup> Tsamdo: Grazingland

<sup>8</sup> Sokshing: Private registered forest used for collection of leaf litters, branches and twigs for domestic household consumptions

31. According to ICAO recommendations States should certify airports open to public use in accordance with the specifications of Annex 14 as well as other relevant ICAO specifications through an appropriate regulatory framework.

32. Article 38 of the Chicago Convention obliges contracting states to notify the ICAO of any differences between their national regulations and practices and the International Standards contained in Annex 14 of the Convention.

### **3. ICAO Annex 16: Environmental Protection**

33. ICAO Annex 16 (3rd Edition 1993) deals with aircraft noise only and provides detailed guidance on noise evaluation procedures and methods, measurement, maximum noise levels, trade-offs and test procedures:

- Part I: Definitions;
- Part II: Aircraft Noise Certification;
- Part III: Noise Measurement for Monitoring Purposes;
- Part IV: Assessment of Airport Noise;
- Part V: Criteria for the Application of Noise Abatement Procedures.

34. According to Part V of the Annex aircraft operating procedures for noise abatement shall not be introduced unless the regulatory Authority, based on appropriate studies and consultations, determines that a noise problem exists. ICAO further recommends that aircraft operating procedures for noise abatement should be developed in consultation with the operators, which use the aerodrome concerned. The factors to be taken into consideration in the development of appropriate aircraft operating procedures for noise abatement should include the following:

- The nature and extent of the noise problem including the location of noise sensitive areas; and critical hours.
- The types of aircraft affected, including aircraft mass, aerodrome elevation, temperature considerations;
- The types of procedures likely to be most effective;
- Obstacle clearances; and
- Human performance in the application of the operating procedures.

### **4. ICAO Annex 18: Safe Transport of Dangerous Goods by Air**

35. The provisions of ICAO Annex 18 (3rd edition 2001) provide international standards and recommended practices regarding the international transport of dangerous goods<sup>22</sup> by air. The relatively broad provisions of this Annex are amplified by the detailed specifications of the Technical Instructions for the Safe Transport of Dangerous Goods by Air (Doc 9284). Each Contracting State shall designate and specify to ICAO an appropriate Authority within its administration to be responsible for ensuring compliance with this Annex.

36. The Annex provides standards for packing of dangerous goods, for labeling and marking, defines the shipper's and operator's responsibilities, specifies information to be provided to the pilot, the crew and passengers and others, claims the establishment of training programmes and of inspection, surveillance and enforcement procedures to ensure compliance with the provisions of this Annex.

## **G. Conclusions**

37. The Project is being developed within a framework based on ICAO Annexes (14, 16 & 18), and the policies and guidelines of the ADB and the laws, regulations and guidelines of the

RGoB. In regard to ADB, the ADB Environmental Assessment Guidelines (2002) and the Safeguard Policy Statement (SPS 2009) are the framework documents. The RGoB framework documents are the Environmental Assessment Act (2000), and Regulation for the Environmental Clearance of Projects (2001). Other regulations of the RGoB require prior clearance for project activities.

### III. DESCRIPTION OF THE PROJECT

#### A. Project Location

38. Domestic airports are located in Bathpalathang (Bumthang District), Yongphula (Trashigang District) and Gelephu (Sarpang District).

39. *Bumthang Airport:* The Bumthang airport is located at Bathpalathang under Chhoeckhor Geog in the Bumthang district in central north Bhutan which is situated 110km (aerial distance) east of the capital Thimphu and approximately 50km (aerial distance) south of the Chinese Border to the North. The elevation of the airport is at 2637m ASL. The site is at a distance of 1 km from Chamkhar or Jakar town.

40. Airport is accessed via Chamkhar – Tamzhing, single lane 3.5m wide feeder road starting from the east-west national highway connecting Thimphu and Trashigang. The road pavement condition was found to be poor and in need of improvement. The road to Tamzhing passes very close to Runway and there are plans to divert road outside the airport boundary and connect the airport via a new link road close to the location of the passenger terminal building which is under construction.

41. The airport site is located on a relatively flat land with gentle slope towards south. The runway under construction is parallel to Chamkhar Chhu River which is the main drainage within Bumthang district.

42. *Yongphula Airport:* The Yongphula airport is located in Yongphula under Kanglung Geog of the Trashigang district, and is situated some 200km (aerial distance) east of the capital Thimphu and approximately 25 to 30km south or southwest of the Indian Border (Arunachal Pradesh District, India). The elevation of the airport is approximately 2750m ASL. The nearest major town is Trashigang located some 30km drive north of Yongphula airport. The airport is connected to Samdrup Jongkhar – Trashigang highway by 0.7 km single lane access road from the south-east end of the airport.

43. *Gelephu Airport:* The Gelephu airport is located at the junction of Bhur (Samteling) and Gelephu Geogs in Sarpang district in southern Bhutan. It is located about 3 km from Gelephu and 30 km from Sarpang district head quarter. The Indo Bhutan Boarder is located within 1 km. Gelephu is the closest market place, which is located at Indo-Bhutan boarder (Datghari of Assam state of India). Airport is some 270 km (aerial distance) from Guwahati (State capital of Assam) and about 260 km (aerial distance) Thimphu.

44. The location of Bumthang, Yongphula and Gelephu airports are shown in Figure III-1, figure III-2, figure III-3 and figure III-4 respectively.

#### B. Project Layout

45. The Project has been designed in accordance with the established guidelines of the ICAO Annex 14, with the operation of aircrafts like the Dornier 228, Beechcraft B200 and Pilatus PC-12 as per Airport Reference Code 2B for all three airports. The general layout of Bumthang, Yongphula and Gelephu airports are shown in Figure III-5, figure III-6, and figure III-7 respectively.

**Figure III-1: Domestic Airport Locations within Bhutan****Figure III-2: Bumthang Airport Location within Bumthang District**

**Figure III-3: Yongphula Airport Location within Trashigang District**



**Figure III-4: Gelephu Airport Location within Sarpang District**





## 1. Runway

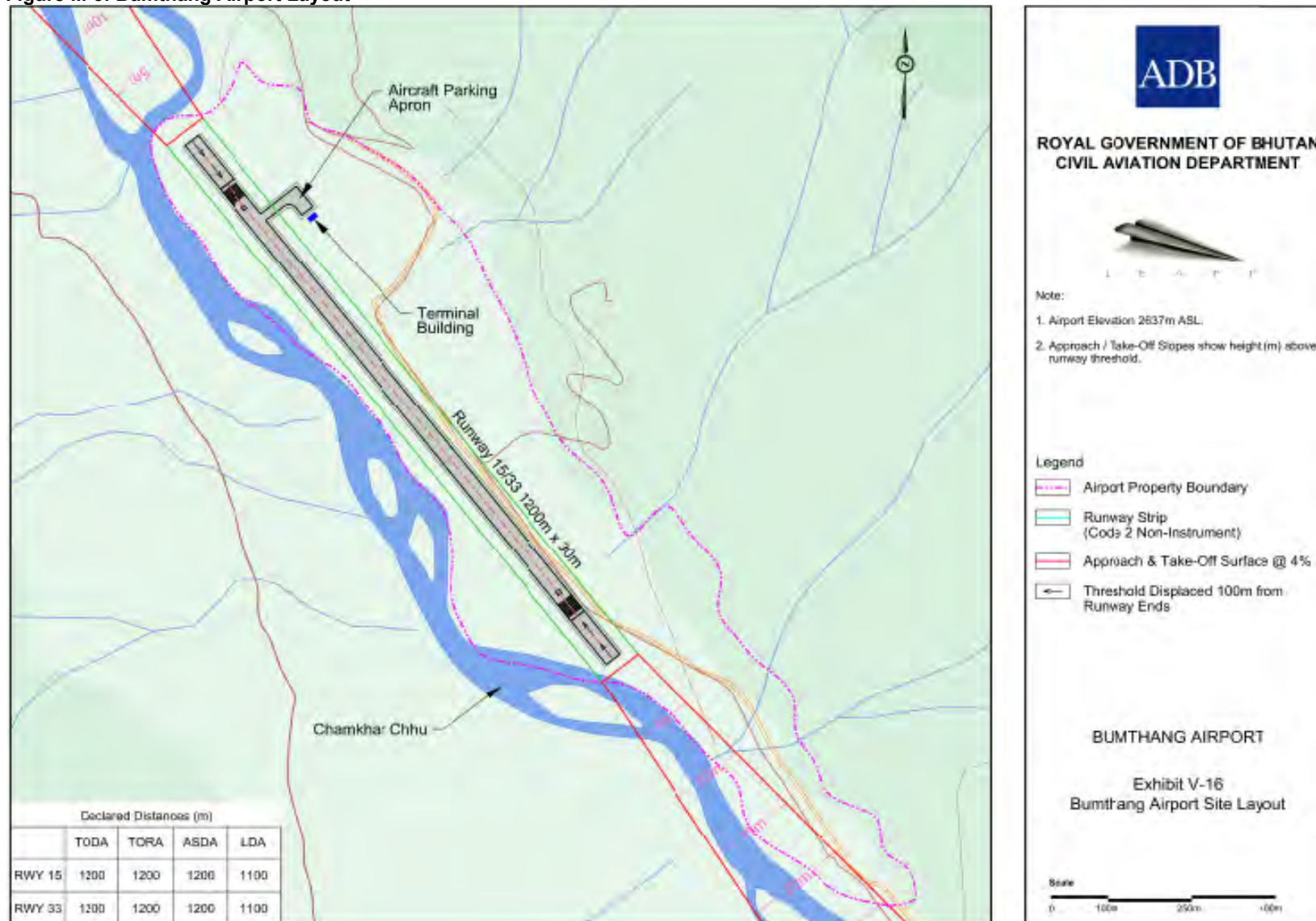
46. *Bumthang Airport*: As per the Progress Report 1 of the ADB TA 7633-BHU, Air Transport Connectivity Enhancement Project, the runway for the Bumthang Airport is being constructed with a total length of 1200m and on a magnetic orientation declared as 15/33. No data on the exact runway true bearing is available. The runway is designed to be 30 m wide with 5m wide paved shoulders on each side from the edge of the runway. The runway longitudinal slope is designed based on 1% grade with 1.5% transverse grade. It was known that the construction of the runway is adhering to the slope design criteria. **Figure III-5** shows the airport layout plan and the take-off and approach directions for the airport.

47. The runway is located on the left bank of river, Chamkhar Chhu and is parallel to the river. Runway way was built entirely on an improved pasture land belonging to Brown Swiss Cattle Farm and National Feed and Fodder Development Area under Department of Livestocks, Ministry of Agriculture and Forests close to Chamkhar Chhu River.

48. *Yongphula Airport* has been constructed since 1960s by Indian Military. The runway pavement length available at Yongphula Airport is 1300m, however DCA plan to declare the runway available as 1200m. **Figure III-6** shows the airport layout plan and the take-off and approach directions for the airport.

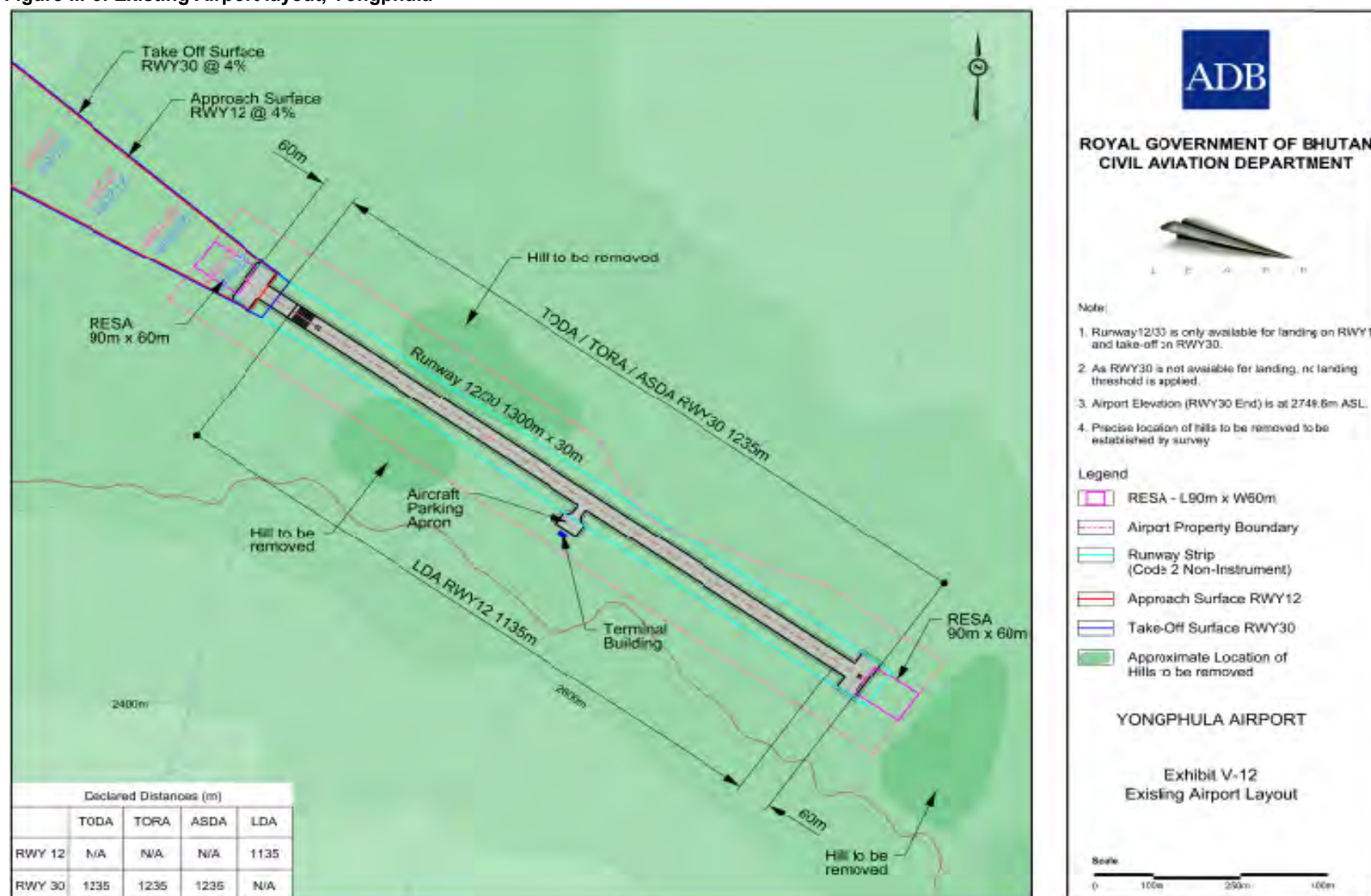
50. *Gelephu Airport*: The airport site used as the basis for airport development planning by Leigh Fisher is shown in **Figure III-7**. This site has a land area of 211ha., providing a site measuring 4000m in length and between 401m to 415m wide to accommodate the runway, runway strip and any future parallel taxiway. An adjacent area on the east side of the land intended for the runway measures 1000m long and between 493m to 500m wide for the apron and terminal facilities.

Figure III-5: Bumthang Airport Layout



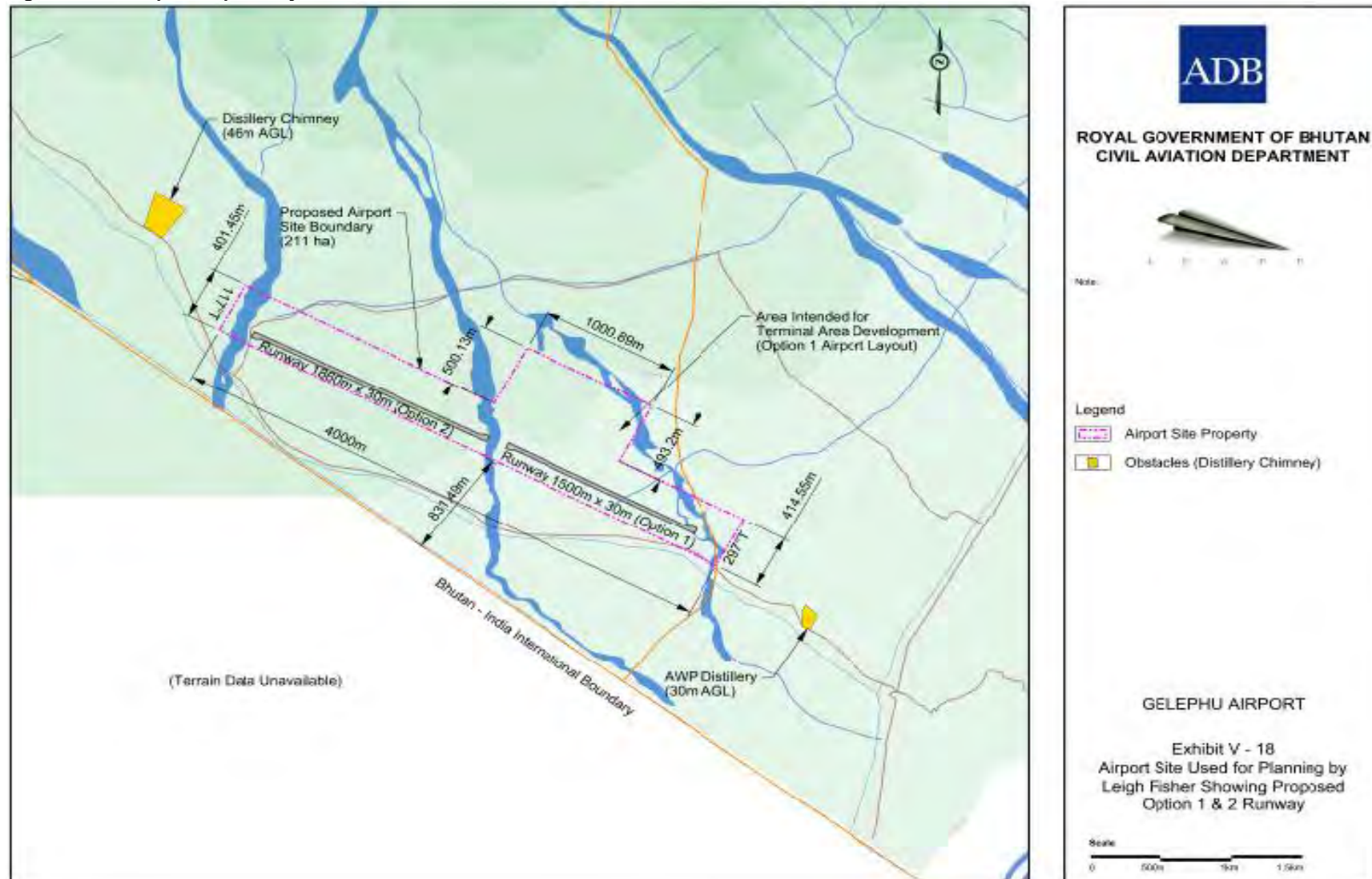
Source: Progress Report 1, Air Transport Connectivity Enhancement Project (ADB TA 7633-BHU)

Figure III-6: Existing Airport layout, Yongphula



Source: Progress Report 1, Air Transport Connectivity Enhancement Project (ADB TA 7633-BHU)

Figure III-7: Gelephu Airport Layout



Source: Progress Report 1, Air Transport Connectivity Enhancement Project (ADB TA 7633-BHU)



## **2. Taxiways and Aprons**

52. All three airports of Bumthang, Yongphula and Gelephu including the runways, taxiways and aprons are designed based on the Dornier 228, Beechcraft B200 and Pilatus PC-12.

53. Taxiway will connect the runway to the apron. The dimensions for taxiways for all three airports are similar. The width of these taxiways will be 10.0 m. The shoulders will be 5.0 m wide. DCA plans to upgrade existing taxiways to accommodate larger aircraft such as ATR 42-500 that is operated by Druk Air.

54. Similarly, apron with 50x50m dimension that can accommodate two code B aircraft has to be upgraded to accommodate ATR 42-500 like aircrafts.

## **3. Drainage System**

55. Runway drainages are required for all airfields. For Yongphula, open lined drainage channels are constructed on both sides of the runway at variable distances from the edges of the runway, ranging from a minimum of 25m to 30m from the runway centreline. The drainage channels consist of open constructed concrete drain without drain covers. The traverse drainage located at 30m intervals along the runway were originally built across and under the runway. On inspection by PPTA engineering team found that drain seems to be in a reasonable condition. However it was also concluded that structural test on all the underground drain channels traversing the runway will be required as fine cracks up to 3cm in diameter have observed. The runway may not be able to withstand the pressure of ATR 42-500 during landing and takeoff.

## **4. River Protection Works**

56. River protection works are mainly concerned with Bumthang and Gelephu airfields. Bumthang airfield is located on a relatively flat land with gentle slope towards south. The runway is parallel to Chamkhar Chhu River which is the main drainage within Bumthang district. During the construction of the runway, Chamkhar River has been diverted at three locations – two near Chakhar Lhakhang and one at north-west end of the runway. These diversion activities have affected the drainage pattern of Chamkhar Chhu River particularly along Dekiling, Wangdicholing, Bathpalathang and Chamkhar areas because of change in flow direction and speed of the river. To protect river banks on both sides (airport and wangdicholing sides), DCA constructed around 2000m river bank protection walls on the airport side and about 800m of on Dekiling and Wandicholing sides.

57. Gelephu airfield is traversed by two seasonal streams (Paitha Chhu in the north, Aiepuwali chhu in the centre of the site and Aiepuwali chhu (small) in the south). The stream beds are observed to be dry and 2-3m lower than ground level. Stream diversions and flood protection works to be carried out as part of the airport development work.

## **5. Landside Facilities**

58. The design of the landside facilities for all three airports (Control tower cum terminal building with associated parking and circulation facilities) will be in accordance with IATA standards. The terminal building is being built in accordance Bhutanese traditional architecture.

## **C. Traffic Forecast**

59. Air traffic forecasts prepared by the under ADB TA Project for the coming 20 years suggest that if unconstrained by air access difficulties and capacity, total air passenger traffic

could grow from the levels recorded in 2010 to 491,000 by 2020, of which approximately 12% (60,000 passengers) would be carried on the new domestic services. By 2030, total passenger levels are forecast to increase on an unconstrained basis to 915,000, of which domestic passengers would account for 17.3% (159,000 passengers). The summary of air traffic forecast for PIA, Bumthang, Yongphula and Gelephu airports are provided in the Table III-1.

**Table III-1: Air Traffic Forecasts for PIA and Bumthang Airport (Unconstrained)**

Passenger Movement (two-way)	Historical		Forecast	
	2000	2010	2020	2030
<b>Paro International Airport</b>				
International Passenger Movements	33,890	127,181	431,400	755,500
Domestic Passenger Movements	--	--	59,900	159,600
Total Passenger Movements	33,890	127,181	491,200	915,100
<b>Bumthang Airport</b>				
International Passenger Movements	--	--	--	--
Domestic Passenger Movements	--	--	53,870	143,600
Total Passenger Movements	--	--	53,870	143,600
<b>Yongphula Airport</b>				
International Passenger Movements	--	--	--	--
Domestic Passenger Movements	--	--	32,190	47,870
Total Passenger Movements	--	--	32,190	47,870
<b>Gelephu Airport</b>				
International Passenger Movements	--	--	--	--
Domestic Passenger Movements	--	--	32,190	47,870
Total Passenger Movements	--	--	32,190	47,870

Source: Progress Report 1, ADB TA 7633-BHU, Air Transport Connectivity Enhancement Project, June 2011

#### **D. Project Status and Implementation Schedule**

60. DCA has completed the RGOB financed construction works on Yongphula and Bumthang airports and the commercial flights by DrukAir and Bhutan National Airline have been started. However, Gelephu airport is targeted to be completed by end of April 2012. Table III-2 provides construction status of the three domestic airports carried out by the DCA using the RGOB funding.

**Table III-2: Construction status of domestic airports carried out by DCA using RGOB funds.**

<b>Work Item</b>	<b>Bumthang Airport (New construction)</b>	<b>Yongphula Airport (Upgrade of existing airfield)</b>	<b>Gelephu Airport (New construction)</b>
<b>Environmental Impact Assessment Study</b>	Completed	Completed	Completed
<b>Issuance of Environmental Clearance (EC) by NEC</b>	Issued (Refer Appendix H -1)	Issued (Refer Appendix H -2)	Issued (Refer Appendix H -3)
<b>Land Acquisition</b>	About 110 acres of Brown Swiss farm land have been acquired. Brown Swiss farm has been provided with the substitute farm land.	No private land acquisition was necessary. Bhutan Telecom and BBS land has been acquired and substitute land has been granted.	Private land belonging to 135 persons has been acquired. Land substitution and cash compensation has been made.
<b>Site clearance</b>	Completed	Completed	Completed
<b>Construction of Runway</b>	Completed	Completed	Under construction
<b>Construction of Runway drainage</b>	Not yet started	There are existing storm water drainages on both side of the runway.	Not yet started
<b>Construction of Taxiways and Aprons</b>	Completed	Completed	Not yet started
<b>Construction of Terminal building</b>	Completed	Completed	Not yet started
<b>River diversion and bank protection works</b>	Completed.	No river protection needed	Not yet started
<b>Construction of boundary wall or security fence</b>	completed	Construction of security fence has been completed.	Construction of boundary wall is ongoing
<b>Expected Date of Completion</b>	Completed	Completed	By the end of April 2012

Source: Field survey, July-August 2011 and Progress Report 1, ADB TA 7633-BHU, June 2011

61. The DCA plans to complete the construction of basic infrastructure requirements of all three domestic airports using its own resources granted by the RGOB. However, it has sought assistance from the ADB to upgrade and improve these airports to meet the international air safety standards. The ADB assistance will be focused on the following items as provided in the Table III-3.

**Table III-3: List of Work items that will be undertaken through ADB assistance**

<b>Subproject</b>	<b>Location</b>	<b>Work Items</b>	<b>Subproject</b>	<b>Location</b>	<b>Work Items</b>
<b>Bumthang Airport</b>	Bathpalathang, Bumthang Dzongkhag	<ol style="list-style-type: none"> <li>1. Install perimeter fence</li> <li>2. New access road</li> <li>3. Final runway asphalt overlay</li> <li>4. General service vehicle</li> </ol>	<b>Bumthang Airport</b>	Bathpalathang, Bumthang Dzongkhag	<ol style="list-style-type: none"> <li>1. Install perimeter fence to Annex 17 standard</li> <li>2. New access road</li> <li>3. Final runway overlay to 50 mm depth</li> </ol>
<b>Yongphula Airport</b>	Yongphula, Kanglung, Trashigang Dzongkhag	<ol style="list-style-type: none"> <li>1. Install perimeter fence</li> <li>2. Remove hills NW(1/2) and SW obstructing the safe operation of the aircrafts</li> <li>3. Repair runway strip drainage</li> <li>4. General service vehicle</li> </ol>	<b>Yongphula Airport</b>	Yongphula, Kanglung, Trashigang Dzongkhag	<ol style="list-style-type: none"> <li>1. Install perimeter fence</li> <li>2. Remove hills NW(1/2) and SW obstructing the safe operation of the aircrafts</li> <li>3. Install drainage covers to cover open unlined drains within runway strips</li> </ol>
<b>Gelephu Airport</b>	Bhur/Gelephu, Sarpang Dzongkhag	<ol style="list-style-type: none"> <li>1. Install 2.4km perimeter fence including security gate and guard house</li> <li>2. ARFFS support facilities (apron, housing for fire tender plus airport maintenance and airside access to runway)</li> <li>3. Airport Access Road</li> <li>4. Terminal expansion</li> <li>5. Apron and taxiway</li> <li>6. Drainage system for runway</li> <li>7. Flood protection structures</li> <li>8. Communications equipment</li> <li>9. DVOR/DME (1)</li> <li>10. General service vehicle</li> </ol>	<b>Gelephu Airport</b>	Bhur/Gelephu, Sarpang Dzongkhag	<ol style="list-style-type: none"> <li>1. Install 2.4km perimeter fence to Annex 17 standard.</li> <li>2. Provision of 1.1km Access Road</li> <li>3. Expansion of existing terminal building to accommodate passenger from the ATR42-50 aircraft</li> <li>4. Apron and taxiway to ATR42-50 aircraft standard</li> <li>5. Provide security gate and guard house on access road</li> <li>6. Cut off drains for surface drainage to the north of the runway</li> <li>7. Provision of runway edge sub surface drains (stone drain RC cover)</li> <li>8. Flood protection structures</li> </ol>

Source: Revised scope of work, PPTA, ADB TA 7633-BHU, Feb 2012

**E. Construction Materials**

62. According to the Department of Civil Aviation the airside pavement areas for all three domestic airports are as follow:

- The runway will be in asphalt paving with touch-down areas in concrete;
- The taxiways will be in asphalt paving;
- The apron will be in asphalt paving



63. Major constructions works for Bumthang airport is over. The construction materials or base course material for the construction of runway and taxiways have been obtained from the existing Gathak Quarry<sup>9</sup>. Similarly, the construction materials for development of new access road will be brought from Gathak Quarry as well. It will be transported to Bathpalathang through the east-west highway over a distance of about 32 km. Enroute trucks will have to pass through Tangsibi, Jalikhar, Gangkhar, Gangrithang and Bathpalathang settlements.

64. The existing runway of Yongphula will be used for landing and takeoff of aircraft. The construction works were restricted to building of apron, taxiway, terminal building as well as part removal of two hills located at northwest from the airport terminal. The Construction works under RGOB funding are now completed and the airport is ready for operations. However, DCA is planning to completely remove 2 small hillocks (northwest) and install drainage cover on the existing drains under the ADB financed project. Hence the construction material requirement will be minimal.

65. The current construction of runway and perimeter wall for Gelephu airport is being financed by the RGOB. The construction material requirement particularly sand and boulders are being quarried from Maokhola<sup>10</sup>. Under ADB project, DCA plans to develop new access road, install perimeter fence, expand of existing terminal, apron and taxiways, construct security gate and guard post, construct sub-surface drains and flood protection structures. These constructions will also procure construction materials from Maokhola surface quarry. The materials will be hauled by trucks through Gelephu town to reach airport construction site.

66. Cement is being imported from Pagli, Gomtu under Samtse district via India through a border of Phuentsholing.

## **F. Construction Equipment**

67. The current construction equipments used for construction of Bumthang and Yongphula airports are Hydraulic Excavator; JCB Loader/Backhoe; Road Rollers, 10T Tippers trucks; Aggregate Processing Plant 250 T/hr; Batch, Concrete Pumps with Spreader, compressors, Generator Sets 1000 kVA; Duct Dewatering etc. Similar construction equipments are used for Gelephu airport construction as well.

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<sup>9</sup> Gathak Quarry is the government approved and privately operated stone quarry. Quarry sells stone chips and boulders to the contractors.

<sup>10</sup> Surface Collection or Quarry Site at Maokhola is being operated by Natural Resources Development Corporation (State Owned). Sand and boulders from the quarry are being sold to the contractors.

#### IV. DESCRIPTION OF THE ENVIRONMENT

68. This chapter describes the existing environmental settings in the study area. In order to identify any potential impact on and to the natural and socioeconomic environment, it is essential to have a thorough understanding of the nature of the existing environment prior to commencement of the proposed activities. This acts as a need to characterize the existing baseline environmental and socio-economic conditions including establishing the prevailing conditions for a range of media through primary monitoring, undertaking focused surveys and the collection of secondary information from various published sources. It includes the physical environment comprising of air, water and land components, the biological environment and socio-economic environment. The major purposes of describing the environmental settings of the study area are:

- To assess the existing environmental quality, as well as the environmental impacts of the future developments being studied;
- To identify environmentally significant factors or geographical areas that could preclude any future development.

69. Additional purposes of the baseline studies is to provide sufficient information so that decision makers alien with the general location can develop an understanding of

- The project need
- Environmental characteristics of the study area

70. The objective of the present study is to assess comprehensive environmental impacts due to proposed ATCEP. The current environmental quality status around the identified project sites represents the baseline status for proposed airport projects.

##### A. Physical Environment

##### 1. Geology, Soils and Seismology

71. The Bhutan Himalaya can be tectonically divided into three east west trending belts:

- The southern frontal belt, which includes the lesser Himalaya and the foothills (Siwalik)
- The central crystalline belt, which includes greater Himalaya and the lesser Himalaya
- The Tethyan belt, which includes portion of the greater Himalaya and portion of lesser Himalaya.

72. The southern frontal belt borders with India in the south and comprises a very narrow strip of Tertiary Siwalik rocks represented by sandstone, mudstone, siltstone and boulder conglomerates. The Lesser Himalaya north of the Main Boundary Fault/Thrust (MBT) is represented by the rocks of Permian-Paleozoic formations. These formations from south to north are the Damuda, Baxa Group and the Shumar.

73. Damuda Formation consists of sandstones, shale with coal seams, felspathic quartzite and carbonaceous shale Buxa Group consists of dolomite, variegated quartzite and conglomerates represented by different formations like Jainti, Manas, Phuentsholing and Panghari.

74. Shumar formation consists of metasedimentary rocks represented by phyllite, micaceous quartzite with rare limestone bands.

75. The central Crystalline Belt over thrusts the southern frontal belt through the Main Central Thrust (MCT). This belt covers most of the Bhutan's Himalayan area, represented by high grade metamorphic and intrusive rocks of Paro Thimphu group (Pre-Cambrian to Tertiary). Rocks of Paro are represented by quartzite, quartz-mica schist, marble, calcisilicate and graphitic schist while rocks of Thimphu are represented generally by granite, gneiss, migmatites and occasionally by granite-mica schist, felspathic schist and amphibolite.

76. The Tethyan Belt covers portions of Northern Higher Himalaya range, Crystalline Belt of the central and eastern part of Bhutan Himalaya. It consists of various rock information's and is represented by sedimentary rocks (Pre-Cambrian to Cretaceous) intruded by Tertiary granites. The main rock types of this belt are shale, phyllite, slate, calcareous phyllite, quartzite and limestone with intrusive granite.

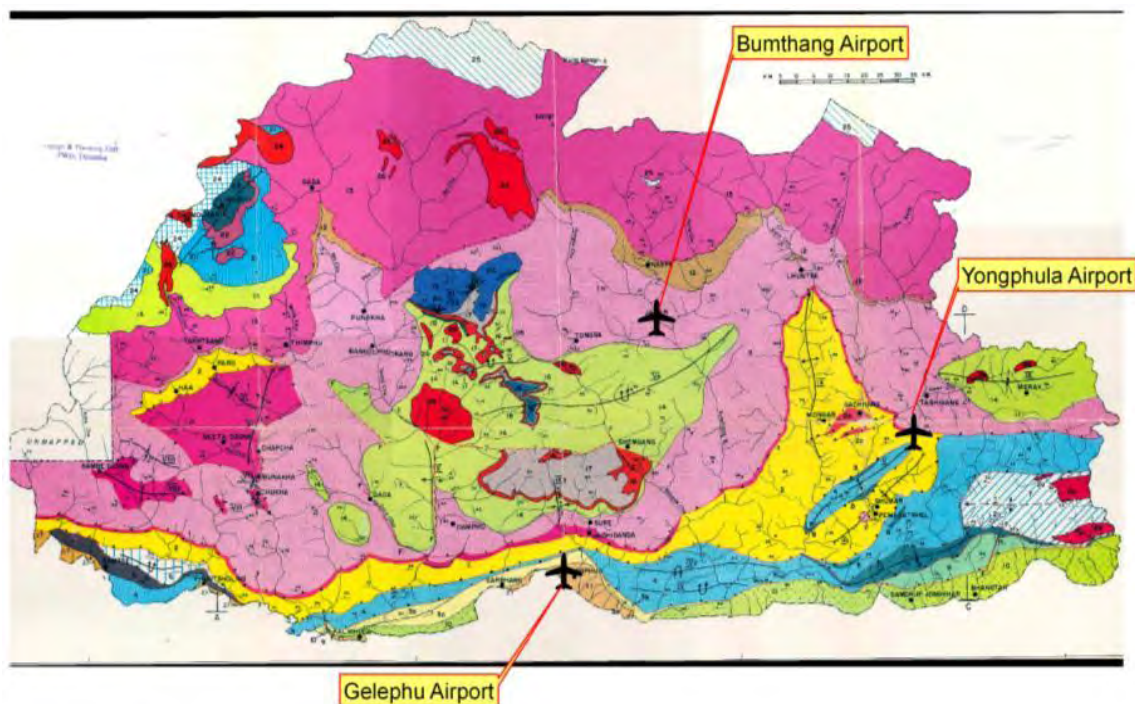
77. Bumthang airport falls in the Thimphu formation of the Higher Himalayan Belt. This formation is made up of pre-Cambrian metamorphic garnets and schist and granite gneiss, and is a prominent geological formation in Bhutan.

78. Yongphula airport lies exactly on the boundary of Thimphu and Shumar formation. Shumar formation consists of metasedimentary rocks represented by phyllite, micaceous quartzite with rare limestone bands.

79. Gelephu airport falls in Quaternary formation of southern frontal belt borders with India in the south and comprises of boulder conglomerates, sand, silt and clay.

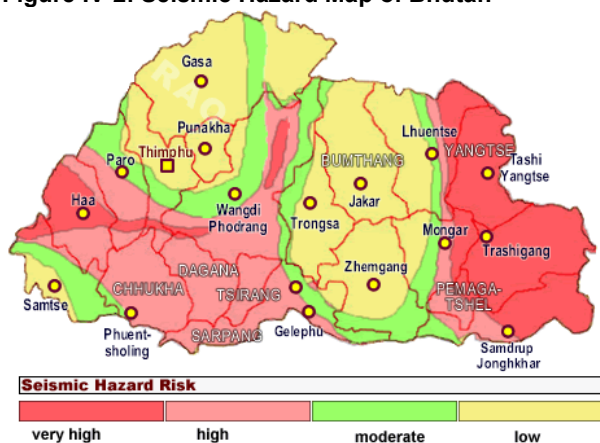
80. In general, Bhutan lies in a region with high to very high seismic hazard zone that increases toward the eastern parts of the country. Historically, earthquakes in the magnitude 5.0-6.0 range have been experienced and at least one magnitude 7.0 event is thought have occurred in the 1700's in eastern Bhutan and adjoining parts of India. (ASC 2009) However there is an absence of other large magnitude seismic events in Bhutan noted in the historical records. (Drukpa, et. al., undated) and a „seismic gap' exists over the region of Bhutan in the large magnitude earthquake event sequence stretching from Nepal into Assam (see Figure IV-3). This may be due to the uplift of the Shillong Plateau in Meghalaya state, north-eastern India, and relief of stress in boundary faults along the southern stretch of Bhutan. (Tobgay, undated) Still there is general agreement in the literature that Bhutan lays in a zone of high earthquake risk. Determining the seismic hazard zone is difficult due to lack of historical data; however if the seismic hazard zoning of similar areas in India is extended, Bhutan falls within seismic risk zones IV and V.

Figure IV-1: Geological Map and Airport Locations



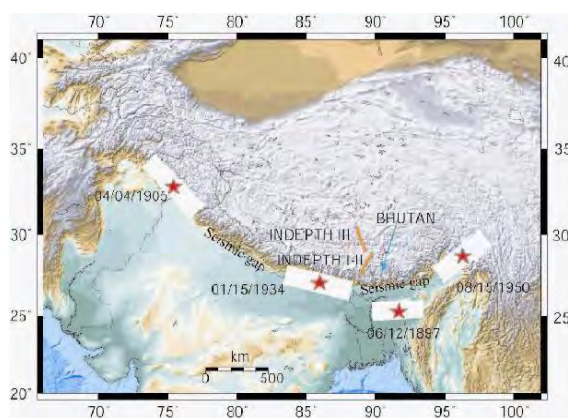
(Ref: Geological Map of Bhutan)

Figure IV-2: Seismic Hazard Map of Bhutan



Source: IIT, Rourkee, 2009

Figure IV-3: Major Seismic Events and Bhutan Gap



Source: Tobgay, undated

81. As per earthquake hazard zonation mapping carried out by the Indian Institute of Technology (IIT), Rourkee, 2009, Bhutan is divided into four hazard zones (very high, high, moderate and low). Bumthang airport falls under low earthquake hazard area. Gelephu and Yongphula airports lie in high and very high earth quake hazard zones respectively.

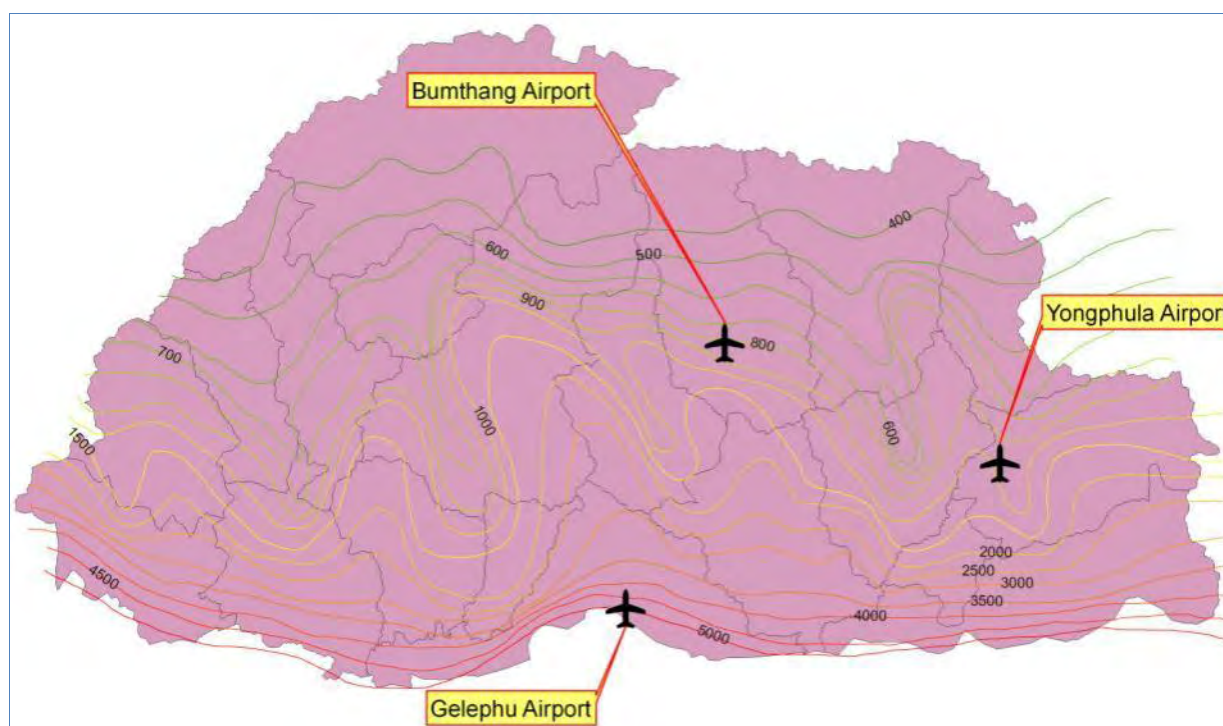
## 2. Meteorology and Climate

82. Climate and meteorology of a place can play an important role in the implementation of any developmental project. Meteorology is also the key to understand local air quality, as there is an essential relationship between meteorology and atmospheric dispersion involving wind in the broadest sense of the term.

83. The country can be divided into three distinct climatic zones corresponding to the three main geographical divisions. Bhutan's climate is as varied as its altitudes and, like most of Asia; it is affected by the monsoons. Western Bhutan is particularly affected by monsoons that bring between 60 and 90 percent of the region's rainfall. The climate is humid and subtropical in the southern plains and foothills, temperate in the inner Himalayan valleys of the southern and central regions, and cold in the north, with year-round snow on the main Himalayan summits. Bumthang and Yongphula airports fall within inner Himalaya while Gelephu airport is in the humid and subtropical southern plain.

84. Temperatures vary according to elevation. Temperatures in Bumthang, located at 2,570 meters above sea level in central Bhutan, range from approximately 14° C to 22° C during the monsoon season of June through September but drop to between about -3.5° C and 11° C in January. Most of the central portion of the country experiences a cool, temperate climate year round. In the south, a hot, humid climate helps maintain a fairly even temperature range of between 15° C and 30° C year-round, although temperatures sometimes reach beyond 35° C in the valleys during the summer.

**Figure IV-4: Rainfall Pattern (average annual rainfall in mm) and Airport Locations**



85. Annual precipitation ranges widely in various parts of the country as shown in the **figure IV-4**. In the severe climate of the north, there is only about forty millimetres of annual precipitation-primarily snow. In the temperate central regions, a yearly average of around 1,000 millimetres is more common, and 7,800 millimetres per year has been registered at some locations in the humid, subtropical south, ensuring the thick tropical forest. Table IV-1 provides the summary of temperature and rainfall within project areas.

**Table IV-1: Summary of Temperature and Rainfall for Bumthang, Yongphula and Gelephu**

Month	BUMTHANG			YONGPHULA			GELEPHU		
	Mean max. temp (°C)	Mean min. temp (°C)	Total rainfall (mm)	Mean max. temp (°C)	Mean min. temp (°C)	Total rainfall (mm)	Mean max. temp (°C)	Mean min. temp (°C)	Total rainfall (mm)
January	11.1	-3.5	0.0	9.0	2.0	0.0	22.4	13.2	78.2
February	12.4	-1.2	21.0	9.0	2.0	54.2	24.0	15.6	0.0
March	14.9	1.9	42.5	11.0	7.0	44.2	26.3	18.2	53.6
April	17.3	5.8	55.4	13.0	9.0	106.8	27.9	20.7	202.8
May	19.5	9.4	173.8	14.0	10.0	151.4	29.2	22.6	246.0
June	21.7	12.7	39.8	17.0	11.0	79.4	29.3	23.7	1538.4
July	22.5	14.3	119.8	17.0	15.0	223.8	29.7	24.0	1265.2
August	22.5	14.3	151.9	18.0	14.0	201.0	30.4	24.4	1027.2
September	21.3	12.2	42.6	16.0	12.0	101.4	30.1	23.8	562.0
October	18.3	6.8	63.9	15.0	10.0	95.8	28.6	21.1	330.8
November	15.3	1.4	0.6	12.0	7.0	0.8	26.4	17.8	0.0
December	12.7	-3.0	0.4	8.0	2.0	1.6	23.6	14.6	21.8
<b>Average/Total</b>	<b>17.5</b>	<b>6.6</b>	<b>711.7</b>	<b>13.3</b>	<b>8.4</b>	<b>1060.4</b>	<b>27.3</b>	<b>20.0</b>	<b>5326.0</b>

Source: Statistical Yearbook of Bhutan, 2010

86. **Precipitation:** Bumthang receives an annual average precipitation of 711.7 mm. Usually the maximum mean monthly rainfall occurs during August, however, in 2009, unusually the maximum monthly rainfall of 173.8 mm occurred in the month of May due to clone Ayla from the Bay of Bengal. The mean minimum monthly rainfall of 0.0 mm takes place in the month of January.

87. Yongphula receives an annual average precipitation of 1060.4 mm. The maximum mean monthly rainfall of 223.8 mm occurs during July while the mean minimum monthly rainfall of 0.0 mm takes in the month of January.

88. Of the three airport sites, Gelephu falls in the high precipitation zone with the annual average rainfall of 5326.0 mm. The maximum mean monthly rainfall of 1538.4 mm takes place in the month of June while the mean minimum monthly rainfall of 0.0 mm occurs in the month of February.

89. **Near Surface Temperature:** August is observed as the hottest month of the year having mean daily maximum temperature of 22.5°C, 18.0°C and 30.4°C for Bumthang, Yongphula and Gelephu airport sites respectively. Similarly, January is the coldest month having mean daily minimum temperature of -3.5°C for Bumthang, 2.0°C for Yongphula and 13.2°C for Gelephu.

90. **Wind Direction and Speed:** Wind direction is reported as the direction from which the wind blows and is based on surface observations. For Yongphula and Gelephu wind direction is predominantly from south-west where as for Bumthang it is predominantly from south-east direction. Table IV-2 provides average annual wind speed, direction and visibility within the project area.



**Table IV-2: Wind speed, direction and visibility of the project areas**

Parameter	Bumthang (2010 Average Reading)	Yongphula (2010 Average Reading)	Gelephu (2009 Average Reading)
Direction	164°	198.33°	201.33°
Speed	3.0	6.50	1.67
Visibility	9609.33	6350.25	9517.92
Anemometer Reading (m/s)	14364.57	55803.58	53818.08

Source: Department of Civil Aviation, 2011.

### 3. Air Environment

91. The existing quality of the air environment serves as an index for assessing the pollution load and the assimilative capacity of any region and forms an important tool for planning project activity in the area. Primary data was collected for pre monsoon season to understand the air quality in the region and to assess the impacts on air environment.

#### **Baseline Ambient Air Quality Monitoring in the Study Area**

92. A site-specific background air quality monitoring program was conducted by BHUCORE in all project sites for one season i.e. Pre monsoon season of 2011. Background data was collected for SPM, RSPM, SO<sub>x</sub>, and NO<sub>x</sub>.

93. The results of BHUCORE's ambient air quality show that the 24 hrs PM<sub>10</sub> values on the Bumthang exceed the Bhutan's ambient air quality standard. This may be on account of the ongoing construction activities at the project site and the anthropogenic activities at village in the vicinity of the site. PM<sub>10</sub> measurements of Yongphula and Gelephu are below national standards. SO<sub>x</sub> and NO<sub>x</sub> were not detected in all three project sites. The national ambient air quality standard and air quality monitoring results of Bumthang, Yongphula and Gelephu airports are presented in Table IV-3.

**Table IV-3: Air sampling and Bhutan Ambient Air Quality Standard**

Location	Monitoring Result		
	PM <sub>10</sub>	SO <sub>x</sub>	NO <sub>x</sub>
<i>Bhutan Ambient Air Quality Standard</i>	<i>75 µg/m<sup>3</sup></i>	<i>30 µg/m<sup>3</sup></i>	<i>30 µg/m<sup>3</sup></i>
Bumthang Airport	76.83µg/m <sup>3</sup>	BDL <sup>11</sup>	BDL
Yongphula Airport	26.75µg/m <sup>3</sup>	BDL	BDL
Gelephu Airport	32.5µg/m <sup>3</sup>	BDL	BDL

Source: BHUCORE Field Survey, 2011

### 4. Noise Environment

94. Unwanted noise and unpleasant sounds are generally classified as noise pollution. Normally a person begins to identify sounds when a level of 10 to 15 dB is reached. The other end of the scale is known as the threshold of pain (140 dB), or the point at which the average person experiences pain. Noise is generally measured in frequency-weighted scales and noise qualities measurements are generally represent in the 'A' level and reported as dB (A).

<sup>11</sup> BDL – Below detection level.

95. Baseline noise monitoring for all project sites were carried out by BHUCORE. The results of noise monitoring and national noise standard are presented in table IV-4.

**Table IV-4: Noise Sampling Results**

<b>Location</b>	<b>Day</b>	<b>Night</b>
Bhutan National Standard	55 dB(A)	45 dB(A)
Bumthang	71.55 dB(A)	40.11 dB(A)
Yongphula	61.46 dB(A)	32.25 dB(A)
Gelephu	52.49 dB(A)	33.42 dB(A)

Source: BHUCORE, field survey 2011

96. The daytime noise level of Bumthang and Yongphula airports exceeded the permissible standard while the night time noise level was within the permissible standard. The major reason for exceedances of noise level during day is attributed to operation of heavy construction equipments for the ongoing construction works of the airport. On the other hand, the noise level for Gelephu airport site was within the permissible standard at that time as the construction work was not started.

## **5. Hydrology and Water Quality**

97. Bhutan has four major river systems: the Drangme Chhu; the Punatsang Chhu; the Wang Chhu and the Amo Chhu. Each flows swiftly out of the Himalayas, southerly through the Duars to join the Brahmaputra River in India.

98. Chamkhar Chhu, which flow close to Bumthang airport, joins Mangde Chhu and Drangme Chhu to form Manas. The river originates from high glacial mountains, from the terrain south of the water divide (ridge) that separates Bhutan's northern territory from Tibet. Forty glacier lakes have been identified in the headwaters of the tributaries of Chamkar Chhu. The western tributary is fed by two fairly large glaciers (approx. 5762 meter amsl). The eastern tributary on the other hand has three glaciers named as Yakshing Glaciers which fed six glacier lakes (approx. 5340 amsl). The catchment area at Kurjey is 1350 Km<sup>2</sup>. Chamkar chhu nearby the project area has a flatter gradient forming few islands. River flow data of Chamkar Chhu measured at Kurjey, which is collated and analysed for two decades 1991-2010 shows that annual average flow has been 146.11 mcm in 1991 which has declined steadily in twenty years. Table IV-5 illustrates the annual average flow of Chamkhar Chhu over a period of 1991 – 2010.

99. Glacial Lake Outburst Flood (GLOF) is of serious concern for the airport being located in close proximity to the Chamkhar Chhu and built partially on a flood plain. As per the GLOF hazard zonation mapping carried out by the DGM show Bumthang airport location as hazardous. Experiences have shown that any major flooding either due to heavy rain or in the event of GLOF will have serious consequences to the airport. Flooding of rivers due to heavy rain as a result of cyclone Ayla in May 2009 have caused extensive damages to the infrastructural properties throughout Bhutan including Bumthang. Figure V-5 and V-6 shows the flooding of Chamkhar town and Bathpalathang (where Bumthang airport is located) that occurred as a result of heavy rainfall caused by Cyclone Ayla in May 2009.



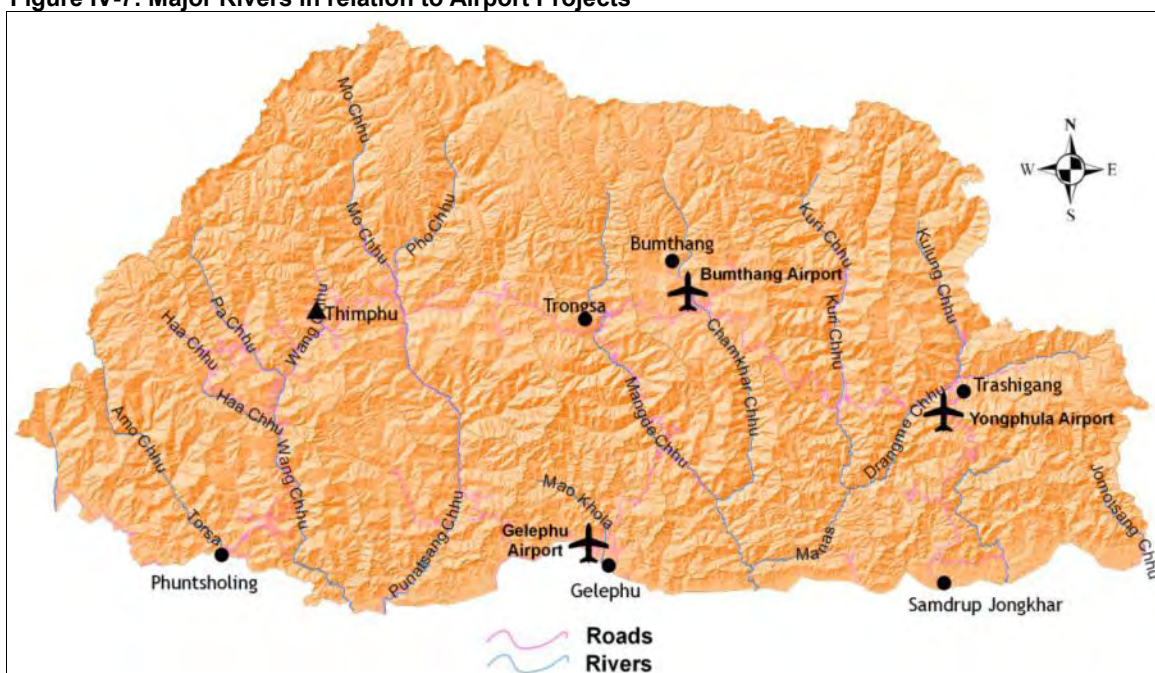
Figure IV-5: Photo showing flooding of Chamkhar Town (May 2009)



Figure IV-6: Photo showing part of flooded Bathpalathang (May 2009)



Figure IV-7: Major Rivers in relation to Airport Projects



100. Drangme Chhu River falls within the 20 km radius of the Yongphula airport but there are no significant rivers or streams near the airport location.

101. Mao Khola and Bhur Khola are river systems that lie within 20 km radius of the Gelephu airport. However, the Paitha Khola and Aiepuwali Khola streams are the ones that actually traverse or intersect the airport. These streams are seasonal, flowing only during monsoon. During the field work of Gelephu airport in the month of August (peak monsoon season), the Paitha and Aiepulwali khola or streams were seen dry with only with bare and exposed sand and gravel banks.

**Table IV-5: Annual Average Flow of Chamkhar Chhu (1991 – 2010)**

Year	Mean	Flow (MCM)	Maximum	Minimum	Runoff (mm)
1991	90.97	240.58	170.17	50.64	178.2
1992	43.83	116.0	66.22	28.87	85.92
1993	46.64	123.2	70.98	34.32	91.26
1994	43.47	114.76	67.51	27.75	85.01
1995	55.79	147.41	102.54	36.18	109.19
1996	60.01	158.58	91.84	41.97	117.46
1997	53.1	140.39	80.25	35.86	103.99
1998	61.06	161.65	95.02	44.19	119.74
1999	55.82	147.44	96.94	31.71	109.21
2000	56.59	149.61	82.71	38.72	110.82
2001	50.91	134.46	80.15	33.0	99.6
2002	49.26	130.33	82.04	31.07	96.54
2003	52.95	139.76	87.8	33.6	103.53
2004	56.68	150.04	89.6	38.32	111.14
2005	49.46	130.85	79.9	34.06	96.93
2006	51.73	136.34	81.03	36.6	101.21
2007	51.73	136.67	90.31	32.09	101.24
2008	54.87	145.12	81.52	35.82	107.5
2009	51.4	135.99	134.42	35.34	100.73
2010	67.34	178.12	106.42	45.39	131.94

Source: Hydrology section Hydromet Service Division, Department of Energy, MoEA, Bhutan.

#### **a) Surface Water Quality**

102. Water quality is the physical, chemical and biological characteristics of water. It is a measure of the condition of water relative to the requirements of one or more biotic species and or to any human need or purpose. It is most frequently used by reference to a set of standards against which compliance can be assessed. The most common standards used to assess water quality relate to health of ecosystems, safety of human contact and drinking water.

103. Environmental water quality, also called ambient water quality, relates to water bodies such as lakes, rivers, and streams. Water quality standards for surface waters vary significantly due to different environmental conditions, ecosystems, and intended human uses. Toxic substances and high populations of certain microorganisms can present a health hazard for non-drinking purposes such as irrigation, swimming, fishing, rafting, boating, and industrial uses. These conditions may also affect wildlife, which use the water for drinking or as a habitat. Modern water quality laws generally specify protection of fisheries and recreational use and require, as a minimum, retention of current quality standards.

104. The water quality tests have been carried out for all three project sites. In Bumthang, tests at two locations (one near, i.e., just opposite the bank of Chakhar Guest house and other at the southern end of the runway) on Chamkhar Chhu were carried out. At Yongphula, water quality test was carried out on a small lake; the prominent water body in the area. Whereas, since there was no permanent water bodies (two stream that intersect the Gelephu airport)

within the airport site, the test was carried out on the drinking water of Majuwa area inside the Gelephu airport site.

**Table IV-6: Surface Water Quality of the project sites**

Parameter	Bumthang (Chamkhar Chhu)		Yongphula (Lake)	Gelephu (Drinking Water at Majuwa)
	Site 1 (Near Chakhar Guest House)	Site 2 (Southern end of the Runway)		
Temperature (degree celcius)	12°C	12°C	20°C	30°C
pH	8.0	8.0	7.0	8.0
Turbidity (JTU)	40	40	100	0
Dissolved Oxygen (DO)	4 ppm	4 ppm	0 ppm	4 ppm
Biological Oxygeng (BOD)	0 ppm	0 ppm	0 ppm	0 ppm
Nitrate (NO <sub>3</sub> )	0 ppm	0 ppm	0 ppm	0 ppm
Phosphate (PO <sub>4</sub> )	1 ppm	1 ppm	1 ppm	1 ppm
Coliform	positive	positive	positive	negative

Source: Field Survey, July-August 2011.

105. Interpretation of Bumthang water quality tests (both sites) through physico-chemical analysis of surface water samples suggests that quality of water is poor due to presence of coliform bacteria. However, it is adequate for irrigation purposes and can also be used for drinking purposes after conventional water treatment and disinfection.

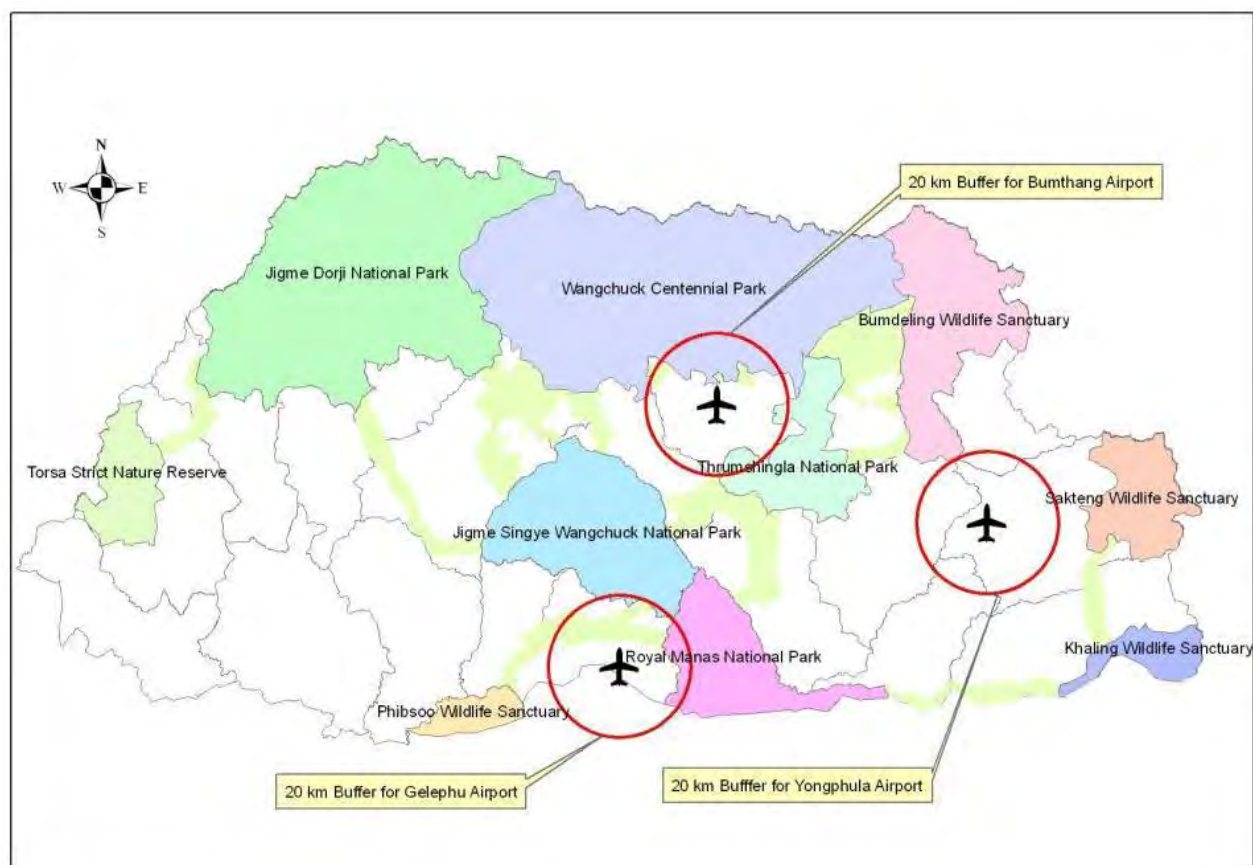
106. Water quality of lake at Yongphula was also poor due to presence of coliform bacteria and with high turbidity. Turbid water is the result of soil erosion from the nearby dumpsite used during the construction of airport.

107. Drinking water quality of Majuwa under Bhur geog of Gelephu airport site was good without coliform bacteria and turbidity.

## **B. Biological Environment**

### **1. Protected Areas**

108. A biological corridor and two protected areas, the Wangchuck Centennial Park (WCP) and the Thrumshingla National Park (TNP) fall within 20 km radius of the Bumthang airport. Similarly, the two National Parks of Jigme Singye Wangchuck and Royal Manas National Parks with their biological corridors are also within the 20 km radius of the Gelephu Airport. However, none of the airports fall inside any of the mentioned protected areas and the biological corridors. Figure IV-8 illustrates the relative location of these features with respect to project developments.

**Figure IV-8: Protected Areas in relation to 20 km buffer zone for three Airport locations**

## 2. Forest Resources and Land Cover

### a) General

109. As per Land Cover and Area Statistic 1997 of MoAF, about 67% of the Bumthang, 66% of Trashigang and 82% of Sarpang Dzongkhag are under true forest cover. Trashigang has the highest percentage of agriculture land (14.2) followed by Sarpang (12%). Blue Pine Forests are dominant in Bumthang whereas Sarpang Dzongkhag has almost 100% broadleaf forest. The land cover details of the project affected dzongkhags are provided in Table IV-7.

**Table IV-7: Land Cover figures of Bumthang, Trashigang and Sarpang Dzongkhags**

Dzongkhag	Land Cover (Area in Ha)				
	Conifer Forest	Broadleaf Forest	Scrub Forest	Agriculture	Others (Snow, Glacier, Rock outcrop, Orchards etc.)
Bumthang	134,630.0	49.0	46,447.0	5,627.0	62,267.0
Trashigang	67,369.0	80,278.0	30,594.0	32,392.0	4,545.0
Sarpang	2,045.0	188,467.00	2,201.0	27,454.0	8,652.0
<b>Total Area</b>	<b>204,044.0</b>	<b>268,794.0</b>	<b>79,242.0</b>	<b>65,473.0</b>	<b>75,464.0</b>

**b) Land Use Change and Forest Loss**

110. **Bumthang Airport:** Land use/cover classification for the airport and its surrounding shows that the dominant land cover is blue pine forest followed by the dry land agriculture. However, the actual land types that are being affected by the ongoing airport construction are 110.47 acres of Brown Swiss farm and its improved pasture land, 5.01 acres of government reserved forest land and 3.99 acres of dry land agriculture (Kamzhing). The total affected land affected is 119.47 acres.

111. **Yongphula Airport** has been already constructed since 1960s. The change in Land use is not significant as other two airports apart from removal three small hillocks aircraft operational safety.

112. **Gelephu Airport:** has started construction works and acquired about 282.93 acres of government reserve forest (GRF) and 235.48 acres of private agriculture land. Therefore total of 518.41 acres of land has been converted for airport development use. Figure IV-9, IV-10 and IV-11 provide the Land cover patterns within 20 km radius of Bumthang and Yongphu and Gelephu Airports.



Figure IV-9: Land use Pattern within 20 km Radius of Bumthang Airport

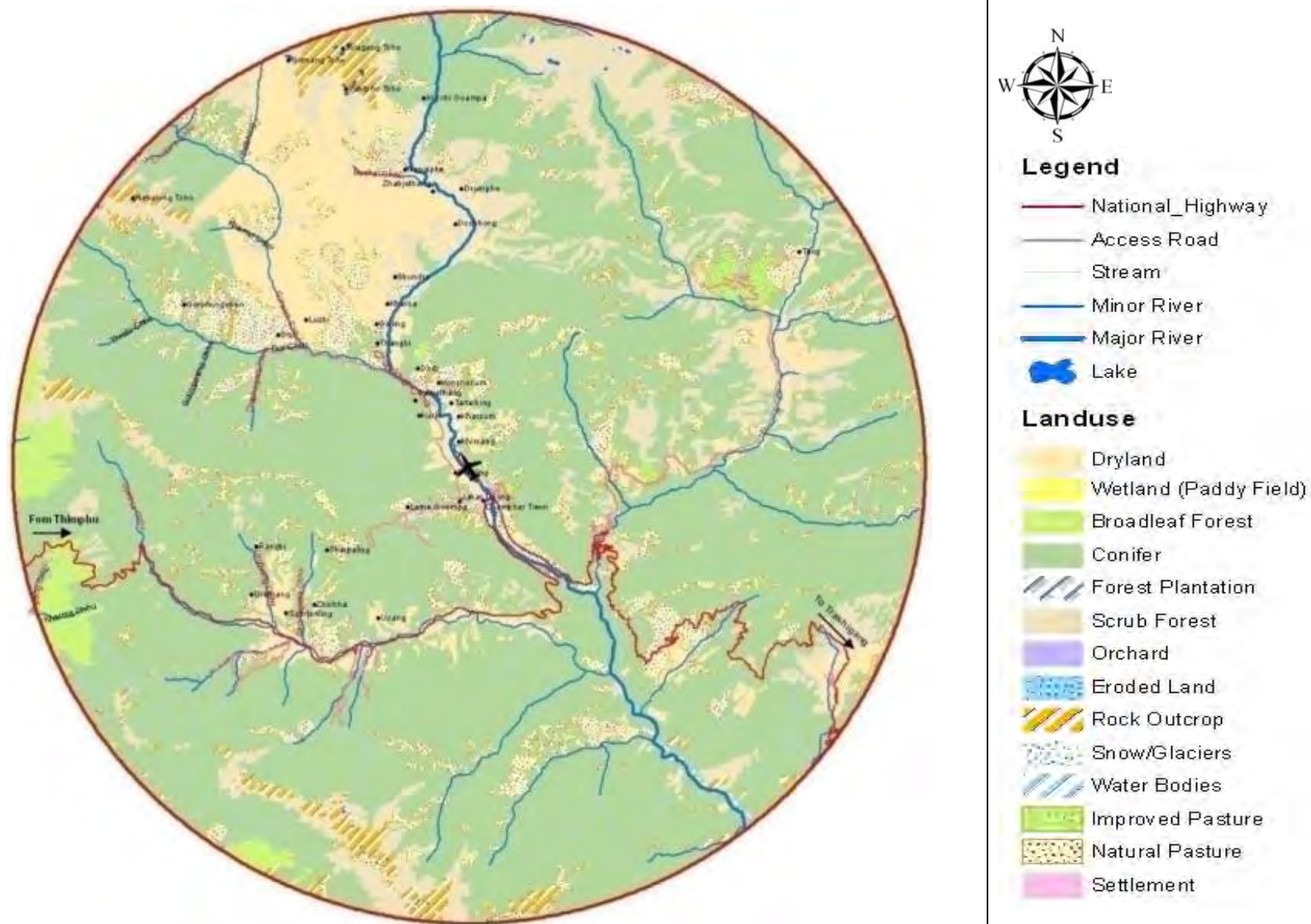


Figure IV-10: Land use Pattern within 20 km Radius of Yongphula Airport

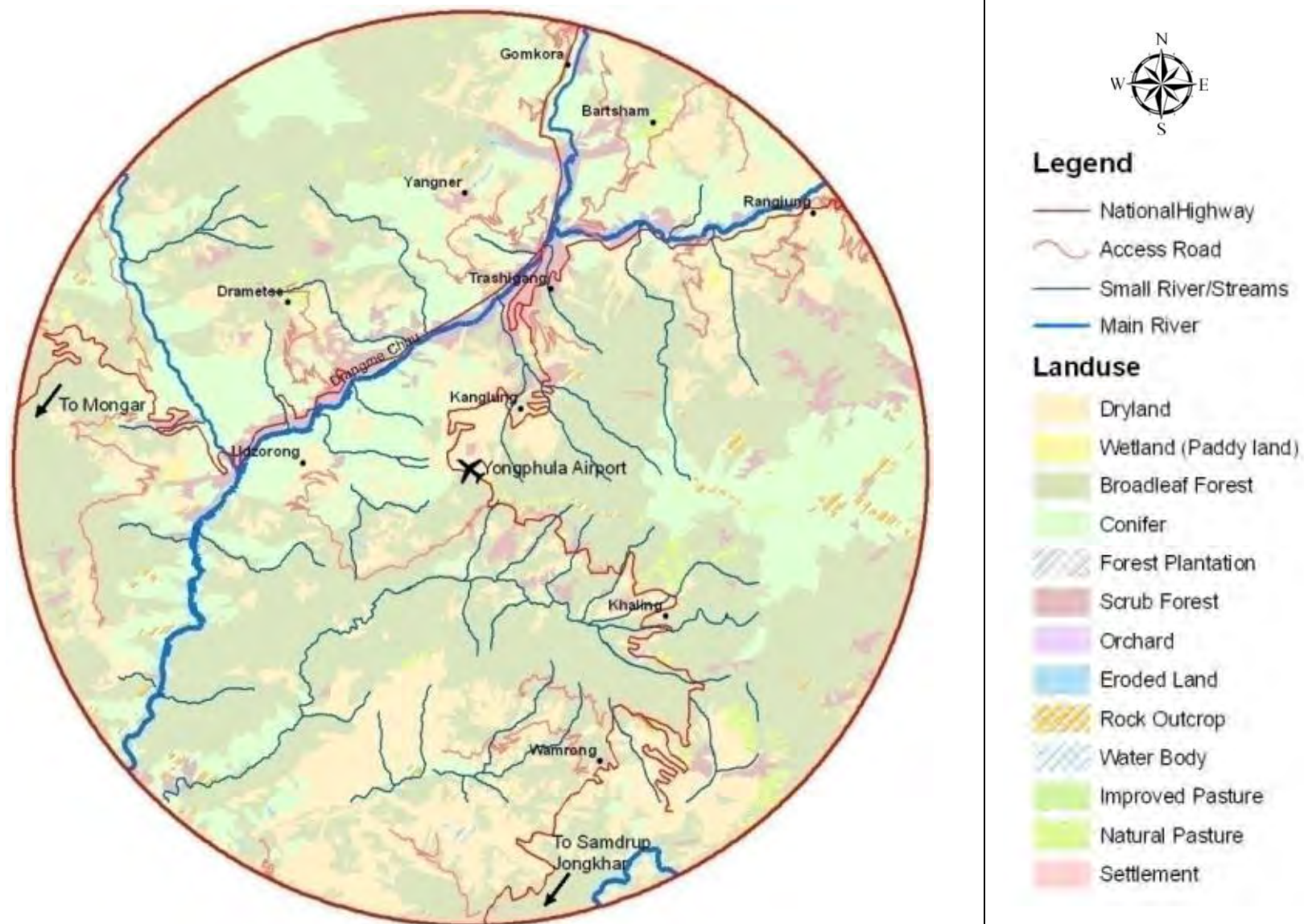
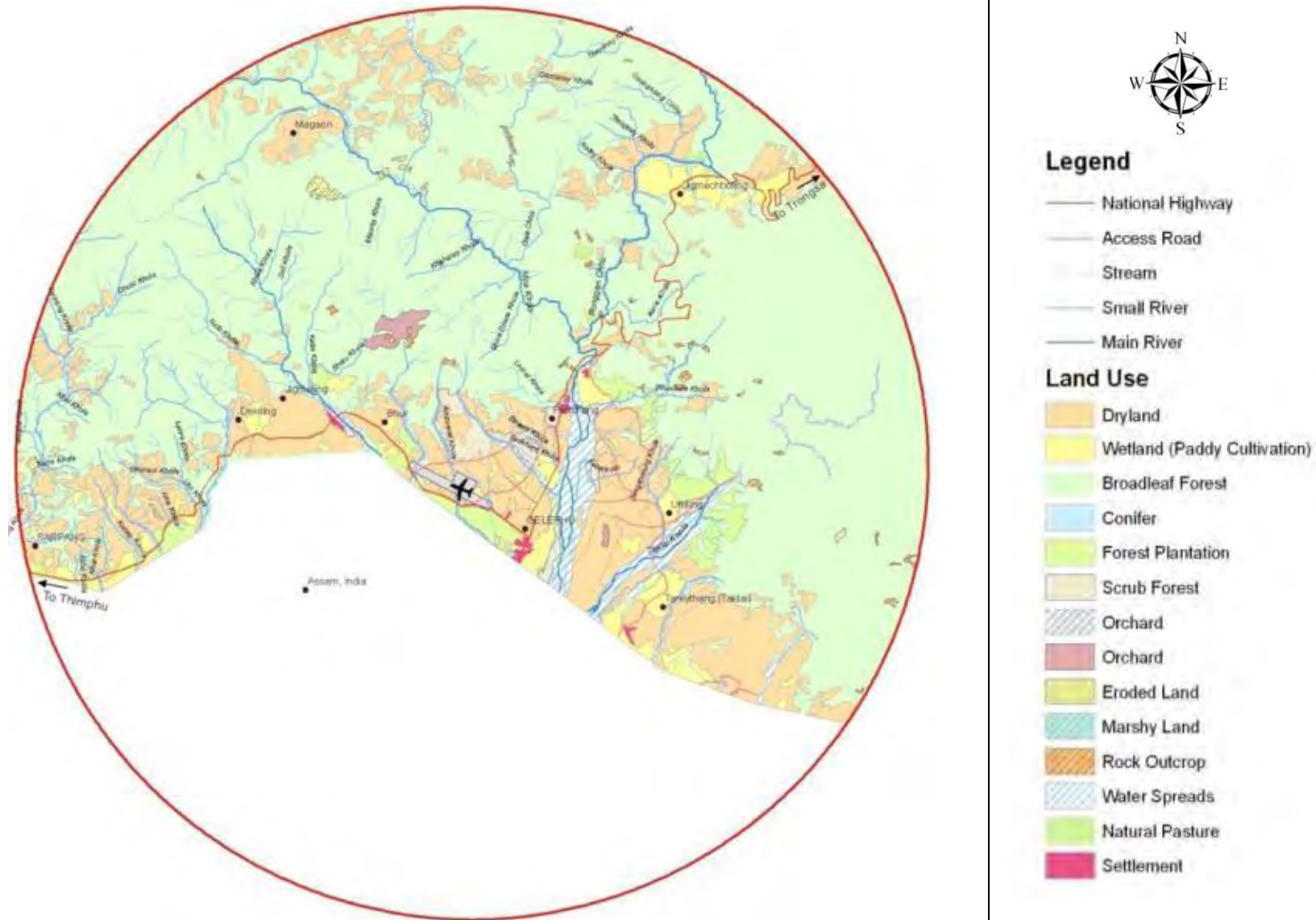




Figure IV-11: Land use Pattern within 20 km Radius of Gelephu Airport





### c) **Forest Types within the Project Sites**

113. **Bumthang Airport** or the runway is in the advance stage of construction. It is constructed mainly on the brown Swiss Cattle farm land of the National Brown Swiss and Horse Breeding Programme of the Department of the Livestock (DOL). There are no natural forests inside the airport area except for the fodder trees which are mainly the willow trees planted by the National Feed and Fodder Development Programme.

114. The forest in the immediate surroundings (on slope towards of RNR RDC area) of the airport area is mainly blue pine forest with the characteristic floral species of *Pinus wallichiana*, *Berberis asiatica*, *Cotoneaster griffithii*, *Lyonia ovalifolia*, *Rhododendron arboretum*, and *Arisaema consanguineum*.

115. Towards the northwest of the airport area, bordering the Chamkhar Chhu or River is the narrow band of riparian forest consisting mainly of *Salix* and *Hippophae* scrubs. Other main floral species found on the small river island are bamboos, *Populus* and Blue pine.

116. **Yongphula Airport:** The vegetation in the immediate surroundings of the airport is mostly scrub forest. On the eastern end of the airport, there are community forest and tree plantation carried out by the Department of Forest and Park Services. The lower on the altitude below 2000m towards Dangme Chhu valley is mostly warm broadleaved and on the drier slope are chir pine forests. On the higher slopes above 2000m is a cool broadleaved forests. The common tree species found in the cool broadleaved forest are *Acer campbellii*, *Betula alnoides*, *Brassaiaopsis alpine*, *Chirita lachenensis*, *Corylopsis himalayana*, *Elatostema monandrum*, *Exbucklandia populnea*, *Helwingia himalaica*, *Ilex fragilis*, *Lecanthus penduncularis*, *Lindera neesiana*, *Persea clarkeana*, *Pilea bracteosa*, *Rosa moschata*, *Rubus lineatus*, *Schisandra grandiflora*, *Symplocos dryophila*.

117. **Gelephu Airport** falls within subtropical forest which is largely deciduous with marked seasonal variation; dry winter season and wet summer (monsoon) season. The common species found in the project area are *Acrocarpus fraxiniifolius*, *Ailanthus grandis*, *Bombax ceiba*, *Crateva religiosa*, *Dillenia pentagyna*, *Duabanga grandiflora*, *Gmelina arborea*, *Leea asiatica*, *Musa*, *Pandanus*, *Pterospermum acerifolium*, *Tetrameles nudiflora*, *Thunbergia*.

### d) **Forest Management**

118. There are basically three types of forest – government owned national forest including Forest Management Units<sup>12</sup> (FMU), community forest, sokshing (private forest registered to an individual person or household) and private tree plantations. The government forest is being conserved by the Department of Forest while community forest is managed by the village or a community. The Sokshing and private tree plantation the private forest is owned and managed by an individual or the household.

119. According to the DOF Forestry Management Unit (FMU) location map, there are no FMUs in the project areas.

### e) **Endangered and Protected Flora**

120. No endangered or protected plant species as listed in Schedule I – Forest and Nature Conservation Rules of Bhutan, 2000 is observed or reported in all three project sites.

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<sup>12</sup> FMUs are geographic areas of government reserved forests that are scientifically managed for purposes of logging and conservation.

### 3. Mammals and Bird Life

121. Pine forests are rather extensive in and around the Bumthang airport area particularly the slope towards the Pedtsheling monastery. Since these forests are close to human habitation and prone to disturbances from fires, fuel wood and grass collection, wildlife abundance is low compared to other habitats. Nevertheless several species, including pheasants, partridges, common crow, magpie and mammals such as goral, Himalayan yellow marten are known to occupy these habitats. Table IV-8 provides the list of birds recorded during the field survey.

122. The wildlife habitat immediately around Yongphula airport is poor due to the proximity to human habitat. However, further away from the human habitation, the abundance of wildlife (mammals and birdlife) is evident. Mammals such as Assamese Macaque, wild boar, barking deer, goral, Himalayan Serow, Sambar, leopard etc. are known to inhabit the areas further away from the human habitation. Leopard is protected species under schedule I of Forest and Nature Conservation Act (FNCA) but it is categorized as lower risk under IUCN categorization. The area outside the Yongphula airport is known to be good habitat for birdlife particularly because of the presence of the broadleaf forests. However, there are no reported endangered or threatened bird species in the area. The details bird species found in the area provided in the table IV-8.

123. The subtropical forest around Gelephu Airport area is known for the richness of wildlife both mammals and birdlife. Mammals such as elephant, barking deer, rhesus macaque, Bengal fox, hares, jungle cat etc inhabit the area. Elephant which known to occasionally visit the area is totally protected under Schedule I of FNCA and is categorized as endangered in IUCN red list. The sub-tropical forest along the foothills up to 1200m is the richest in bird species. The list of birds that are found the area is provided in the table IV-8.

**Table IV-8: Avifauna recorded in Project Area**

Scientific name	Common Name	B <sup>13</sup>	T <sup>14</sup>	S <sup>15</sup>	FNCA Status	IUCN Status
<i>Aceros nipalensis</i>	Rufous-necked hornbill			√	Protected	Vulnerable
<i>Buceros bicornis</i>	great hornbill			√	-	Near Threatened
<i>Pavo cristatus</i>	Indian peafowl			√	-	Least Concern
<i>Urocissa flavirostris</i>	Yellow-billed Blue Magpie	√	√		-	-
<i>Pica pica</i>	Black-billed Magpie	√			-	-
<i>Pyrrhocorax pyrrhocorax</i>	Yellow-billed Chough	√			-	-
<i>Nucifraga caryocatactes</i>	Spotted Nutcracker	√			-	-
<i>Corvus macrorhynchos</i>	Large-billed Crow	√	√	√	-	-
<i>Corvus splendens</i>	House Crow			√	-	-
<i>Lanius tephronotus</i>	Grey-backed Shrike	√			-	-
<i>Dendrocitta Formosae</i>	grey treepie		√	√	-	-
<i>Dendrocitta vagabunda</i>	rufous treepie			√	-	-
<i>Dicrurus macrocercus</i>	black drongo			√	-	-
<i>Streptopelia chinensis</i>	spotted dove			√	-	-
<i>Streptopelia orientalis</i>	oriental turtle dove	√	√	√	-	-
<i>Chalcophaps indica</i>	emerald dove			√	-	-
<i>Ducula badia</i>	mountain imperial pigeon		√	√	-	-
<i>Myophonus caeruleus</i>	blue whistling thrush	√	√	√	-	-
<i>Hypsipetes leucocephalus</i>	black bulbul	√	√		-	-
<i>Pycnonotus cafer</i>	red-vented bulbul		√	√	-	-
<i>Acridotheres tristis</i>	common myna			√	-	-
<i>Ictinaetus malayensis</i>	black eagle	√	√	√	-	-
<i>Spilornis cheela</i>	crested serpent eagle		√	√	-	-
<i>Celeus brachyurus</i>	rufous woodpecker		√	√	-	-
<i>Lanius cristatus</i>	brown shrike			√	-	-
<i>Megalaima australis</i>	blue-eared barbet			√	-	-

<sup>13</sup> B – Bumthang (Chumey, Chhoekhor, Tang and Ura Area)

<sup>14</sup> T – Trashigang (Kanglung, Yongphula and Khaling Area)

<sup>15</sup> S – Sarpang (Dekiling, Bhur, Gelephu, Chuzagang and Umling Area)

Scientific name	Common Name	B <sup>13</sup>	T <sup>14</sup>	S <sup>15</sup>	FNCA Status	IUCN Status
<i>Magalaima Virens</i>	great barbet		√	√	-	-
<i>Megalaima asistica</i>	blue -throated barbet		√	√	-	-
<i>Pericrocotus flammeus</i>	scarlet minivet	√	√		-	-
<i>Halcyon smyrnensis</i>	white-throated kingfisher		√	√	-	-
<i>Megaceryle lugubris</i>	crested kingfisher	√	√	√	-	-
<i>Chaimarrornis leucocephalus</i>	white-capped water redstart	√	√	√	-	-
<i>Enicurus schistaceus</i>	Slaty-backed forktail		√	√	-	-
<i>Copsychus saularis</i>	oriental magpie robin		√	√	-	-
<i>Heterophasia capistrata</i>	Rufous Sibia	√	√			
<i>Motacilla alba</i>	white wagtail	√	√	√	-	-
<i>Yuhina nigrimenta</i>	black-chinned yuhina		√	√	-	-
<i>Yuhina Zantholeuca</i>	white-bellied yuhina			√	-	-
<i>Garrulax albogularis</i>	White-throated Laughingthrush	√	√			
<i>Garrulax leucolophus</i>	white-crested laughingthrush		√	√	-	-
<i>Hirundo rustica</i>	barn swallow		√	√	-	-
<i>Phylloscopus trochiloides</i>	Greenish Warbler	√	√	√		
<i>Abroscopus superciliaris</i>	yellow-bellied warbler			√	-	-
<i>Seicercus affinis</i>	white-spectacled warbler		√	√	-	-
<i>Cissa chinensis</i>	common green magpie			√	-	-
<i>Apus affinis</i>	house swift			√	-	-
<i>Collocalia brevirostris</i>	Himalayan swiftlet	√	√	√	-	-
<i>Tephrodornis gularis</i>	large wood shrike			√	-	-
<i>Oriolus traillii</i>	maroon oriole		√	√	-	-
<i>Hierococcyx sparveroides</i>	large hawk cuckoo	√	√	√	-	-
<i>Lophura leucomelanos</i>	kalij pheasants	√	√	√	-	-
<i>Gallus gallus</i>	red junglefowl			√	-	-
<i>Merops leschenaultia</i>	chestnut headed bee-eater		√	√	-	-
<i>Upupa epops</i>	common hoopoe	√	√	√	-	-
<i>Pomatorhinus erythrogenys</i>	rusty-cheeked scimitar babbler		√	√	-	-

Source: Field work July-August 2011

## C. Socio-Economic Environment

### 1. Population and Poverty

124. The airport projects fall under of three dzongkhags namely, Bumthang, Trashigang and Sarpang. The total population of the three dzongkhags was enumerated in 2005 at about 106,448 persons with an overall average sex ratio (male/female) of 1.08. Within the geogs where airports are located there are about 29,910 persons. Population projections prepared for the dzongkhags by the National Statistics Bureau (NSB, 2008) show a rate of increase by 1.6% in 2015, reflecting overall population for the three dzongkhag by 2015 would be around 123,479.68. Number of households and population of administrative units within the three dzongkhags and affected geogs are shown in Table IV-9.

125. The Small Area Estimation of Poverty in Rural Bhutan, August 2010, jointly carried out by World Bank & NSB, shows the number of poor in the three dzongkhags to be 18,594 with the poverty rate of 15.5% for Bumthang, 30% for Trashigang and 23% for Sarpang. *Poverty Analysis Report 2007* by NSB established the poverty line at Nu.1,096.94 per person per month.

**Table IV-9: Population and Households of the Project Area**

Dzongkhag <sup>16</sup> and Geogs	No. of Geogs <sup>17</sup> / Chiwogs <sup>18</sup> / Villages	No. of Households	Population as per PHCB 2005		
			Male	Female	Total
<b>Bumthang Dzongkhag</b>	Chhoekhor, Chhume, Tang and Ura geogs	2,870	8,751	7,365	16,116
Chhoekhor geog	5 chiwogs with 32 villages	798	2,509	2,044	4,553
Municipal Area	5 towns (Jakar, Bathpalathang, Chamkhar, Dekiling and Jalkhar towns)	740	2,350	1,850	4,200
<b>Trashigang Dzongkhag</b>	Bartsham, Bidung, Kanglung, Kangpar, Khaling, Lumang, Merag, Phongmed, Radi, Sagteng, Samkhar, Shongphoog, Thrimshing, Udzorong and Yangnyer geogs	10,813	24,912	23,871	48,783
Kanglung Geog	5 chiwogs and 8 villages	1,064	2,419	2,330	4,749
Municipal Area	Kanglung town	278	976	741	1,717
<b>Sarpang Dzongkhag</b>	Chuzagang, Chudzom, Dekidling, Gakidling, Gelephu, Jigmichoeling, Samtenling, Serzhong, Shompangkha, Sengye, Tareything and Umling Geogs	8,211	21,664	19,885	41,549
Samtenling / Bhur	5 chiwogs and 8 villages	289	761	756	1,517
Gelephu	5 chiwogs and 7 villages	784	2,127	1,848	3,975
Gelephu Municipal	Gelephu town and the extended area	1,851	4,904	4,295	9,199

Source: Population & Housing Census of Bhutan 2005, Election Commission Delimitation Maps, 2011 and Field Survey 2011

126. About 22.18% people of the three dzongkhags lives in urban areas. Sarpang Dzongkhag has the highest number of people in the urban area with 12,596 (30% of the dzongkhag population). About 86% of the people of Trashigang live in rural areas. Hence there is high rate of poverty in Trashigang (30%) comparing to other two dzongkhags (15.5% for Bumthang and 23% for Sarpang).

## 2. Agriculture

127. In 2008, Agriculture contributed 18.5% to the total economy i.e. as measured by the Gross Domestic Product. It was also the single largest sector that provides livelihood to 66.6% of the population as per Bhutan Living Standard Survey (BLSS) 2007.

128. Only about 2% of the Bumthang Dzongkhag's total area of 2,714 km<sup>2</sup> is under agriculture, which is mainly found in the Chhume and the southern part of Chhoekhor geogs with predominantly the dry land farming. In recent years, paddy cultivation has been started in Chhoekhor geog. However, the main crops are wheat, buckwheat, barley and rye. Apart from the cereal crops, people of Bumthang cultivate potatoes and apples as the cash crops. About 8.2% of the total area of Bumthang Dzongkhag is Tsamdro (pasture land) which carries more than 19,927 heads livestock (*Livestock Population and Production 2010, Bumthang Dzongkhag*).

129. Kamzhing (Dry land) is the dominant agricultural land use followed Chuzhing (irrigated wetland) under Trashigang. Maize, rice, wheat, millet, potato, garlic and chili are the main annual crops of the Dzongkhag. Apart from the agriculture, livestock rearing and poultry farming are also important activities. As per RNR census 2009, there are about 36,348 cattle, 1,019 pigs and 10,444 poultry.

<sup>16</sup> Dzongkhag - District

<sup>17</sup> Geog – Block (Administrative Unit under District)

<sup>18</sup> Chiwog – Sub Block (Smallest Administrative Unit under Block)

**Table IV-10: Agriculture Land Holdings and Land Types in the Project Area**

<b>Dzongkhag</b>	<b>Wetland (in Ha)</b>	<b>Dry land (in Ha)</b>	<b>Cash Crop Land (in Ha)</b>	<b>Total Area (in Ha)</b>
Bumthang	65.53	4,120.70	42.87	4,229.10
Trashigang	1,097.59	5,717.45	77.87	6,892.91
Sarpang	1,902.90	4,181.22	1,349.53	7,433.65

Source: Policy and Planning Division, MoAF, Thimphu

130. Sarpang has highest wetland paddy cultivation with substantial yield 4.05 metric ton per hectare. Therefore, rice is important cereal produced in the area. The other important crops are maize, mustard and millet. The cash crops such as orange, cardamom, jackfruit, areca nut, ginger, guava and mango are grown. Sarpang has around 30,628 cattle, 1,264 pigs and 28,306 poultry (RNR census 2009).

### **3. Health**

131. Overall for three dzongkhags (Bumthang, Trashigang & Sarpang), 17.8% of households have piped water inside the house, and 69.3% have piped water outside the house. Of the remaining, 12.9% of households utilize springs, rivers or ponds, and other sources. Overall there is a heavy reliance on piped water, totalling 80% (Population & Housing Census of Bhutan, 2005).

132. Concerning access to sanitation, among all dzongkhag, 9.44% of households have indoor flush toilets, and 60.33% utilize pit latrines. Of the remaining, 8.3% have no toilet facilities.

133. Some conclusions can be reached in respect to these data: there is little access to surface or groundwater and a heavy reliance on small, reticulated water supply systems (piped water). Use of some form of toilet facilities is high even in rural areas, compared to other parts of Asia. The values derived for dzongkhag regarding water supply and sanitation closely parallel those given in the 2005 census for urban and rural households, respectively, for the overall country.

134. The percent of households to visit health facilities in the past year for each of all three dzongkhag is close to the norm for the Country – about 90%.

### **4. Education**

135. The average literacy nationwide is nearly 60%, and with the exception of Bumthang, other two dzongkhags have literacy rates lower than the national average. The lowest literacy rate is found in Trashigang dzongkhag, with 56.2%. All dzongkhags show literacy rates among the urban population higher than the national norm, and conversely literacy is particularly low among the rural population, with Trashigang the lowest at 52.3%.

136. Regarding school attendance, Trashigang dzongkhag also reflects the poorest ratio of attendance between male and female residents, with 27% of males having attended, and 19% of females. Corresponding values for Chhukha are 38% and 17%. Only 3.5% of urban residents in Trashigang dzongkhag have failed to attend school, whereas among rural residents, 51% have failed to attend. In Sarpang dzongkhag 10% of urban residents have not attended school, and 38% of rural residents. These data indicate that the rural population is disadvantaged in education, and in some instances perhaps severely so.

137. The data for Trashigang and Sarpang dzongkhag bracket the range of education and literacy opportunity. No other data found in the 2005 census related to education can be readily disaggregated to reflect the situation within the project area.

## 5. Community Infrastructure

138. Community and rural infrastructure constructed by the Royal Government of Bhutan include community schools, primary schools (CPS), middle and high schools, hospitals, basic health units (BHUs), outreach clinics (ORC), renewable natural resources (RNR) extension offices and irrigation and rural water supply schemes (RWSS). Since the 8th Five Year Plan the government has begun construction of farm roads, power tiller tracks and mule tracks with the aim of connecting villages to market and administrative centers. The details of community infrastructures in the project area are provided in Table IV-11.

**Table IV-11: Community Infrastructures in Project Affected Dzongkhag**

S. No	Sector / Infrastructure	Bumthang Dzongkhag	Trashigang Dzongkhag	Sarpang Dzongkhag
1	<b>RNR Sector</b>			
a	RNR Center	6	17	5
c	Veterinary Hospital	1	-	-
e	Irrigation channels (Km.)	23.92	24.5	24.1
g	Farm roads (Km.)	89.2	182.9	89.1
2	<b>Health</b>			
a	Hospitals	1	3	2
b	Basic Health Units (BHU)	4	19	10
c	Out Reach Clinics (ORCs)	14	57	11
d	RWSS Construction (New)	185	68	
3	<b>Education</b>			
a	Higher Secondary School	2	3	4
b	Middle Secondary School	2	4	2
c	Lower Secondary School	3	9	4
d	Primary School	1	12	0
e	Community Primary School	12	35	11
g	Non-Formal Education Center (NFE)	18		
4	<b>Roads and Bridges</b>			
a	Suspension bridge	19	29	23
b	Motorable Bridge	-	-	-
5	<b>Rural Electrification Coverage (%)</b>			
a	No of Villages electrified	All 4 Geogs	13 Geogs	-
b	Percent of households electrified	100	91.19	-
6	<b>Rural Telecommunication Coverage (%)</b>			
a	No of villages covered	All 4 Geogs	15	-
b	Percent of households covered	100	96.39	-

Source: Midterm Review Document, 10<sup>th</sup> Five Year Plan, Statistical Year Book 2010 and Field Survey 2011.

## D. Physical Cultural Resources

### 1. Religious, Historical, Cultural and Archeological Sites

#### ***Bumthang Dzongkhag***

139. Bumthang was under the rule of King Sendhaka (alias Sindhu Raja), ruled from his 'iron castle' or Chakhar near south east of the present day Jambay Lhakhang. It was king Sendakha, who invited Guru Rimpoche to cure him of a serious illness, inflicted upon by an angry deity *Shelging Karpo*. Guru Rimpoche subdued the local deity and cured the ailing king. Thereupon, King Sendhaka embraced Buddhism as his new religion. Shelging Karpo is the protective deity

of Kurje. Consequently, Guru Rimpoche introduced Buddhism in Bumthang in 8<sup>th</sup> century and Bumthang became the home of famous lamas of Nyingmapa School such as Longchen Rabjampa (1308-1363), Dorji Lingpa (1346-1405) and above all Pema Lingpa (1450-1521), who was also born in the dzongkhag. Hence, Bumthang is considered as one of the most sacred places in the country as many of the famous pilgrimage sites and monasteries are located in Bumthang's four geogs.

140. The Buli Lhakhang, Tharpaling, Nyingmalung and Chodrak and Chorthen Ngingpo Lhakhang and the Domkhar Tashichoeling palace are some of the important places in the Chhume Valley.

**Figure IV-12: Kurje Monastery**



**Figure IV-13: Jampa Lhakhang**

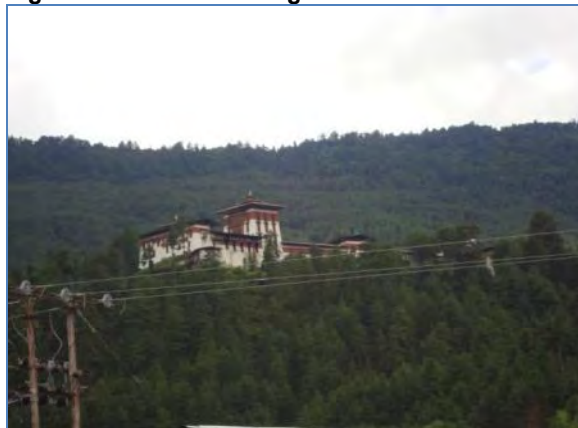


141. The Jakar dzong, Chakhar, Konchosum Lhakhang, Tamzhing Lhakhang, Padma Sambhava Lhakhang, Kurje Lhakhang, Thangbi Lhakhang, Jampa Lhakhang Chorten Lhakhang, Guru Lhakhang, Wangduchoeling Palace, Jakar Dzong, Lamey Gonpa, Jakar Lhakhang are located in Choekhor valley. Of the many monasteries and temples, Jambay and Kurje Lhakhang are considered and revered as most sacred and holy temples in Bhutan and in the Buddhist world. Bumthang Airport is located 1.3 and 2.5 km southeast of these Jampa and Kurje Lhakhangs. From the Jakar Dzong (District Administrative and Monastic center) it is located at around 1.15 km northeast.

**Figure IV-14: Tamshing Monastery**



**Figure IV-15: Jakar Dzong**



### ***Trashigang Dzongkhag:***

142. Trashigang spans the easternmost corners of the kingdom, skirting up to the edge of the Indian state of Arunachal Pradesh, and is the country's largest district. The district has an

altitude ranging from 600 m to over 4000m and Bhutan's largest river, the Dangmechu, flows through the district. Trashigang town, on the hillside was once the center for a brisk trade with Tibet.

143. Today it is the junction of the east-west highway, with road connections to Samdrup Jongkhar and then into the Indian state of Assam. Trashigang town is also the principle market place for the semi-nomadic people of Merak and Sakteng, whose way of dress is unique in Bhutan. There are numerous temples, monasteries and cultural sites in Trashigang Dzongkhag. However, some of the important sites are described below:

**Figure IV-16: Chorten Yulay Nampargyal, Yongphula**



**Figure IV-17: Kanglung Zangtopelri**



144. *Trashigang Dzong*, built in 1659, atop a spur overlooking the Dangmechu River, the fortress of the auspicious hill has been the political stronghold of eastern Bhutan for over 300 years. The Landscape, on which the Dzong stands, is picturesque. The hillock like Mount Meru is the site of the palace of the Druk Chhoglay Namgyal (victory of Bhutanese over enemies in all directions). It is accessible only from the north, through a slender road, paved by blasting the cliff. Due to its location Trashigang Dzong is one of the most strategically placed Dzongs in Bhutan. The present Dzong was enlarged by Dzongpon Dopola, in 1936.

145. *Chhador Lhakhang* is located in the village of Bartsham. The temple is known for fascinating tales revolving around its famous thumb size replica of Chador or Vajrapani.

146. *Bremung Lhakhang*: is located in the village of Bidung. It dates back to the 15th century and a sacred relic is the embalmed remains of its founder Kuenga Wangpo, son of Terton Pema Lingpa.

147. *Kupijigtsam Lhakhang*: On the other side of the valley across Dangmechu, is the village of Yangneer where the Kupijigtsam lhakhang or the temple of the cuckoo is located. Built in the 15th century, this lhakhang is another sacred monument in Trashigang.



Figure IV-18:Yonphu Lhakhang, Kanglung



Figure IV-19: Sherubtse Lhakhang, Kanglung



148. *Kanglung Zangtopelri* is located some 22 kilometres from Trashigang on the highway towards Samdrup Jongkhar. Built in the early 1970's at the initiative of the late Tamzhing Jagar, the Minister for Home and Cultural Affairs, the lhakhang houses some of the most intricately designed statues of Guru Padmasambhava, besides a Shedra, a monastic school.

149. *Yonphu Lhakhang* under Kanglung Geog is located the oldest temple in Trashigang whose establishment cannot be ascertained. It houses several sacred relics and a Tercham that is conducted twice in a year commemorates the feats of religious luminaries like Guru Padmasambhava.

150. *Rangjung Lhakhang*: is located in Rangjung town east of Trashigang. The temple built in the architectural style of the Tibetans has a monastic school supported by HH Garab Rinpoche.

151. *Namdrucholing or Phongmey Lhakhang*: is located further east of Rangjung town under Phongmey Geog. Built in the late 1890's this lhakhang serves the spiritual needs of the village. Opposite the lhakhang, across the Gamri Chu River is the abode of the local deity Meme Ralang with hermitages on its top.

152. Other popular and famous religious, spiritual or cultural sites which are close to Trashigang but not under it are Gom Kora and Chorten Kora under Trashiyangtse Dzongkhag.

153. Yulay Namgyal Chorten/Stupa was built in 1959, a year before the construction of the Yongphula airport by the Indian Military which is within the airport boundary on small hillock east of airport terminal building. It is one of the sacred chortens in the area built by late Lam Karpo, the father of current Lam Jigme Tenzin of Yongphula Monastery at the behest of Late Buddhist Master Dudjom Rinpoche to bring peace and prosperity in the area.

154. Other important religious and cultural assets in the vicinity (at 1-2km aerial distance) of the Yongphula airports are Ugyen Dongacholing Monastery and Shingchen Goenpa. Ugyen Dongacholing Monastery is headed by Lam Jigme Tenzin, son of late Lam Karpo. The monastery has around 130 gomchens (lay monks).

### ***Sarpang Dzongkhag:***

155. Apart from few newly built monasteries or temples under Gelephu and Sparpang, there are no important historical, spiritual or cultural entities within the Dzongkhag.

## **2. Visual Aesthetic, Recreational Resources and Tourism Potential**

156. Bumthang dzongkhag consisting of four wide shaped valleys curved by ancient glaciers presents unique visual and aesthetic resources that are typical of the higher Himalayas. The area provides a diversity of potential recreational resources, natural beauty and scenic qualities, including hiking, trekking, river rafting, appreciation of nature, wild animals and forests, and access to secluded areas. In 2010, around 10,169 tourists arrived in the dzongkhag.

157. Trashigang is considered as the Jewel of the East. Trashigang spans the easternmost corners of the kingdom, skirting up to the edge of the Indian state of Arunachal Pradesh, and is the country's largest district. The district has an altitude ranging from 600 m to over 4000m and Bhutan's largest river, the Dangmechu, flows through the district. The beautiful valleys of Merak and Sakteng hosts Bhutan's last unspoilt bastion of traditional nomad yak herders. Once restricted area, the RGOB has recently allowed controlled tourism to encourage regional balanced development. In 2010, around 1,607 tourists arrived in the dzongkhag.

158. Sarpang Dzongkhag is situated in the central southern foothills bordering India. The area of the dzongkhag stretches from Sunkosh, Lhamoizingkha in the west to the Royal Manas National Park in the east. It encompasses a total geographical area of approximately 2,288 km<sup>2</sup> (Source- LUPP). Its topographic features have undulated terrain with an elevation ranging from 200m to 3600 m above mean sea level. About 82% of total land area is under forest cover. Due to its proximity to three protected areas; Royal Manas National Park in the east, Phibsoo Wildlife Sanctuary in the west and Jigme Singye Wangchuck National Park in the north, Sarpang Dzongkhag has considerable tourism potential particularly with regard to ecotourism. However, due to limited tourism infrastructure coupled with volatile security situation only about 33 tourists has visited Sarpang in 2010.

## V. REVIEW OF ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES IMPLEMENTED UNDER RGOB FINANCED COMPONENTS

### A. Land Reclamation and River Protection Works:

159. *Bumthang airport* construction adjacent to the Chamkhar Chhu River has carried out substantial land reclamation through diversion of the river to the northwest and the southwest of the part of the airport. The impact of river diversion has been felt by the communities of Wangdicholing and Dekiling townships. As a result of river diversion, there is increase in volume and velocity of flow of the river towards the Wangdicholing and Dekiling side causing the bank erosion (also eroding agricultural or paddy fields downstream). The bank erosion gets aggravated during heavy rainfall.

160. Similarly, *Gelephu airport* is intersected by two seasonal streams, (Paitha Khola and Aiepuwali Khola streams) which usually flow during heavy downpour in monsoon season. The debris (boulders and sand) along these stream beds indicate their erosive and flooding nature. The uncontrolled streams could damage the airport that is currently under construction and render it unusable. Detail hydrological study of the area has not been carried out.

Figure V-1: River Diversion near Chakhar Lhakhang



Figure V-2: River protection works on Dekiling Side



#### Mitigation Measure:

161. Protection works on the Wangdicholing and Dekiling side is said to be inadequate both in terms of height and length (by locals) as it was not designed as per the ground situation. The river water during the heavy downpours flows easily above the river protection structures (Gabion walls). Therefore, the appropriately designed river protection structures will need to be constructed on both side of the river (particularly on airport and Dekiling/Wangdicholing side).

162. Prior to the construction of river training works for the protection of the Gelephu airport, there is a need to carry out a thorough hydrological studies. Based on the finding of the study, the appropriate stream banks or river protection structures have to be designed during the detailed design phase of the project.

### B. Loss of Land

163. For Bumthang airport construction, there are no private land acquisition issues. A total of 110.47 acres of cattle farm and fodder development area under the National Brown Swiss Cattle Breeding Program and National Feed & Fodder Development Program has been acquired for the construction of the Airport. Because of the acquisition the program which liaises with the

Department of Livestock under the Ministry of Agriculture has lost cattle farm and improved pasture land. It was agreed that the farm will be allowed to graze on the remaining pasture land till it is permanently relocated after the required farm infrastructures is developed at the new site in Lebi.

164. No private agriculture land has been acquired in Yongphula except for the 2.89 acres of institutional land belonging to Bhutan Telecom and Bhutan Broadcasting Services Corporation (BBSC). Land substitutions have been provided.

165. Gelephu airport project has acquired private land belonging to 135 persons. Land substitution and cash compensation has been provided to the affected persons.

166. Further details on land acquisition, substitution and compensation made are provided in the social due diligence report.

*Mitigation Measure:*

167. The land substitution and cash compensation has been carried out as per the land act 2009 and guidelines of the Property Assessment and Valuation Agency (PAVA) 2009.

**C. Demolition of Residential Structures**

168. Yongphula airport construction did not require demolition of any structures.

169. Although there are several semi and permanent structures such as office buildings, Cattle Sheds, Feed Stores, Seed Stores, Silos and staff quarters belonging to Brown Swiss Farm and National Feed and Fodder Development Programme under Department of Livestock's, there is no immediate plans by DCA to dismantle the structures for foreseeable future.

170. On the other hand, Gelephu airport construction will need to demolish at least 10 semi-permanent structures. Cash compensation at replacement cost has already been provided to the affected people.

*Mitigation Measure*

171. Demolition of structures particularly houses will be carried out in consultation with affected persons. The affected households will be provided time to construct their new home and shift to the new house only after completion of the construction.

172. The new settlement area shall be provided with water supply, electricity and access road.

**D. Construction Material and its Transportation**

173. The construction materials were sourced from outside area was basically stone and sand. For Bumthang airport construction works, the stone or boulders were required for making stone aggregates used for construction of runway. The construction materials was bought from the Gathak Quarry which is located at some 32 km from the construction site. The quarry is privately owned and operated with the permission from Department of Geology and Mines. The quarrying is carried out as per DGM's quarry and mining rules. Transportation of stones from the Gathak quarry till the Bumthang airport construction site passes through number of settlements (Tangsibi, Jalkhar, Chamkhar and Bathpalathang).

174. For Gelephu airport the construction materials such as stone and sand are being brought from Mao Khola River through surface collection approved by Natural Resource Development Corporation (NRDCL). The transportation of construction materials from Mao Khola passes through Gelephu town.

175. Yongphula airport rehabilitation works were basically restricted to construction of apron, terminal building and the widening of airfield by removing parts of the small hillocks. The construction material requirement therefore is minimal compared to construction of new airports at Bumthang and Gelephu.

176. No major impacts were observed as a result of quarrying both Gathak Quarry and Maokhola surface collection sites. However, it is learnt that the impact was more from haulage of construction materials from the quarry to construction sites due to vehicular exhaust pollution and to dust from exposed construction materials during transportation.

#### **E. Water Environment (Surface Water Resources)**

177. Construction of in storm water drains alongside the Yongphula airfield since 1960s have resulted in concentrated storm water flow towards Yongphula settlement causing erosion and landslide downstream. The issue was raised by the people of Yongphula during public consultation meeting. The request was made that the storm water from the airfield be diverted equally on both sides of the runway to reduce volume of storm water towards Yongphula settlement to curtail further erosion and landslide downstream. No measures were taken under RGOB funded works carried out for Yongphula airport upgradation. Hence, this issue needs to further studied under the detailed design phase of the ADB funded project and appropriate measure be applied to resolve it.

#### **F. Site Clearance**

178. Site clearance is the initial step of the construction phase. Usually the removal of the existing vegetation cover would be done with heavy equipment, while trees with larger stems would be felled by hand using chain saw. The impact of site clearance will be significant in terms of quantity or the number of trees felled. Bumthang airport is built on a pasture land with very few trees. No trees were felled on Yongphula airport since it was just a rehabilitation of the existing airport. However, total of 1829 trees were felled for the construction of Gelephu airport.

179. Right-of-ways (airport boundaries) are clearly marked to avoid removal of vegetation unnecessarily. Necessary actions such as tree marking were carried out in accordance with the forestry rules before felling of trees for the project roads. The DOFPS prepared a survey and inventory of the commercial timber present on public lands prior to construction of any given airports, in accordance with the official procedures of the DOFPS as contained in the Forest and Nature Conservation Rules (FNCR 2006). The Natural Resources Development Corporation Limited (NRDCL) was authorized to collect and market the timbers with commercial value.

**Figure V-3: Stormwater Drain towards Yongphula Settlement from Yongphula Airport**



**Figure V-4: Old Gullies by Stormwater from the Yongphula airport**



## **G. Wildlife Habitat**

180. The airport construction has led to loss wildlife habitat comprising of pastures land; agricultural fields; forests; shrubs and riparian vegetation of Bumthang, Yongphula and Gelephu.

181. Nearly 100 acres of Brown Swiss Cattle pasture land which is habitat for small rodents and birds (Sparrow, Crow, Oriental Turtle Dove, Red-billed Cough, Black-billed Magpie etc) has been lost to construction of the Bumthang airport. Riparian forest and Chamkhar Chhu banks close to the airport construction site which is the habitat of Ibisbill and Ruddy Shelduck, the winter visitor is damage due to construction of river protection works.

182. Yongphula airfield was constructed since 1960s by Indian Military. So the upgradation of the existing airport had limited impact on wildlife habitat.

183. For Gelephu airfield construction, about 235 government reserve forest has been already cleared which was the habitat of Barking Deer, Rhesus Macaque, Bengal fox, Hare, Jungle Cat and even Elephant was known to visit the area occasionally. The area was also habitat of numerous bird species including the Indian Peafowl which requires undisturbed forests for its habitation. Indian Peafowl is no more seen in the area due to destruction and disturbance to its natural habitat.

184. Due to the type of the planned development and the fact that the development of a new commercial areas are developed, no effective measures were found for mitigating of the impacts on wildlife. However, the availability of similar habitats in nearby areas (both Bumthang and Gelephu) has reduced the predicted impacts of wildlife. The construction activities are carried out during day time only. Compensatory plantation activities needs to be explored during the detailed design stage of the project..

## **H. Community Structures**

185. For Bumthang airport construction, the community suspension bridge at Bathpalathang has been demolished which has affected the people of Bathpalathang, Tamzhing, Konchosum, Kharsum and Tekarzhong settlements. The demolished suspension bridge was a connection for the people to go to School, hospital and district headquarter. The demolition of the bridge has resulted in extra walking time (by at least two hours extra every day) for people particularly for school going children. Although, a new bridge site was designated at safe distance from the airfield, the suspension bridge was not rebuilt due to insufficient budget. Chhokhor Geog which



is responsible for restoration of the bridge has applied for additional budget for financial year 2011-2012 for the construction of suspension bridge at new site.

**Figure V-5: Suspension bridge before demolition, at Bathpalathang, Bumthang**



**Figure V-6: People using Yongphula Airport Runway to commute**



186. People of Yongphula and upper Uzorong were using part of the airport to commute to and from their village to a market centre in Yongphula. The footpath is particularly important for people of Uzorong as it serves as trade route to sell their produce and buy essential items. As per locals, they have been using the route even before the construction of airfield. Closing of footpath forces people to take detour which requires more two hour additional walk time including the return travel. This is a severe socio-economic impact on poor people who depend on this route for marketing their products as well as buying of daily essential items. During detailed design the feasibility of the new route outside airport boundary on eastern side will need to be studied and subsequently built for the commuters to reduce impact on locals.

## **VI. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES PROPOSED FOR ADB FINANCED AIR TRANSPORT CONNECTIVITY ENHANCEMENT PROJECT**

### **A. Introduction**

187. This section provides an assessment of the positive and negative impacts on the physical environment in the immediate vicinity of the study area resulting from the development of the project, and the corresponding mitigation and enhancement measures to negate such adverse impacts. The environmental quality of the project site could be affected from project activities during each phase of project development, if environmental management measures are not properly followed.

188. This section discusses the potential environmental impacts of the proposed rehabilitation and upgrading works of the existing domestic airports and identifies mitigation measures to minimize the impacts in the design or pre-construction, construction and operational phases.

189. The major environmental issues regarding the upgrading and rehabilitation of the existing domestic airports are related to i) design of airports; ii) temporary impacts of mobilization and construction; iii) problems of pollution related to disposal of sewage, waste fuel and oils, and solid wastes generated during construction and operations; iv) impacts associated with increased road traffic, v) aircraft take-off and landing; vi) possible accidents. The proposed development will not affect any or encroach into ecologically sensitive areas.

### **B. Pre-Construction Phase Impacts**

#### **1. Environmental Impacts due to Project Design**

##### ***a) Slope Erosion***

190. The main embankment of the runway strip of Bumthang is located parallel to Chamkhar Chhu River with possible slope and bank erosion.

191. Gelephu runway is built on the flat terrain with no slope erosion problem.

192. Yongphula airport is built on the ridge top. There will be slope erosion problem as a result of earthworks during removal of two small hillocks particularly in monsoon.

#### ***Mitigation Measure:***

193. Potential slope erosion will be mitigated by designing slope erosion controls such as benching, retaining and breast walls, and bioengineering (plantation of locally available plant species) for Bumthang and Yongphula airports.

### **C. Construction Phase Impacts**

#### **1. Land Environment**

##### ***Construction Material and its Transportation***

194. The construction materials such as stone and sand will be sourced from an area outside the construction zones. The stones or boulders for making aggregate for runway extension and access road development of Bumthang airport will be brought from Gathak Quarry located some



32 km from the airport. The Gathak Quarry is approved by the Department of Geology & Mines (DGM) and the quarrying is carried out as per DGM's quarry and mining rules. Transportation of stones from the quarry till the Bumthang airport site will pass through number of settlements (Tangsibi, Jalkhar, Chamkhar and Bathpalathang).

195. Drainage improvement works of Yongphula airport will also require construction materials. The quarries for the construction materials will be identified during detailed design. For Gelephu airport the construction materials such as rock and sand will be brought from Mao Khola River. The transportation of construction materials from Mao Khola will pass through Gelephu town.

196. Haphazard quarrying can cause environmental damages such as slope failure, soil erosion, surface water pollution and siltation. The haulage of construction materials from the quarry to construction sites increases the pollution due to vehicular exhaust and to dust from exposed construction materials.

*Mitigation Measure:*

1. Environmental friendly quarrying through benching process shall be carried out both at Gathak Quarry, Bumthang.
2. Only surface shall be carried out at Maokhola surface collection sites at Gelephu.
3. Blasting if required shall be carried out in strictly controlled manner to minimize the wildlife and its habitat.
4. Only required forest clearing shall be done.
5. To stabilize the quarried slopes, an appropriate bioengineering shall be carried out by planting native plants (grasses and shrubs). Salix (shrub species) is suitable for Bumthang while plantation of Artemisia and Berberis spp. are good for Yongphula area. Bioengineering or plantation of grass and bushes may not be necessary in Gelephu area because of high natural regeneration capacity of vegetations in the subtropical zone of high precipitation.
6. Regular maintenance of transport vehicles will be carried out to reduce the exhaust fume pollution.
7. Construction materials will be covered during transportation to minimize dust pollution.

***Excavation, Filling and levelling works***

197. The construction of access road for Bumthang and Gelephu airport will require excavation, filling and levelling of earth to maintain the roadway gradient. Similarly, earthwork and excavation will be required for removing two small hillocks northwest of the air terminal to improve air safety for Yongphula airport. These activities will generate earth/debris which will need to be properly disposed off. However, most of the excavated materials will be used for filling and levelling works for all within the airport construction sites. Only some amount of excavated material may remain to be disposed particularly from removal of the small hillocks at Yongphula airport.

198. Impact on soil owing to the construction activities includes erosion of top soil, loosening of soil compaction material, dust pollution and siltation of river and streams. However, the impacts will not be significant if following mitigation measures are employed.

*Mitigation Measure:*

199. Surface run-off leads to topsoil erosion; hence an effective plan for runoff management on construction sites will control erosion and retain sediments on site to the maximum extent possible. An effective plan for both structural and non-structural controls will help in restricting soil erosion on site. Erosion controls can directly reduce the amount of sediment transported off-site, thereby reducing the need for sediment controls. Some of the structural and non-structural controls that can be adopted are as follows:

200. Structural controls include:

- Bioengineering of exposed slopes on all three domestic airport upgradation work sites;
- Construction of strong and effective boulders and log barriers will be erected particularly for Yongphula spoil disposal sites.
- Construction of sediment basins, which allow sediment to settle out of the airports runoff.

201. Non-structural erosion controls include:

- Planning and designing the development within the natural constraints of the site;
- Minimizing the area of bare soil exposed at one time (phased grading);
- Planning for stage construction; and
- Avoiding the unnecessary clearing of the vegetation, that is not required at all.

202. In addition to the above measures, material stockpiles, borrow areas, access roads and other land-disturbing activities will be located away from critical areas such as steep slopes, highly erodible soils and other susceptible areas prone to soil erosion. The top soils, which are removed by the clearing activity during construction, will be stockpiled and then reapplied to the site for bioengineering purposes. Dust pollution will be controlled by sprinkling water on exposed soil at least twice a day.

***Waste disposal***

203. The wastes generated due to construction activities on all three airports are likely to cause negative environmental impacts during its storage, transportation and disposal. The wastes include the following:

- Site clearance residue of the existing structures including excavated materials will cause land and air pollution
- Chemical waste material from washing of equipment and vehicle carrying construction material will cause soil and water pollution
- Workers engaged during construction phase will generate municipal solid wastes such as food wastes; packaging and wastepaper will cause land and water pollution if not disposed properly.

*Mitigation Measures:*

204. In general, waste will be managed by reduction of waste generation at source, re-use and recycling. However, the specific mitigation measures are proposed to alleviate the impacts caused by the construction, excavated materials, chemical and municipal solid wastes:

- Construction and demolition waste materials from existing structures will be segregated so that waste materials could be re-used. For example, waste timber could be reused for

construction of temporary labour camps. Concrete waste could be used filling and levelling the ground during construction of access roads.

- Excavated material will be stockpiled safely away from the streams and river beds to prevent soil erosion and ultimate water pollution. As much as possible excavated materials will be re-used for filling. It will be possible to do this in Bumthang and Gelephu airport due to existence of relatively flat topography with gentle undulations.
- Chemical waste from the machineries will be collected and stored properly. Spent engine oil from the equipments will be recycled and re-use.
- The contractor will provide rubbish or dustbin to temporarily store the municipal wastes (or solid waste). For Gelephu, the municipal waste will be transported and dumped at the municipal disposal site at Bhur. Similarly, for Bumthang municipal waste from the construction will be disposed off at the municipal disposal site at Garpang. There is no municipal disposal site at Yongphula. Hence, the contractor will incinerate the non-biodegradable waste.

## **2. Water Environment (Surface Water Resources)**

205. During construction surface water resources may be affected by accidental spillage or by inappropriate management practices of hazardous substances into a river or streams. Construction of the river/stream protection works are another potentially critical issue for both Gelephu and Bumthang airports. Water pollution may arise due to the construction works (bank protect works) by way disposal of spoil directly into the river/stream.

206. Similarly, construction works have direct impact on the quality of water in small pond or lake located north-west of Yongphula airport. One of the storm water drainages terminates into this small pond which may cause the siltation of the pond. Improper drainage construction will lead to concentration of runoffs and subsequent erosion and gulying. The impacts from the past airport development works in and around Yongphula airport is clearly visible.

207. Hence the following mitigation measures should be implemented.

### *Mitigation Measures:*

- Discharge of sediment laden construction water (e.g. from areas containing dredged spoil or pumped ground water from foundations) directly into surface water courses will be forbidden. The sediment laden construction water will be discharged into settling ponds or tanks prior to final discharge. This applies particularly to the Bumthang and Gelephu airports construction works along the river/stream banks.
- Carry out water quality monitoring on the Chamkhar Chhu River, Bumthang and Lake near Yongphula airport. Pre-construction data baseline water quality data (**Table IV-6**) will be the reference to assess potential subsequent impact of construction or future operation on the local water resources.
- Washing of vehicles or any construction equipment in the Chamkhar Chhu River or any other stream shall be strictly forbidden.
- Dumping of construction waste into storm water drainage will be avoided to minimize the siltation of Lake/pond near Yongphula airport.
- Storm water will be equally diverted towards the western side of runway to reduce the volume of the flow and further erosion downstream.

## **3. Air Environment**

208. During site clearance and earthwork operations there will be temporary negative impacts on air quality in terms of increased dust suspension and gaseous emissions from the movement

of heavy machinery and equipment. Dust will inevitably occur at and inside the construction corridor throughout that period. During construction, dust will also be generated alongside the haul route (Gathak Quarry to Bumthang Airport site and Maokhola to Gelephu airport site) from the quarries from where aggregate for the upper layer of the runway will be obtained. In addition dust will be a health and safety issue for the workforce at the site.

*Mitigation Measure:*

209. The level and significance of dust generation and nuisance can be effectively mitigated through:

- Regular spraying the work area; covering trucks where the haulage of material involves transport on public roads; timely and regular cleaning of public roads as required. Water for this measure for Bumthang airport construction will be used from Chamkhar Chhu. For Yongphula and Gelephu, since there is no sufficient water nearby the construction sites, the water has to be transported using tankers.
- The absolute level of construction-related ambient air pollution can be minimized by proper site management and construction organisation by good maintenance of the vehicle fleet and by immediately excluding over-aged or worn out vehicles and machinery from the construction site.
- The operation of the asphalt plant is a potential source of harmful emissions, which may affect the human and the natural environment and the health of the workforce. The site of the asphalt plant will be at a minimum distance of 100 m from any watercourse or settlement.
- The construction workers will be provided with gasmask to prevent direct inhalation of dust in a work environment.
- In addition air quality will be monitored throughout construction phase. Parameters to be measured are dust, PM10 (Suspended particulate), smoke of asphalt plant, No<sub>x</sub> and So<sub>x</sub> (as indicated in the **Table IV-3**).

#### **4. Noise Environment**

210. During construction noise will occur at and around the construction sites from the operation of heavy site equipment and construction vehicles. The impact will be temporary and local and generally decrease with the distance from the source. The settlements that will most likely be temporarily affected by construction noise are Bathpalathang and parts of Wangdicholing for Bumthang airport construction site. For Gelephu and Yongphula airport, noise pollution will not be of serious issue as the settlements are at sufficient distance away from the construction sites.

211. Workers exposed to construction noise are further sensitive receptors. The level of noise exposure and associated risks for the health and well being of the workforce depends on the individual work place and type of equipment used.

*Mitigation Measures:*

- Limit the working period to daylight hours.
- The potential negative impact of construction noise on the workforce will be generally mitigated by providing the workforce with appropriate noise protection gear such as earplugs and by using construction equipments that produces less noise.

## 5. Ecological Environment

### **Site Clearance**

212. Site clearance is the initial step of the construction phase which has already been carried out under the RGOB funded activities. which has already. For the construction of access road for Bumthang airport will require approximately 340 trees (mostly blue pine) to be felled. There will be no tree felling at Yongphula and Gelephu airports.

### *Mitigation Measures:*

- Right-of-ways (airport boundary) should be clearly marked to avoid removal of vegetation unnecessarily.
- Necessary actions such as tree marking must be carried out in accordance with the forestry rules before felling of trees for the project roads. All paperwork and approvals such as forestry clearances particularly for Bumthang airport must be obtained well ahead in time to prevent delays in construction.
- The DFPS will prepare a survey and inventory of the commercial timber present on public lands prior to construction of any given airports, in accordance with the official procedures of the DFPS as contained in the Forest and Nature Conservation Rules (FNCR 2006). Natural Resources Development Corporation Limited (NRDCL) will be authorized to market the timbers with commercial value.
- Compensatory plantation (of 1:5) will be carried out for trees lost for the construction of three airports. The compensatory plantation is proposed to be carried out under the banner of the Greenbelt Development Plan. The Greenbelt Development Plan (thick plantation cover around the airport, the preferred methods to mitigate air pollution as plant serve as a sink for pollutants and also check flow of dust and also reduce the noise pollution) will be developed during the detailed design phase.

### **Wildlife Habitat**

213. The airport construction has already led to loss of wildlife habitat comprising pasture land; agricultural fields; forests; shrubs and riparian vegetation of Bumthang, Yongphula and Gelephu.

214. Runway resurfacing and access road development at Bumthang will have minimum impact or habitat loss as the development work will take place in an area which is already developed.

215. Yongphula airfield was constructed since 1960s by Indian Military. So the upgradation of the existing airport will have limited impact on wildlife habitat.

216. Under RGOB financed Gelephu airfield construction, about 235 government reserve forest has been already cleared and habitat has been lost. The future proposed upgradation works under ADB project will have limited impact on wildlife habitat.

217. Nevertheless following mitigation measures will be implemented:

- The construction activities will be carried out only during day time.
- The Master Plan or zoning plans may determine the protection or development of some areas with significance or potential for wildlife protection, e.g. alongside the Chamkhar Chhu River in Bumthang and Forest areas in the vicinity Gelephu airport areas.
- Greenbelt development programme with a compensatory plantation (of 1:5) will replace to some extent the lost wildlife habitat. The Greenbelt Development Plan will be

developed during the detailed design phase in all three airport sites. However, the main purpose of greenbelt is shield the noise and control air pollution from spreading unabated out of the airport sites.

## **6. Socio-Economic Environment**

### ***Community Structures***

218. People of Yongphula and upper Uzorong were using part of the airport as footpath to commute for their daily activities (sell and buy items). The footpath is particularly important for people of Uzorong as it serves as trade route to sell their produce and buy essential items from the market at Yongphula. As per locals they have been using the even before the construction of airfield. However, the construction of permanent airport security fence will permanently block their footpath. The blockage of footpath will force people to take detour which will require more two hours additional walk time inclusive of return journey. This will have severe socio-economic impact on poor people who depend on this route.

219. The rural water supply scheme (RWSS) with its pipeline and the storage tank catering about 70 households of Yongphula community within the airport boundary. Therefore, any future expansion and runway upgradation works may disrupt the community water supply and cause drinking water shortages for Yongphula and neighbouring area. Drinking water resources is scarce in the area.

### ***Mitigation Measure***

- Study possible location of alternative footpath (during detailed design) along the eastern perimeter of the Yongphula airport boundary and subsequently construct it to mitigate the impact as a result of closure of existing walkway (which used the part of the existing airfield).
- Any future Yongphula airport upgradation and expansion works will consider the importance of the community water supply system within airport boundary. The community will be consulted if the shifting water supply line and tanks are to be carried out.

## **7. Health and Safety of Construction Workers**

220. During construction the health and safety of the workforce is at risk due to an accident-prone working environment, long shifts and through accommodation at a campsite. To minimise the risks associated to these framework conditions DCA will be responsible to ensure that adequate health care arrangements will be available at the site throughout the construction period.

### ***Mitigation Measures:***

- The construction workers will be provided with adequate and appropriate shelters which are wind and rainproof. The camps will be constructed at safe distance from the habitation of the local communities to minimize the disturbances or undue interference by the foreign workers.
- Access to healthcare will be ensured with provision of first aid at the work sites. And in the event of major accidents, emergency services of the district hospitals of Bumthang, Trashigang and Gelephu will be availed.
- Adequate water supply, pit toilets and solid waste disposal sites will be provided
- Monitoring of the sanitary conditions within the worker's camps is the responsibility of the DCA, who would regularly carry out surprise checks to inspect the camps.

- To minimize the risk of new infections and the spread of HIV/AIDS/STI a specific tailor-made campaign will be carried out under the Project. This would comprise of conducting HIV/AIDS/STI sensitisation sessions at the campsite including the distribution of information materials / brochures at the camp. The proposed services may be rendered in the framework of the national AIDS/STI Prevention Programme established under the Dzongkhag Administrations and MOH, and would thus be free of cost.

## **8. Physical Cultural Resources**

### ***Religious, Historical, Cultural and Archaeological Sites***

221. Although there are many cultural and religious sites (temple, monasteries, chortens etc.) in Bumthang, there will be no impact during the runway resurfacing and access road development of the airport as the sites are away from the immediate construction zone.

222. At Yongphula airport, the hills with the important Chorten/Stupa built in 1959 by Lam Karpo at the behest of Late Buddhist Master Dudjom Rimpoche, will not be demolished to save the stupa. The stupa was built for the wellbeing sentient beings and it is revered by the locals. The demolition of chorten would result in loss of important local religious or cultural asset.

223. Gelephu area has fewer religious and cultural assets as in Bumthang and Trashigang. Few that exist currently are located away from the construction zone. So there will be no impact at all to these assets during the runway extension and river protection works.

#### ***Mitigation Measure:***

224. As far as possible demolition of any cultural or religious structures more so the important ones (like the chorten at Yongphula airport) will be avoided. However, if it is unavoidable, beyond any reasonable doubt, then prior to the demolition (chorten at Yongphula airport) a thorough public consultation with the local community (particularly with monastic community headed Lam Jigme Tenzin), Kanglung Geog Administration and Trashigang Dzongkhag will be carried out during the detailed design stage. The demolition and relocation issues will be jointly decided. Based on consensus the relocation of the chorten will be carried out with the assistance of the project.

## **D. Operational Phase Impacts**

225. The operation of the domestic Airports of Bumthang, Yongphula and Gelephu will require a modern management structure to be established aiming at safe operations, good quality service and handling growing passenger and cargo volumes in accordance with ICAO international standards and procedures.

226. This scenario bears both opportunity and risk. The opportunity is that the domestic Airport may become a model enterprise for sustainable management practices and environmentally sound business operations in line with the RGOB and ADB's environmental policy statements. The risk is that this opportunity will be missed and that decisions are taken, which in the medium to longer term will entail unsustainable operations resulting in continuous adverse impact on both the human and the natural environment.

227. To ensure effective operations and achieve substantial output, the following environmental impacts have to be taken care of.

## 1. Air Environment

228. The major air emissions expected during the operation phase of the airport project will be due to operation of aircrafts and vehicular traffic generated because of airport operations. However, the extent of air pollution will be minimal due to limited traffic of both aircrafts and automotive vehicles.

### *Mitigation Measures:*

229. The operation phase of the airport involves slight increase in traffic volume, which further contributes to vehicular emissions. In order to cope up with the situation, a detailed traffic management plan will be developed during the detailed design stage of the project.

230. The other major pollutants found to be generated in an airport is from the aircraft exhaust. Hence, following methods of abatement can be adopted to control the air pollution at the source level:

- Shut down of engines to the maximum extent possible during taxiing and idling period.
- Allowing aircrafts with ICAO certified engines to land and takeoff, as far possible
- Appropriate greenbelt development with thick plantation cover is one of the preferred methods to mitigate air pollution as plant serve as a sink for pollutants and also check flow of dust and also reduce the noise pollution.

## 2. Noise Environment

231. The calculation and assessment of noise impacts from airport operations requires reliable data on traffic development and aircraft mix, which according to the DCA have not yet been established. In the absence of the data on noise, impacts due to noise can be assessed only qualitatively.

232. During operation noise associated with an airport can be attributed to a number of sources and activities such as:

- Aircraft take-offs and landing;
- Aircraft flights over residential neighbourhoods;
- Engine run-ups, which are tests performed on aircraft engines and systems after maintenance to ensure that they function safely;
- Reverse thrust, which is used to slow down an aircraft when landing on the runway;
- General noise from ground services equipment.

233. Increased level of noise above 60 dB has a major health effects. Elevated noise levels can create stress, increase workplace accident rates, and stimulate aggression and other anti-social behaviors. The noise pollution may affect the residents living near the airports. The impact might be on inhabitants of Chamkhar Chhu valley particularly, Chamkhar town, Jakar, Wangdicholing, Dekiling and Tamshing settlements.

### *Mitigation Measures:*

234. The ICAO Balanced Approach<sup>19</sup> concept provides airports with an agreed methodology to be used to address and manage aircraft noise problems in an environmentally responsive and economically responsible way. The Balanced Approach to noise management encompasses four principal elements:

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<sup>19</sup> See: ICAO Airport Development Reference Manual, 9th edition, 2004



- Reduction of noise at source;
- Land use planning and management;
- Noise abatement operational procedures;
- Operating restrictions on aircraft.

235. The DCA will be responsible to actively address these issues in a noise management policy and programme. Under the framework for future effective noise management at all airports and airport authority shall carry out:

- Airport authority will have a wide range of environmental management tasks, including the preparation and implementation of a noise management programme for the systematic reduction of operational noise impact of the airport
- Assign a noise study based on ICAO Annex 16 procedures („Aircraft Noise’), which also is a requirement for the later certification of the airport according to the „Manual on Certification of Aerodromes’;
- By importing aircraft that make less noise such as plane with turbo-fan rather than turbojet.
- A computer model will be used which simulates the effects of aircraft noise upon building structures. Variations of aircraft type, flight patterns and local meteorology can be studied in future with the availability of all required data.
- Appropriate greenbelt development with thick plantation cover is one of the preferred methods to mitigate air pollution as plant serve as a sink for pollutants and also check flow of dust and also reduce the noise pollution.

### **3. Water**

236. During operation phase, airport activities will produce substantial amount of wastewater. The wastewater if discharged untreated will pollute the surface as well ground water. In Bumthang, wastewater may directly pollute Chamkhar Chhu; at Yongphula, it may pollute the small lake or pond (located in the North West of the airport); and at Gelephu it may pollute to small seasonal streams (dry most part of the year) that intersect the airport.

#### *Mitigation Measure:*

237. In general the amount wastewater will be reduced through proper and efficient use of water. The wastewater treatment plant will be installed in future based on the waste water production and the treatment requirement.

### **4. Ecological Environment**

#### ***Impact on Protected Areas and Habitats of Protected Species***

238. The protected areas that are within 20 km radius of the Bumthang airport site are Wangchuck Centennial Park to the north and Thrumshingla National Park south and south-east. Some of level of disturbance to wildlife due to aircraft noise during landing and take-off on both the protected areas is expected. But the impact would be minimal as the proposed air traffic just few times in a week.

239. For Yongphula airport site there are no protected areas that falls within the 20 km radius.

240. The part of Royal Manas National Park (RMNP) to the east and Jigme Singye Wangchuck National Park (JSWNP) to the north of Gelephu airport site falls within 20 km radius. Impacts on wildlife due to noise pollution would be minimal as the RMNP lies 13 km and the JSWNP lies 16.5 km away from the airport.

*Mitigation Measures:*

241. The ICAO Balanced Approach<sup>20</sup> concept provides airports with an agreed methodology to be used to address and manage aircraft noise problems in an environmentally responsive and economically responsible way. The Balanced Approach to noise management encompasses four principal elements:

- Reduction of noise at source;
- Land use planning and management;
- Noise abatement operational procedures;
- Operating restrictions on aircraft.

242. The DCA will be responsible to actively address these issues in a noise management policy and programme. Under the framework for future effective noise management at all airports and airport authority shall carry out:

- Airport authority will have a wide range of environmental management tasks, including the preparation and implementation of a noise management programme for the systematic reduction of operational noise impact of the airport
- Assign a noise study based on ICAO Annex 16 procedures („Aircraft Noise’), which also is a requirement for the later certification of the airport according to the „Manual on Certification of Aerodromes’;
- By importing aircraft that make less noise such as plane with turbo-fan rather than turbojet.
- Appropriate greenbelt development with thick plantation cover is one of the preferred methods to mitigate air pollution as plant serve as a sink for pollutants and also check flow of dust and also reduce the noise pollution.

## **5. Socio-Economic Environment**

243. During the operational phase of the project, following impacts have been identified on the basis of various public consultations carried out during field visit:

### ***Regional Development***

244. The proposed airport project is expected to bring in required development in the region, which is so far has not been happening due to lack of air access to the region. Tourism business opportunities will grow as result of commission of these domestic airports (Bumthang, Yongphula and Gelephu).

### ***Employment and Job Opportunities***

245. The proposed airports will employ considerable number of persons during operation phase. Since these jobs will vary in nature like technical, non-technical, managerial, support staff etc therefore there is some scope of employment of local population.

### ***Additional Revenues for Government agencies***

246. Direct access to Bumthang, Gelephu and Yongphula will provide an opportunity to more foreign tourists to visit famous religious, cultural and natural sites and thereby generate revenue for the state and central governments. There will be additional business opportunities in the form of tour and travel and hospitality sector development.

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<sup>20</sup> See: ICAO Airport Development Reference Manual, 9th edition, 2004

### ***Demography***

247. Proposed project involves emergence of new and developed transportation facility with some ancillary commercial development. Hence there will be no significant change in the local demography.

### ***Noise Generation***

248. During operation phase, it is expected that high decibel noise (65-70 dB) will be generated due to airplane land and takeoff. It will have serious impact on local population at all three airport sites.

#### ***Mitigation Measure:***

249. The noise exposure for communities at all domestic airports would be of short duration (approx. 5-10 minutes), further there will be limited number of flights per week. Hence negative impact may not be severe as expected. In addition, tree plantation (through greenbelt development programme) will be carried out around the village habitations to absorb the noise as much as possible and to give relief to the surrounding communities.

## **6. Physical Cultural Resources**

250. During operation of Bumthang and Yongphula airports, there will be some impacts due to noise of aircraft landing and takeoff, on the religious and cultural assets located in the vicinity of the airports. For Bumthang; Jakar Dzong, Jampa Lhakhang, Kurje and Tamzhing monasteries while in Yongphula; Shingchen Goenpa, Mongling Goenpa and Yongphula monasteries are expected to be impacted in some way due to noise and vibration as a result of the aircraft operation.

#### ***Mitigation Measure:***

251. DCA will actively implement effective noise management programme through import of aircraft with less noise, reduction of noise at source and certify airports based on the noise study as per ICAO Annex 16 procedures ('Aircraft Noise').

252. To further reduce effect of noise and vibration, the DCA will implement the noise reduction barrier through plantation of trees (as part of the greenbelt development plan) that absorbs the noise. Greenbelt development plan will be developed during the detailed design phase.

## **VII. INDUCED AND CUMULATIVE IMPACTS AND THEIR CONTROL**

### **A. Introduction**

253. Domestic airport project is one of the largest air transport projects ever undertaken by the RGOB in the central, eastern and southern region. Regarding the economic, socio-economic and social effects of this Project there is a broad consensus among all stakeholders that there will be large scale indirect, induced and potential long-term development with environmental impacts that will reach far beyond the footprints of the new airports.

254. This section of the IEE study puts the Project into a broader development context and briefly discusses other ongoing and planned developments that may add to or otherwise influence the impacts of the Project. Potential development scenarios are discussed in a descriptive manner as quantitative assumptions cannot be made in this context.

255. The main purpose of this section of the IEE report is to draw attention to areas of potential conflicts and unwanted induced development and off-site impacts of the Project. This information would enable decision makers to make informed strategic decisions and initiate timely corrective measures and planning decisions.

### **B. Regional Context**

256. Currently, most of the tourism businesses of Bhutan are concentrated in the western part of the country because of the existences of the airport and other tourist infrastructures. It is the fastest growing area which is home to the major administration services, educational, commercial, and recreational and employment activities, as well as social services.

257. In 2010, approximately 40,000 tourist visited Bhutan. The capital region, which includes Thimphu, Paro, Punakha and Wangdiphodrang received the maximum number of tourists. Bumthang, the central region received about 37% whereas the eastern or Trashigang received only about 6% and insignificant number visited Sarpang or southern region.

258. The poverty analysis by carried out jointly World Bank and National Statistical Bureau of Bhutan (2010) show the high poverty incidences in central, southern and eastern region of the country. The poverty rate for Bumthang is 15%, 30% for Trashigang and 23% for Sarpang. With the development of domestic airports, the government aims to bring about balanced regional economic development to reduce poverty incidences in the country, especially through distribution of tourism businesses across the regions of the country.

### **C. Major Current and Future Development Projects**

#### **1. Air Transport Development**

259. The domestic airports upgradation (at Bumthang, Trashigang and Gelephu) and air transport development through ADB assistance are planned at achieving air travel of approximately 53,870 passengers per year for Bumthang and 32,190 each for Trashigang and Gelephu by 2020.

260. The airports upgradation works and subsequent operations will create scores of new jobs, which will add to the locally growing demand for housing, shopping and other commercial activities in the respective regions.

## **2. Second East-West Highway**

261. Other big transport project, the Road Network Project (RNP) II that currently Bhutan is undertaking is the development of second East-West Highway through southern part of Bhutan. The RNP II is also being financed by the Asian Development Bank.

262. Given the scale and nature of these public sector development projects and considering their location in the southern part of the island it can be expected that their combined effects will be substantial. The development process induced by the cumulative forces of these projects will be highly dynamic and has potential to affect the economic, social and natural environment of Southern and eastern part of the country.

### **D. Induced Development and Impacts**

#### **1. Positive Impact**

##### ***a) Impacts on Regional Development and Land Use***

263. In the medium to longer term the new domestic airports of Bumthang, Yongphula and Gelephu are expected to develop into a regional growth pole with far-reaching impacts on land use and spatial development. Supported by the effects of the previously mentioned public sector projects push and pull factors will emerge, which will add to the dynamics and dimensions of expected development patterns throughout the central, southern and eastern region of the country.

264. The further development of Bumthang airport will spur the development of the nearby townships such as Bathpalathang, Jalkhar, Chamkhar, Wangdicholing, Dekiling and even the rural settlement nearby. Similarly, areas surrounding Yongphula and Gelephu airports will also see accelerated development of such as housing, hotels and other infrastructure.

##### ***b) Positive Socioeconomic Impacts***

265. The overall objective of the RGOB is to diversify the economic base and to achieve balanced growth and sustainable development by promoting agriculture, industry and tourism.

266. The tourism in particular has an outstanding potential and could be developed to become the greatest foreign exchange earner of the country. The new airports will contribute to overcome the main obstacle for future economic development provision improved accessibilities. Therefore the positive impacts will be complex and nationwide. The most important positive impacts are socioeconomic and spatial development effects.

267. The establishment of airports is expected to create scores of new jobs, which will add to the locally growing demand for housing, shopping and other commercial activities in Bumthang, Yongphula and Gelephu areas. Thus the new airport is expected to contribute considerably to future economic growth and public welfare.

#### **2. Negative Impact**

##### ***a) Impacts on Traffic Volumes, Patterns and Safety***

268. Looking at the geographical location of the domestic airports with existing commercial, residential and tourist centres in Bumthang and Trashigang, it becomes obvious that most of the users of the new airport will use the narrow access road to the airports. There will be congestion and traffic safety problem as a result of increased traffic. This effect will be temporary and can be mitigated with improvement of access roads.

269. The expected local and regional development and growth together with growing traffic volumes and changes of traffic patterns will not only have spatial planning implications but also increase the demand for the provision of upgraded and / or technical, transport and social infrastructure. Therefore, the DCA along with the respective Dzongkhags, Geogs and municipal administrations will come up with development or zoning plans in the immediate vicinity of the airports. These plans shall be in line with the overall national plan so that they are holistic in nature contributing to socio-economic wellbeing and happiness of the people.

***b) Impact of Tourism***

270. It is assumed that the new domestic airports will generally give further impetus to the development of the tourism sector of the country. The related infrastructure development is expected to follow in the central, southern and eastern region of the country. The development of tourism and related infrastructures will bring in unplanned development, encroachment into sensitive or critical wildlife areas and social and cultural erosion. However, by following the principle of low volume and value tourism policy, the impact of tourism will be minimal and manageable. In fact, responsibly managed tourism will have positive impact on the environment.

***c) Impact on Real Estate***

271. The public sector infrastructure projects as mentioned earlier and resulting induced development will generally result in increased pressure for new land to be developed in the central, southern and eastern regions of the country. In the medium to longer term expanded economic activities will create substantial demands for the full range of public and private services and especially for land to be developed with housing, work places, commercial establishments, schools, parks etc.

272. The demand is likely to rise in the near future and the scale and pace of demand for new development is expected to accelerate as the Project takes shape. As the value of the land in that part of the country will increase, speculations will inevitably occur and induce conflicting and most likely unsustainable demands. The signs of such demands for new development have already been observed during the public consultations at all three domestic airport sites.

## VIII. PUBLIC CONSULTATION, DISCLOSURE AND GRIEVANCE MECHANISM

### A. Stakeholder Analysis

273. Stakeholders include institutions and cohorts of individuals affected either beneficially or adversely, directly or indirectly, by the Project. Those affected adversely are commonly referred to as Affected Persons (APs). APs may experience environmental impact or be entitled to compensation due to land taken or property lost. Their number is certainly less than that comprising the group of beneficially affected given the nature of the project and the project proponent, a national agency following a national transport development plan.

274. Local stakeholders are cohorts of individuals inhabiting the directly linked or affected geogs of Choekhor of Bumthang, Kanglung geog of Trashigang and Bhur and Gelephu geogs under Sarpang. Those adversely affected by environmental impact include those directly exposed to construction impacts due to their proximity to the airports, those entitled to compensation for structures and land for constructions, those along haul routes of construction materials, and those who may be affected by long term impacts stemming from the airports during its operation. Stakeholders benefiting from the Project include virtually all groups which are engaged in economic pursuits in the area, whether it be sell of handicraft products, sourcing of resources and raw materials, sale of products in an expanded market or the purchase of those goods. Local government benefits through closer ties with national agencies.

275. The list of local stakeholder groups thus is comprised of a) those directly affected by adverse environmental impact during construction, b) those entitled to compensation due to relocation of buildings and taking of land, c) those indirectly affected over the long term due to various forms of cumulative impact, d) a variety of identifiable groups (farmers, suppliers, etc.) that benefit from the economy associated with air transport, and e) local government administrators. Women also form an identifiable stakeholder group as they may be adversely affected during construction. For example; women and children of Bathpalathang, Kharsum, Tamzhing and Tekarzhong in the vicinity of Bumthang Airprot are particularly affected due to demolition of suspension bridge to make way for the airport. The demolition of suspension bridge has increased walking duration of women and children to schools and health centres by almost 2 hours.

276. National stakeholders include groups making up the citizenry of the Nation and the various groups within the Royal Government of Bhutan. List of officials consulted for this study is attached as **Appendix D, section 4 other key stakeholders consulted**. Benefits for groups at regional and national levels stem from increasing connectivity for transfer of goods and services in both private and public sectors and improved governance including better resource management.

### B. Process of Involvement of Public

#### 1. Early Screening

277. The project conforms to the Civil Aviation Master Plan and Bhutan Transport 2040 Integrated Strategic Vision Plan that prioritizes development of domestic airports. Both these documents were reviewed and approved by government stakeholders, indicating broad consensus in the RGoB for the proposed airports. The structure of government assures that local community representatives are aware of master plans that include the proposed airports.

## 2. Public Consultation

278. The Department of Civil Aviation (DCA) on behalf of the Consultant wrote official letters to the Dzongkhag (District) and Dungkhag (sub-District) administrations to inform the public living in the study area of the proposed airport development projects. The Dzongkhags and Dungkhags in turn informed the public through Geog administrations. Affected Dzongkhag of Bumthang, Tashigang and Sarpang was informed of the impending environmental and socio-economic assessment studies through this process. The IEE and Social/Resettlement Assessment team jointly conducted public consultation according to a prescribed format and in accordance with the following objectives:

- To inform the public and present details regarding the proposed project, its design and anticipated function (the reason it is being built), steps to implement the and timeframe
- To ask local residents about their air transport needs (both short term and long term)
- To explore whether or not the proposed project is consistent with their needs and goals

279. Participants were specifically asked their views on issues related to the ongoing airport development works, beneficiary and affected groups, impacts of the airport development works due to existing conditions and expected impacts from proposed rehabilitation measures, priorities for transport, environmental issues, community participation and women's issues.

**Table VIII-1: Location, Attendance and Timing of Public Consultations**

Airport Name	Location	Attendance	Time and Dates
Bumthang (Bathpalathang)	At Tamzhing Non-Formal Education center	8 male 23 female Total = 31	Time: 9.00am Date:27/7/2011
	At Wangdicholing (Palace of His Majesty Jigme Wangchuck, the second Hereditary Monarch of Bhutan	9 male 33 female Total = 42	Time: 12.30pm Date:28/7/2011
Yongphula (Trashigang)	Yongphula Airport	17 male 15 female Total = 32	Time: 10.30am Date:10/8/2011
Gelephu (Sarpang)	Geog Assembly Hall, Bhur Geog Office	93 male 35 female Total 128	Time: 10.00am Date:20/8/2011
	Geog Office, Gelephu Geog	34 male 12 female Total = 46	Time: 2.45pm Date:20/8/2011

## C. Summary of Public Acceptance and Opinion

280. The main purpose of the consultation was to present the proposed project, illicit issues and concerns that the people in the impact area may have relevant to the proposed development and discuss the environmental requirement for projects of this type. The major issues raised were mostly related to the government financed activities. Summary of discussions are provided in the following sections:

### ***Bumthang Airport:***

281. River training works: People of Wangdicholing and Dekiling expressed inadequacy of the ongoing river training or river bank protection works both in terms of length and height of the structure on their side to protect their agriculture land. Volume and flow speed of the river has been changed due to river diversion works carried out during the construction of the airport.



282. Pedestrian Bridge: The pedestrian bridge connecting Wangdicholing and Bathpalathang was demolished for aircraft flight and landing safety requirement. This has affected school children and villagers alike with the requirement of extra walking time of 2 hours to reach schools, district administration office and the hospital. In this regard, the residents of Tamzhing, Kharsum, Konchosum, Bathpalathang and Tekarzhong requested the restoration of pedestrian bridge as soon as possible.

283. Local sand and stone quarry located between Chamkhar Bridge and the Bumthang airport: People were concerned whether they will be permitted to collect sand and stones for their domestic consumption from the quarry located in between southern end of airport and above the Chamkhar Chhu Bridge. If the quarrying is not allowed then there will be shortage construction materials for the localities.

**Figure VIII-1: Public Consultation at Tamzhing, Bumthang**



**Figure VIII-2: Public Consultation at Wangdicholing, Bumthang**



### ***Yongphula Airport:***

284. Relocation of Stupa/Chorten: People of Yongphula requested that the demolition of chorten located near the airport be avoided as far as possible. Chorten is considered as an important religious and cultural heritage built by Lam Karpo at the behest of the great Buddhist Master, Late Dudjom Rimpoche. If the demolition is unavoidable then proper consultation has to be carried out particularly with Yongphula Monastic community headed by Lam Jigme Tenzin.

285. Storm Water Drainage: People were concerned about the storm water from the runway drained towards the settlements of Yongphula. In the past the storm water runoff particularly during the monsoon has severely affected the settlement due to erosion and landslide. People mentioned that the impact of concentrated storm water can be seen all the way to the bridge site at Bodidrang between Kanglung – Rongthong on Samdrup Jongkhar -Trashigang Highway. To lessen the further impact in future due to the storm water from the improved airport, people requested to redesign the storm water drain in such a way that the storm water is evenly spread out on the both side of the airport.

286. Foot Path: Part of Yongphula airfield has been used by the people of Uzorong village to travel to and from Yongphula commercial centre for many years. On consultation, people of Uzorong requested for alternative foot path from the east that is along the outside the boundary of the airport. Without the alternative footpath people will have to take lengthy detour (approximately more than 1 hour extra walk) to reach the commercial centre.

287. Water Supply: Water supply line and the tank fall inside the airport boundary. The water supply scheme in the area benefits about 70 households. If the water supply line and tank are demolished or relocated, it would affect the water supply and cause inconveniences to the local communities. Therefore, the communities requested for the protection of their water supply as there is no other alternative water source in the area.

**Figure VIII-3: Public Consultation at Yongphula**



**Figure VIII-4: Public consultation at Yongphula**



### ***Gelephu Airport:***

288. Land substitution: All the APs whose land and structures got affected were given substitute land just outside the air strip boundary. This was done to provide the APs with basic amenities such as Water supply and Electricity. The Affected persons are happy with this arrangement as currently the APs have been facing problems with water and electricity.

289. Guidelines on construction of Structures: During public consultations, people have raised construction issues surrounding the airport boundary. They need guidelines or building codes (the type and height of structures that people can construct, the distance to be maintained from the Air strip boundary etc) for construction of structures around the airport.

**Figure VIII-5: Public consultation at Bhur, Sarpang**



**Figure VIII-6: Public consultation at Gelephu**



## **D. Information Disclosure**

290. During the public consultation, the description of the project attributes in the local context provided to members of the public that attended consultation. It was noted that the future

airports expansion project is being funded by the ADB. The meetings were held in conjunction with field surveys. Specific aspects were described of the RGoB policy on resettlement and compensations for lost land and assets.

291. The IEE report will be sent to the respective dzongkhags and dungkhags for further disclosure among project affected persons. The comments and suggestions received henceforth will be incorporated during the detailed design stage.

292. Furthermore, ADB's Safeguard Policy Statement 2009 and the Public Communications Policy Review 2011 require the IEE report prepared be reviewed by the ADB and disclose that same on its website for wider public dissemination.

## **E. Further Public Involvement and Grievance Mechanism**

### **1. Mechanisms for resolution of conflicts and appeals procedures**

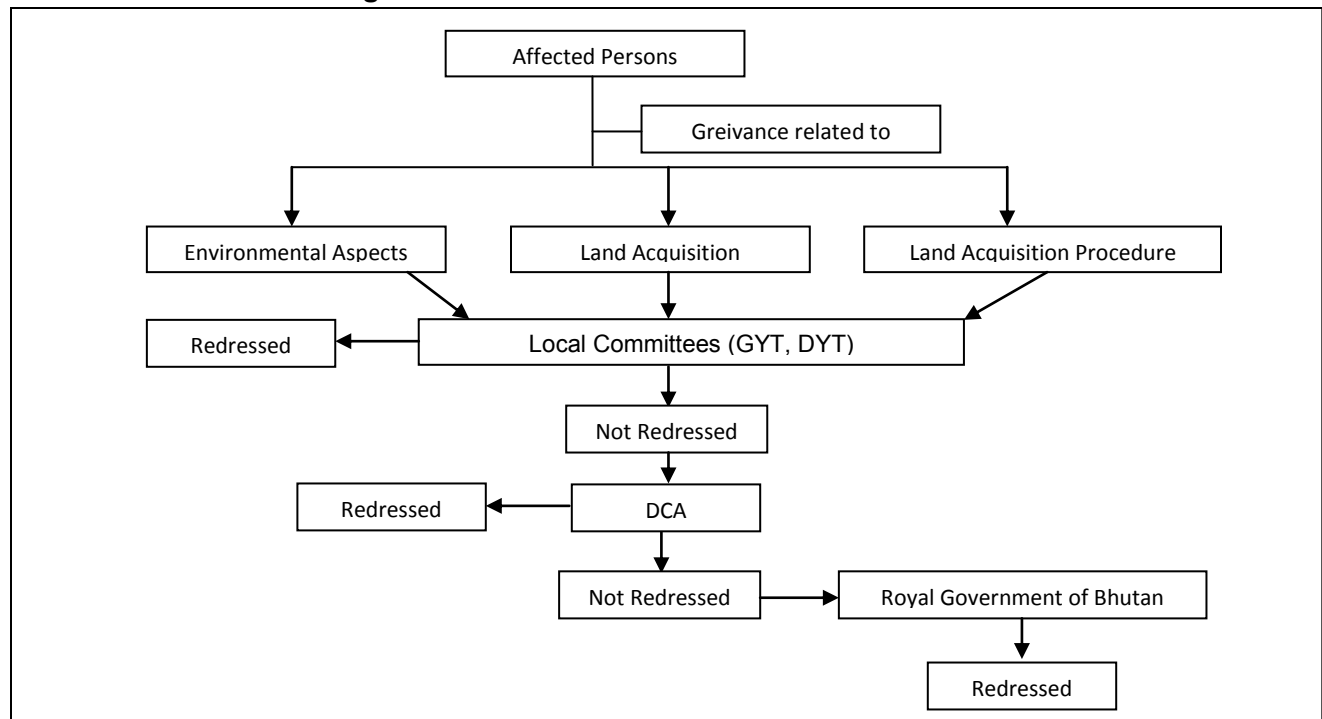
293. The Project will be implemented through participatory<sup>21</sup> approach involving local communities and local government organisation such as Geog Yargay Tshogchung (GYT) and Dzongkhag Yargay Tshogdu (DYT). Through this participatory process acceptance of the Project will be enhanced and complaints reduced. Nevertheless, during the process project implementation, there will be issues that individuals or groups who feel that they are not given adequate attention, or the issues are not properly addressed. Therefore, in this light, project will establish a Grievance Redress process in the existing mechanism of local committees (Geog Yargay Tshogchung, Dzongkhag Yargay Tshogdu), and the Dzongkhag/Dungkhag which will hear complaints and facilitate in providing solutions. If the issue is not resolved, the individual/group may approach DCA and if the issue remains unresolved, people would have the right to approach RGOB as per traditional practices.

### **2. Procedures and Time Frame for Grievance Redressal**

294. The detailed procedures for redressing grievances will be established for the project in order to create avenues for APs to express their grievances related to environment, land acquisitions and resettlements. **Figure VIII-7** shows the grievance redressal procedures:

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<sup>21</sup> The rural communities in Bhutan are organised into *geog* (block) development groups for discussion and self-help. All households are required to be at the meetings that will be called by the *Gup* (Head of the block). In this context, the planning process is essentially participatory with priorities and needs identified by communities and passed through the "*Geog Yargay Tshogchung*" (Block Development Committees) to the "*Dzongkhag Yargay Tshogdu*" (District Development Committees) and then to the *Dzongkhag* (District Administration) and Royal Government.

**Figure VIII-7: Grievance Redressal Process**

- **Step 1:** If any aspects of the grievances related to environment, land acquisition and resettlements that aggrieve any AP, he/she can lodge a written grievance to the grievance redress committee. In the case of land acquisition related grievances the written grievance should be forwarded to the grievance redress committee within 15 days from the date of receiving the notification of compensation and rehabilitation. The committee must respond within 15 days.
- **Step 2:** If the person making the complaint is not satisfied with the decision or he/she receives no response within 15 days of registering the grievance, he/she can approach the DCA and finally, can appeal to the Royal Government of Bhutan or His Majesty the King.

## IX. ENVIRONMENTAL MANAGEMENT PLAN

295. The primary focus of the EMP is mitigation of environmental impacts occurring in the natural and social environment. The EMP consists of the following parts: (i) acquisition of prior clearances and no-objection certificates, (ii) a listing of environmental impacts and mitigation measures, responsibilities and their estimated costs; (iii) the environmental monitoring program for construction and operation periods; and (iv) the implementation framework of institutional and job responsibilities for mitigation and monitoring.

296. Mitigation measures that are the responsibility of the construction contractor have to be included in the construction tender documents. The EMP is a draft document that will be revised during the preparation of grant project implementation according to preferred practice by the Asian Development Bank.

### A. Acquisition of Prior Clearances and No-objection Certificates

297. Table IX-1 summarizes the status of clearances and no-objection certificates that are already obtained or are likely necessary for implementation of the construction works.

**Table IX-1: Status of Clearance and No-objection Certificates**

Agency or Group	Purpose and Status	Responsible Party	Timeframe
National Environment Commission	Environmental clearance required for airport upgradation and expansion works. Status: Update of existing application needs to be prepared during pre-construction stage.	DCA	Prior to construction
Dzongkhag	Administrative approval Status: Some have been obtained; others are pending	DCA	Prior to construction
DFPS	Removal of trees in airports Status: not yet obtained	DCA	Prior to construction
Department of Culture	Location near cultural and religious sites Status: locations to be identified in detailed design	DCA supported by DC	Prior to construction
Private property or land owners	Written clearances obtained and private land donated by the communities	DCA GA & DA	Prior to construction
Department of Health	Within 50m of hospital Status: locations to be identified in detailed design	DCA	Prior to construction
Department of Education	Within 50m of school Status: locations to be identified in detailed design	DCA	Prior to construction
BPCL	Relocation of power transmission line Status: locations to be identified in detailed design	DCA	Prior to construction
Department of Roads	Access from highways and feeder roads Status: locations to be identified in detailed design	DCA	Prior to construction

### B. Mitigation Measures

#### 1. Summary of Specific Impacts and Mitigation

298. Table IX-2 summarizes the environmental impacts and proposed mitigation measures, along with their locations, that were identified in Chapter IV. The table also prescribes implementation and monitoring responsibilities for the following groups: the design consultant (DC) and the construction contractor (CC); the Department of Civil Aviation (DCA), other national institutional authorities (identified by their common acronyms); and local authorities, Geog Administration (GA) or Dzongkhag administrations (DA). Implementation and monitoring responsibilities for a particular mitigation may be shared among these units.

Table IX-2: Summary of Environmental Impacts and Mitigation Measures

<u>S.N</u> <u>o</u>	<u>Action</u>	<u>Possible Effects</u>	<u>Mitigation Measures</u>	<u>Location</u>	<u>Institution</u> <u>Responsibility</u>	<u>Cost</u>
<b><u>PRE-CONSTRUCTION PHASE</u></b>						
1.	Slope Erosion	<p>The main embankment of the runway strip of Bumthang is located parallel to Chamkhar Chhu River with possible slope and bank erosion during runway extension works.</p> <p>Gelephu runway is built on the flat terrain with slope erosion problem.</p> <p>However, the Yongphula airport is built on the ridge top. There will be slope erosion problem as a result of earthworks for runway extension and access road constructions particularly during monsoon.</p>	Potential slope erosion will be mitigated by designing slope erosion controls such as benching, retaining and breast walls, and bioengineering (plantation of locally available plant species) for Bumthang and Yongphula airports.	Design Office, DCA	Design Consultant (DC), DCA	Design contract
<b><u>CONSTRUCTION PHASE</u></b>						
2.	Construction material and its transportation	<p>Mining and transportation of construction materials from quarry to the construction sites causes following environmental effects:</p> <ul style="list-style-type: none"> <li>• Soil erosion and siltation of streams and rivers</li> <li>• Loss of forest cover and wildlife habitats</li> <li>• Haulage of construction materials from the quarry till the construction causes air pollution due to dust and vehicular emissions.</li> </ul>	<ul style="list-style-type: none"> <li>• Environmental friendly quarrying to be carried out through benching and controlled blasting will be implemented.</li> <li>• Topsoil to be collected and used for bioengineering by planting local or native plant species</li> <li>• Only required forest or vegetation clearance will be carried out.</li> <li>• For Bumthang native plants such as local bamboos (Yushinia spp.) and salix (shrub species) are suitable while for Yongphula plantation of Artemisia and Berberis spp.</li> <li>• Regular maintenance of transport vehicles has to be carried out to reduce the exhaust fume pollution.</li> <li>• Construction materials have to be covered during</li> </ul>	<ul style="list-style-type: none"> <li>• Gathak Quarry – 32km from Bumthang airport</li> <li>• Maokhola river side surface stone and sand collection</li> </ul>	Construction Contractor (CC), DCA and DOFPS	Cost to be borne by the mining agent.

<u>S.No</u>	<u>Action</u>	<u>Possible Effects</u>	<u>Mitigation Measures</u>	<u>Location</u>	<u>Institution Responsibility</u>	<u>Cost</u>
			transportation to minimize dust pollution.			
3.	<p>Excavation, filling, leveling works of runway extension and access road constructions</p> <ul style="list-style-type: none"> <li>Excavation, filling, and leveling works for Bumthang and Yongphula airports are complete under RGOB funding project.</li> <li>For Gelephu airport, the excavation, filling and leveling works are underway and will be the major one till the project is over.</li> </ul>	<p>Almost all the excavated materials will be used for filling and leveling works. Only small amount of excavated material may remain to be disposed. Impact on soil owing to the construction activity includes erosion of top soil, loosening of soil compaction material, dust pollution and siltation of river and streams. However, the impacts will be significant if proper mitigation measures are not employed.</p>	<p>An effective plan for both structural and nonstructural controls will help in restricting soil erosion on construction site. Erosion controls can directly reduce the amount of sediment transported off-site, thereby reducing the need for sediment controls. Some of the structural and non-structural controls that can be adopted are as follows:</p> <p>Structural controls include:</p> <ul style="list-style-type: none"> <li>Bioengineering of exposed slopes;</li> <li>Construction of strong and effective boulders and log barriers will be erected particularly for Yongphula disposal sites.</li> <li>Construction of sediment basins, which allow sediment to settle out of the urban runoff.</li> </ul> <p>Nonstructural erosion controls include:</p> <ul style="list-style-type: none"> <li>Planning and designing the development within the natural constraints of the site;</li> <li>Minimizing the area of bare soil exposed at one time (phased grading);</li> <li>Planning for stage construction; and</li> <li>Avoiding the unnecessary clearing of the</li> </ul>	Construction zone of all three airports: Bumthang, Gelephu and Yongphula	CC, DCA	Cost will be included in the construction contract

<u>S.No</u>	<u>Action</u>	<u>Possible Effects</u>	<u>Mitigation Measures</u>	<u>Location</u>	<u>Institution Responsibility</u>	<u>Cost</u>
			<p>vegetation, that is not required at all.</p> <p>In addition to the above measures, material stockpiles, borrow areas, access roads and other land-disturbing activities will be located away from critical areas such as steep slopes, highly erodible soils and other susceptible areas prone to soil erosion. The top soils, which are removed by the clearing activity during construction, will be stockpiled and then reapplied to the site for bioengineering purposes. Dust pollution will be controlled by sprinkling water on exposed at least twice a day</p>			
4.	Waste Disposal	<p>The construction wastes generated are likely to cause negative environmental impacts during its storage, transportation and disposal. The wastes include the following:</p> <ul style="list-style-type: none"> <li>• Site clearance residue of the existing structures (construction and demolition waste materials from the demolition of existing houses and sheds within Bumthang and Gelephu Airport) including excavated materials will cause land and air pollution</li> <li>• Chemical waste material from washing of equipment and vehicle carrying construction material will cause soil and water pollution</li> <li>• Workers engaged during construction phase will generate municipal solid wastes such as food wastes; packaging and wastepaper will cause land and water pollution if not disposed properly.</li> </ul>	<p>In general waste will be managed by reduction of waste generation at source, re-use and recycling. However, the specific mitigation measures are proposed to alleviate the impacts caused by the construction, excavated materials, chemical and municipal solid wastes:</p> <ul style="list-style-type: none"> <li>• Construction and demolition waste materials from existing structures will be segregated so that waste materials could be re-used. For example, waste timber could be reused for construction of temporary labour camps. Concrete waste could be used filling and leveling the ground during construction of access roads.</li> <li>• Excavated material will be stockpiled safely away from the streams and river beds to prevent soil erosion and ultimate water pollution. As much as possible excavated materials will be re-used for filling. It is possible to do in Bumthang and Gelephu airport due to existence of relatively flat topography with gentle undulations.</li> <li>• Chemical waste from the machineries will be collected and stored properly. Spent engine oil from the equipments will be sent to India for recycling and re-use.</li> </ul>	Construction zone of all three airports: Bumthang, Gelephu and Yongphula	CC	Cost will be included in the construction contract



<u>S.N</u> <u>o</u>	<u>Action</u>	<u>Possible Effects</u>	<u>Mitigation Measures</u>	<u>Location</u>	<u>Institution</u> <u>Responsibility</u>	<u>Cost</u>
			<ul style="list-style-type: none"> <li>The contractor will provide rubbish or dustbin to temporarily store the municipal wastes (or solid waste). The municipal waste will be transported and dumped at the municipal disposal site. Since there is no municipal disposal site at Yongphula, the contractor will incinerate the non-biodegradable waste.</li> </ul>			
5.	Water Environment (Surface water resources)	<p>During construction surface water resources may be affected by accidental spillage of hazardous substances into a river or streams or by inappropriate management practices.</p> <p>Construction of the river/stream protection works are another potentially critical issue for both Gelephu and Bumthang airport. Water pollution may arise due to the construction of river/stream bank protect works.</p> <p>Similarly, construction works have direct impact on the quality of water in a small pond or lake north-west of the airport as one of the storm water drainage terminates towards the small pond causing the siltation of the pond.</p> <p>Since the construction of Yongphula airport in 1960s and subsequent construction of storm water drainages; the settlements of Yongphula and part of Kanglung has been severely affected due to concentrated stormwater flow which has caused gullying, erosion and even landslides downstreams. This issue was raised by the people of Yongphula during public consultation meeting. They mentioned that all the stormwater from the Yongphula airport has been diverted towards the Yongphula settlement side</p>	<ul style="list-style-type: none"> <li>Discharge of sediment laden construction water (e.g. from areas containing dredged spoil or pumped water from foundations) directly into surface water courses will be forbidden. The sediment laden construction water will be discharged into settling ponds or tanks prior to final discharge. This applies particularly to the Bumthang airport construction works along the river banks. Application of the measure for Gelephu airport stands true only during wet season.</li> <li>Carry out water quality monitoring on the Chamkhar Chhu River, Bumthang and Lake near Yongphula airport. Pre-construction data baseline water quality data (<b>Table IV-6</b>) will be the reference to assess potential subsequent impact of construction or future operation on the local water resources.</li> <li>Washing of vehicles or any construction equipment in the Chamkhar Chhu River or any other stream shall be strictly forbidden. The airport authorities in future shall install the waste water treatment plant particularly for Bumthang Airport to prevent the waste water from entering the river directly. The guiding principle of these operations shall be to prevent any surface water pollution at source;</li> <li>Dumping of construction waste into storm water drainage will be avoided to minimize the siltation of Lake near Yongphula airport.</li> <li>Stormwater will be equally diverted towards the western side of runway to reduce the volume of the</li> </ul>	Construction zone of all three airports: Bumthang, Gelephu and Yongphula	CC	Cost will be included in the construction contract

<u>S.No</u>	<u>Action</u>	<u>Possible Effects</u>	<u>Mitigation Measures</u>	<u>Location</u>	<u>Institution Responsibility</u>	<u>Cost</u>
		causing all the erosion problems. It was requested that stormwater from the airfield be diverted equally on bothsides of the airfield to reduce volume of stormwater and its destructive power.	flow and further erosion downstream			
6.	Air environment	<p>During earthwork there will be a temporary adverse impact on air quality in terms of increased dust suspension and gaseous emissions from the movement of heavy machinery and equipment. Dust pollution would be serious issue during construction activities.</p> <p>Dust will inevitably occur at and inside the construction corridor throughout that period. During the final stage of construction dust will also be generated alongside the haul route (Gathak Quarry to Bumthang Airport site and Maokhola to Gelephu airport site) from the quarries from where aggregate for the upper layer of the runway will be obtained. In addition dust will be a health and safety issue for the workforce at the site.</p>	<p>The level and significance of dust generation and nuisance can be effectively mitigated through:</p> <ul style="list-style-type: none"> <li>Regular spraying the work area; covering trucks where the haulage of material involves transport on public roads; timely and regular cleaning of public roads as required. Water for this measure for Bumthang airport construction will be used from Chamkhar Chhu. For Yongphula and Gelephu, since there is no sufficient water nearby the construction sites, the water has to be transported using tankers.</li> <li>The absolute level of construction-related ambient air pollution can be minimized by proper site management and construction organisation by good maintenance of the vehicle fleet and by immediately excluding over-aged or worn out vehicles and machinery from the construction site.</li> <li>The operation of the asphalt plant is a potential source of harmful emissions, which may affect the human and the natural environment and the health of the workforce. The site of the asphalt plant will be at a minimum distance of 100 m from any watercourse or settlement.</li> <li>In addition air quality will be monitored throughout construction phase. Parameters to be measured are dust, PM10 (Suspended particulate), smoke of asphalt plant, Nox and Sox (as indicated in the <b>Table IV-3</b>).</li> </ul>	Construction zone of all three airports: Bumthang, Gelephu and Yongphula	CC	Cost will be included in the construction contract
7.	Noise Environment	During construction noise will occur at and around the construction sites from the	<ul style="list-style-type: none"> <li>Strictly limiting the working hours to weekdays and to the relatively least sensitive daytime periods.</li> </ul>	Construction zone of all	CC	Cost will be included in

<u>S.No</u>	<u>Action</u>	<u>Possible Effects</u>	<u>Mitigation Measures</u>	<u>Location</u>	<u>Institution Responsibility</u>	<u>Cost</u>
		<p>operation of heavy site equipment and construction vehicles. The impact will be temporary and local and generally decrease with the distance from the source. The settlements that will most likely be temporarily affected by construction noise are parts of Bathpalathang and Wangdicholing for Bumthang airport construction site. For Gelephu and Yongphula airport, noise pollution will not be of serious issue as the settlements are quite at a sufficient distance from the construction sites.</p> <p>Workers exposed to construction noise are further sensitive receptors. The level of noise exposure and associated risks for the health and well being of the workforce depends on the individual work place and type of equipment used.</p>	<ul style="list-style-type: none"> <li>The potential negative impact of construction noise on the workforce should be generally mitigated by providing the workforce with appropriate noise protection gear such as ear plugs and by using construction equipments that produces less noise.</li> </ul>	three airports: Bumthang, Gelephu and Yongphula		the construction contract

<b><u>S.N</u></b> <b><u>o</u></b>	<b><u>Action</u></b>	<b><u>Possible Effects</u></b>	<b><u>Mitigation Measures</u></b>	<b><u>Location</u></b>	<b><u>Institution</u></b> <b><u>Responsibility</u></b>	<b><u>Cost</u></b>
8.	Site Clearance including vegetation removal	As of August 2011, about 1500 trees have been felled for Gelephu airport construction. Similarly, Bumthang and Yongphula airport upgradation works such as construction of access roads in future will require approximately about 340 and 140 trees respectively to be felled.	<ul style="list-style-type: none"> <li>• Right-of-ways should be clearly marked to avoid removal of vegetation unnecessarily.</li> <li>• Necessary actions such as tree marking must be carried out in accordance with the forestry rules before felling of trees for the project roads. All paperwork and approvals must be obtained well ahead in time to prevent delays in construction.</li> <li>• The DFPS will prepare a survey and inventory of the commercial timber present on public lands prior to construction of any given airports, in accordance with the official procedures of the DFPS as contained in the Forest and Nature Conservation Rules (FNCR 2006). Natural Resources Development Corporation Limited (NRDCL) will be authorized to market the timbers with commercial value.</li> <li>• Compensatory plantation (of 1:5) will be carried out for trees lost for the construction of three airports. The compensatory plantation is proposed to be carried out under the banner of the Greenbelt Development Plan. The Greenbelt Development Plan will be developed during the detailed design phase.</li> </ul>	Construction zone of all three airports: Bumthang, Gelephu and Yongphula	DFPS, DCA and CC	Cost will be included in the construction contract
9.	Wildlife Habitat	The implementation of the Project (RGOB funded component) has resulted in loss wildlife habitat comprising pastures; agricultural fields; forests; shrubs; riparian vegetation and government reserved forests.	<ul style="list-style-type: none"> <li>• The construction activities will be carried out only during day time.</li> <li>• The Master Plan or zoning plans may determine the protection or development of some areas with significance or potential for wildlife protection, e.g. alongside the Chamkhar Chhu River in Bumthang and Forest areas in the vicinity Gelephu airport areas.</li> <li>• Greenbelt development programme with a compensatory plantation (of 1:5) will replace to some extent the lost wildlife habitat. The Greenbelt Development Plan will be developed during the detailed design phase. However, the main purpose</li> </ul>	Construction zone of all three airports: Bumthang, Gelephu and Yongphula	DFPS, DCA, DC and CC	-

<b><u>S.No</u></b>	<b><u>Action</u></b>	<b><u>Possible Effects</u></b>	<b><u>Mitigation Measures</u></b>	<b><u>Location</u></b>	<b><u>Institution Responsibility</u></b>	<b><u>Cost</u></b>
			of greenbelt is shield the noise and air pollution from spreading unabated out of airport sites.			
10.	Community Structures	<ul style="list-style-type: none"> <li>Community suspension bridge at Bathpalathang has been demolished which has affected the people of Bathpalathang, Tamzhing, Konchosum, Kharsum and Tekarzhong settlements. The demolition of the bridge has resulted in extra walking time for people particularly for school going children who have to walk at least one-two hours extra.</li> <li>People of Yongphula and upper Uzorong were using part of the airport to commute between to and fro. The footpath is particularly important for people of Uzorong as it serves as the trade route to sell their produce. By stopping the current footpath will force people to take detour which will require more one hour additional walk time. This will have severe impact on poor people who depend on this route.</li> <li>The rural water supply scheme (RWSS) with its pipeline and the storage tank catering about 70 households of Yongphula community within the airport boundary. Therefore, future airport upgradation works may disrupt the community water supply and may cause severe water supply shortage in the area. Drinking water resources is scarce in the area.</li> </ul>	<ul style="list-style-type: none"> <li>In order to reduce impacts of demolition of Suspension bridge, the new one is being proposed to be built by the Chhoechor geog administration to north of Bumthang airfield.</li> <li>Alternative footpath will be constructed along the eastern perimeter of the Yongphula airport boundary to mitigate the closure of the existing walkway (which used the part of the existing airfield).</li> <li>Any future airport upgradation and expansion works will consider the importance of the community water supply system within airport boundary. The community will be consulted if the shifting water supply line and tanks are to be carried out.</li> </ul>	Chhoechor geog, Bumthang  Yongphula Airport	DA, GA, DCA, and CC	<p>RGOB will bear the cost of relocation and reconstruction of the suspension bridge.</p> <p>For footpath development cost will be included in the construction contract package</p>
11.	Health and Safety of Construction workers	During construction the health and safety of the workforce is at risk due to an accident-prone working environment, long shifts and through accommodation at a	<ul style="list-style-type: none"> <li>The construction workers will be provided with adequate and appropriate shelters which are wind and rainproof.</li> <li>Access to healthcare will be ensured with provision</li> </ul>	At all three airport construction sites	DCA, CC, and MOH	The HIV/AIDS awareness services may be rendered

<u>S.No</u>	<u>Action</u>	<u>Possible Effects</u>	<u>Mitigation Measures</u>	<u>Location</u>	<u>Institution Responsibility</u>	<u>Cost</u>
		campsite. To minimise the risks associated to these framework conditions DCA will be responsible to ensure that adequate health care arrangements will be available at the site throughout the construction period.	<p>of first aid at the work sites. And in the event of major accidents emergency services of the district hospitals of Bumthang, Trashigang and Gelephu will be availed.</p> <ul style="list-style-type: none"> <li>• Adequate water supply, pit toilets and solid waste disposal sites have to provided</li> <li>• Monitoring of the sanitary conditions within the worker's camps is the responsibility of the DCA, who would regularly carry out surprise checks to inspect the camps.</li> <li>• To minimize the risk of new infections and the spread of HIV/AIDS/STI a specific tailor-made campaign should be carried out under the Project. This would comprise of conducting HIV/AIDS/STI sensitisation sessions at the campsite including the distribution of information materials / brochures at the camp.</li> </ul>	(Bumthang, Yongphula, Gelephu)		in the framework of the national AIDS/STI Prevention Programme established under the MOH and would thus be free of cost.
12.	Religious, Historical, cultural and Archeological Sites	At Yongphula airport construction site, an important Chorten/Stupa built in 1959 by Lam Karpo at the behest of Late Buddhist Master Dudjom Rimpoche, will have to be demolished during airport extension. The stupa was built for the wellbeing sentient beings and it is revered by the locals. The demolition of chorten would result in loss of important local religious or cultural assets.	<p>As far as possible, the destruction and demolition of important religious and cultural asset like important chorten at Yongphula airport will be avoided.</p> <p>However, if it is unavoidable, then prior to the demolition of chorten, a thorough public consultation with the local community (particularly with monastic community headed Lam Jigme Tenzin), Kanglung Geog Administration and Trashigang Dzongkhag will be carried out during the detailed design stage. The demolition and relocation issues will be jointly decided. Based on consensus the relocation of the chorten will be carried out with the assistance of the project.</p>	Yongphula Airport	DCA, DC, DA and GA	Cost of relocation of the chorten would be determined during the detailed design
<b><u>OPERATIONAL PHASE</u></b>						
13.	Air Environment	The major air emissions expected during the operation phase of the airport project	The extent of air pollution will be minimal due to limited traffic of both air and vehicular. However,	At all three airport	DCA	-

<u>S.No</u>	<u>Action</u>	<u>Possible Effects</u>	<u>Mitigation Measures</u>	<u>Location</u>	<u>Institution Responsibility</u>	<u>Cost</u>
		will be due to operation of aircrafts and vehicular traffic generated because of airport operations.	<p>following mitigation measure can still be applied:</p> <ul style="list-style-type: none"> <li>• Shut down of aircraft engines to the maximum extent possible during taxiing and idling period.</li> <li>• Allowing aircrafts with ICAO certified engines to land and takeoff, as far possible</li> <li>• Appropriate greenbelt development with thick plantation cover is one of the preferred methods to mitigate air pollution as plant serve as a sink for pollutants and also check flow of dust and also reduce the noise pollution. Greenbelt development plan will be developed during the detailed design phase.</li> </ul>	construction sites (Bumthang, Yongphula, Gelephu)		
14.	Noise Environment	<p>During operation noise associated with an airport can be attributed to a number of sources and activities such as:</p> <ul style="list-style-type: none"> <li>• Aircraft take-offs and landing;</li> <li>• Aircraft over flights of residential neighbourhoods;</li> <li>• Engine run-ups, which are tests performed on aircraft engines and systems after maintenance to ensure that they function safely;</li> <li>• Reverse thrust, which is used to slow down an aircraft when landing on the runway;</li> <li>• General noise from ground services equipment.</li> </ul> <p>Increased level of noise above 60 dB has a major health effects. Elevated noise levels can create stress, increase workplace accident rates, and stimulate aggression and other anti-social behaviors.</p>	<p>The ICAO Balanced Approach concept provides airports with an agreed methodology to be used to address and manage aircraft noise problems in an environmentally responsive and economically responsible way. The Balanced Approach to noise management encompasses four principal elements:</p> <ul style="list-style-type: none"> <li>• Reduction of noise at source;</li> <li>• Land use planning and management;</li> <li>• Noise abatement operational procedures;</li> <li>• Operating restrictions on aircraft.</li> </ul> <p>The DCA will be responsible to actively address these issues in a noise management policy and programme. Under the framework for future effective noise management at all airports and airport authority shall carry out:</p> <ul style="list-style-type: none"> <li>• Airport authority will have a wide range of environmental management tasks, including the preparation and implementation of a noise management programme for the systematic</li> </ul>	At all three airport construction sites (Bumthang, Yongphula, Gelephu)	DCA	-

<b><u>S.N</u></b> <b><u>o</u></b>	<b><u>Action</u></b>	<b><u>Possible Effects</u></b>	<b><u>Mitigation Measures</u></b>	<b><u>Location</u></b>	<b><u>Institution</u></b> <b><u>Responsibility</u></b>	<b><u>Cost</u></b>
		The noise pollution may affect the residents living nearby all three airports (Bumthang, Yongphula and Gelephu)	<p>reduction of operational noise impact of the airport</p> <ul style="list-style-type: none"> <li>Assign a noise study based on ICAO Annex 16 procedures („Aircraft Noise’), which also is a requirement for the later certification of the airport according to the „Manual on Certification of Aerodromes’;</li> <li>By importing aircraft that make less noise such as plane with turbo-fan rather than turbojet.</li> <li>To further reduce effect of noise and vibration, the DCA could implement the noise reduction barrier through plantation of trees (greenbelt) that absorbs the noise.</li> </ul>			
15.	Surface Water	During operation phase, airport activities will produce substantial amount of wastewater. The wastewater if discharged untreated will pollute the surface as well ground water. In Bumthang, wastewater may directly pollute Chamkhar Chhu; at Yongphula, it may pollute the small lake or pond (located in the North West of the airport); and at Gelephu it may pollute to small seasonal streams (dry most part of the year) that intersect the airport.	In general the amount wastewater will be reduced through proper and efficient use of water. Depending on the wastewater generation, the wastewater treatment plant will be installed. The capacity treatment plant and its design will be developed during the detailed design.	At all three airport construction sites (Bumthang, Yongphula, Gelephu)	DCA	Cost of wastewater treatment plants will be determined during detailed designed stage
16.	Safety	<p>Operation of an Airport requires a range of safety measures to be considered in accordance with ICAO standards. In this respect appropriate framework conditions will have to be provided for</p> <ul style="list-style-type: none"> <li>Emergencies;</li> <li>Rescue and fire fighting services;</li> <li>Dangerous cargo; and</li> <li>Bird strike.</li> </ul>	<p>Details of the safety arrangements proposed for domestic are not yet available, but it is evident that the present arrangements of domestic airports would not meet the relevant ICAO standards. To comply with the relevant ICAO safety standards for the operation of an international airport it is thus recommended to</p> <ul style="list-style-type: none"> <li>Establish an emergency (response) plan and take all required decisions in terms of organisation, equipment, staffing, training and operational framework conditions in compliance with ICAO recommendations provided in ICAO Annex 14 (I) to</li> </ul>	At all three airport construction sites (Bumthang, Yongphula, Gelephu)	DCA	-



<u>S.No</u>	<u>Action</u>	<u>Possible Effects</u>	<u>Mitigation Measures</u>	<u>Location</u>	<u>Institution Responsibility</u>	<u>Cost</u>
		To comply with operational safety requirements in accordance with international standards steps and measures will have to be taken in terms of organisation, equipment, staffing, training and operation.	<p>ensure safe airport operations;</p> <ul style="list-style-type: none"> <li>Set up an effective program for the safe transport of dangerous goods in accordance with recommendations provided in ICAO Annex 18;</li> <li>Establish and implement a best practice management plan in accordance with ICAO's revised Standards and Recommended Practices (SARPS) on airport wildlife control of 2003 particularly for prevention of bird strike.</li> </ul>			
17.	Religious, Historical, Cultural and Archeological sites	During operation of Bumthang and Yongphula airports, there will be some impacts due to noise of aircraft landing and takeoff, on the religious and cultural assets located in the vicinity of the airports. For Bumthang; Jakar Dzong, Jampa Lhakhang, Kurje and Tamzhing monasteries while in Yongphula; Shingchen Goenpa, Mongling Goenpa and Yongphula monasteries are expected to be impacted in some way due to noise and vibration as a result of the aircraft operation.	<p>DCA will actively implement effective noise management programme through import of aircraft with less noise, reduction of noise at source and certify airports based on the noise study as per ICAO Annex 16 procedures („Aircraft Noise').</p> <p>To further reduce effect of noise and vibration, the DCA could implement the noise reduction barrier through plantation of trees (as part of the greenbelt development plan) that absorbs the noise. Greenbelt development plan will be developed during the detailed design phase.</p>	At all three airport construction sites (Bumthang, Yongphula,	DCA	-

## **C. Environmental Monitoring and Reporting**

### **1. Introduction**

299. Environmental monitoring is a vital component of any IEE/EMP for development projects. Monitoring helps in signalling potential problems or shortcomings at all project stages and promptly implementing corrective measures. Environmental monitoring will be required for the final detailed design during preconstruction, construction and operational phases of the Project. The main objectives of the proposed environmental monitoring are:

- To support the effective implementation of environmental mitigation measures at all project stages;
- To assess potential changes of environmental conditions during construction and operation: and
- To assess the effectiveness of the proposed mitigation measures
- To warn significant deteriorations in environmental quality or safety for further preventive action.

300. The following sections briefly explain the proposed approach for environmental monitoring during the various Project stages. A matrix with a summary of all monitoring steps and the relevant institutional responsibilities is provided in Table X-3.

### **2. Responsibilities and Necessary Institutional Arrangements**

#### **a) *Department of Civil Aviation (DCA)***

301. To strengthen the institutional capacities of the DCA for EMP implementation and monitoring an overall environmental safeguards coordinator (currently the Joint Director of DCA) has been appointed within DCA. The project coordinators for respective sub-projects (for Bumthang, Yongphula and Gelephu airports) shall be the site level environmental focal persons on behalf of DCA. These site level focal persons will carry out compliance monitoring and subsequent reporting to the Joint Director. The construction supervision consultants team will include an environment specialist who will support DCA on monitoring of EMP implementation by the contractor and provision of technical advice and guidance.

302. The site level environmental focal persons will not only deal with the day to day monitoring of environmental, health and safety aspects, but also act as the liaison body between the DCA, the Construction Contractor (in the following: CC), the construction supervision consultant (CSC) the relevant government institutions and agencies and other stakeholders among the public in case of complaints.

303. The site level environmental focal persons and CSC environment specialist will have the responsibility to

- Provide advice and support to the Construction Contractor (CC) / the CC's 'Nominated Person' (see below) on environmental issues (including reviewing and approving specific working methods / practices with potential for environmental impacts;
- Initiate corrective action where required and issue corrective action request to the CC and approves when completed;
- Review and approve the issues in the monthly Environmental Inspection Checklist;
- Keep his own Environmental File with copies of key correspondence on it;
- Submit annual reports on EMP implementation to Environmental Monitoring In-Charge (the Joint Director)

- Environmental Monitoring In-Charge shall compile the Environmental Monitoring Reports and submit to ADB and other relevant government agencies
- Also regularly inform the public about the progress of construction.

**b) Construction Contractor**

304. The Construction Contractor (CC) will be requested to

- Nominate a staff member („CC’s Nominated Person’) with the overall responsibility to ensure compliance of operations with all relevant national environmental legislation, environmental controls and environmental measures specified in the EMP;
- Submit the various method statements that need to be approved by the DCA’s construction supervision team prior to the beginning of operations;
- Set up an Emergency Response Unit with a minimum of one medical person and a medical emergency service and an ambulance available for the Project workforce.

305. To achieve his task the CC’s Nominated Person (and his representative) will be responsible for community liaison and liaison with Governmental departments and the CSC. The CC’s Nominated Person will also be responsible for maintaining the Project Environmental File which will contain:

- Copies of all weekly Environmental Inspection Checklists;
- A log of Environmental Incidents and Complaints;
- Records of all Corrective Action Requests issues have been resolved.

Table IX-3: Environmental Monitoring Plan

<u>S.No</u>	<u>Action</u>	<u>Mitigation Measures</u>	<u>Method of Monitoring</u>	<u>Location</u>	<u>Frequency</u>	<u>Responsible Party</u>
<b><u>PRE – CONSTRUCTION PHASE</u></b>						
1.	Slope erosion	Potential slope erosion will be mitigated by designing slope erosion controls such as benching, retaining and breast walls, and bioengineering (plantation of locally available plant species) for Bumthang and Yongphula airports.	<ul style="list-style-type: none"> <li>Retaining and breast walls are sufficient quantity and sizes</li> <li>Benching are designed as per the site slope conditions</li> <li>Bioengineering items are appropriately proposed as per site conditions</li> </ul>	Bumthang, Yongphula, Gelephu airports	Once at Detailed Design Phase	DCA, DC
<b><u>CONSTRUCTION PHASE</u></b>						
2.	Construction material and its transportation	<ul style="list-style-type: none"> <li>Environmental friendly quarrying to be carried out through benching and controlled blasting.</li> <li>Topsoil to be collected and used for bioengineering by planting local or native plant species</li> <li>Only required forest or vegetation clearance will be carried out.</li> <li>Regular maintenance of transport vehicles has to be carried out to reduce the exhaust fume pollution.</li> <li>Construction materials will be covered during transportation to minimize dust pollution.</li> </ul>	<ul style="list-style-type: none"> <li>Inspection of quarry site</li> <li>Check haulage route s</li> <li>Interview people living along haulage route</li> </ul>	<ul style="list-style-type: none"> <li>Gathak Quarry – 32km from Bumthang airport</li> <li>Maokhola river side surface stone and sand collection</li> </ul>	Monthly	CSC, NEC and DFPS
3.	Excavation, filling, leveling works of airports constructions <ul style="list-style-type: none"> <li>Excavation, filling, and leveling works for</li> </ul>	An effective plan for both structural and non-structural controls will help in restricting soil erosion on construction site. Erosion controls can directly reduce the amount of sediment transported off-site, thereby reducing the need for sediment controls. Some of the structural and non-structural controls that can be adopted are as follows:	<ul style="list-style-type: none"> <li>Review contractors work plan</li> <li>Inspection of airport construction sites</li> <li>Check if the construction works are carried out in phased manner</li> <li>Review of bioengineering plan and</li> </ul>	Construction zone of all three airports: Bumthang, Gelephu and Yongphula	Monthly	CSC, DCA and NEC

<u>S.No</u>	<u>Action</u>	<u>Mitigation Measures</u>	<u>Method of Monitoring</u>	<u>Location</u>	<u>Frequency</u>	<u>Responsible Party</u>
	<p>Bumthang and Yongphula airports are complete under RGOB funding project.</p> <ul style="list-style-type: none"> <li>For Gelephu airport, the excavation, filling and leveling works are underway and will be the major one till the project is over.</li> </ul>	<p>Structural controls include:</p> <ul style="list-style-type: none"> <li>Bioengineering of exposed slopes;</li> <li>Construction of sediment basins, which allow sediment to settle out of the urban runoff.</li> </ul> <p>Nonstructural erosion controls include:</p> <ul style="list-style-type: none"> <li>Planning and designing the development within the natural constraints of the site;</li> <li>Minimizing the area of bare soil exposed at one time (phased grading);</li> <li>Planning for stage construction; and</li> <li>Avoiding the unnecessary clearing of the vegetation, that is not required at all.</li> </ul> <p>In addition to the above measures, material stockpiles, borrow areas, access roads and other land-disturbing activities will be located away from critical areas such as steep slopes, highly erodible soils and other susceptible areas prone to soil erosion. The top soils, which are removed by the clearing activity during construction, will be stockpiled and then reapplied to the site for bioengineering purposes. Dust pollution will be controlled by sprinkling water on exposed at least twice a day</p>	<p>Inspections at jobsite</p> <ul style="list-style-type: none"> <li>Material stockpiles and access road are located away from the critical areas such as steep slopes, highly erodible and other susceptible areas.</li> </ul>			
4.	Waste Disposal	<p>In general waste will be managed by reduction of waste generation at source, re-use and recycling. However, the specific mitigation measures are proposed to alleviate the impacts caused by the construction, excavated materials, chemical and municipal solid wastes:</p> <ul style="list-style-type: none"> <li>Construction and demolition waste materials from existing structures will be segregated so that waste materials could be re-used. For example, waste timber could be reused for construction of temporary labour camps. Concrete waste could be used filling and leveling the ground during construction of</li> </ul>	<ul style="list-style-type: none"> <li>Review contractors' disposal plan</li> <li>Check the recycling procedures</li> <li>Inspection of storage of hazardous and toxic waste areas</li> <li>Inspection of waste oil trap structures</li> <li>Inspection of temporary solid waste disposal site or structures</li> </ul>	Construction zone of all three airports: Bumthang, Gelephu and Yongphula	<p>Daily</p> <p>Monthly</p>	<p>CC</p> <p>CSC, DCA &amp; NEC</p>

<u>S.No</u>	<u>Action</u>	<u>Mitigation Measures</u>	<u>Method of Monitoring</u>	<u>Location</u>	<u>Frequency</u>	<u>Responsible Party</u>
		<p>access roads.</p> <ul style="list-style-type: none"> <li>Excavated material will be stockpiled safely away from the streams and river beds to prevent soil erosion and ultimate water pollution. As much as possible excavated materials will be re-used for filling. It is possible to do in Bumthang and Gelephu airport due to existence of relatively flat topography with gentle undulations.</li> <li>Chemical waste from the machineries will be collected and stored properly. Spent engine oil from the equipments will be sent to India for recycling and re-use.</li> <li>The contractor will provide rubbish or dustbin to temporarily store the municipal wastes (or solid waste). The municipal waste will be transported and dumped at the municipal disposal site. Since there is no municipal disposal site at Yongphula, the contractor may have to incinerate the non-biodegradable waste.</li> </ul>				
5.	Water Environment (Surface water resources)	<ul style="list-style-type: none"> <li>Discharge of sediment laden construction water (e.g. from areas containing dredged spoil or pumped water from foundations) directly into surface water courses will be forbidden. The sediment laden construction water will be discharged into settling ponds or tanks prior to final discharge. This applies particularly to the Bumthang airport construction works along the river banks.</li> <li>Dumping of construction waste into storm water drainage will be avoided to minimize the siltation of Lake near Yongphula airport.</li> <li>Washing of vehicles or any construction equipment in the Chamkhar Chhu River or any other stream shall be strictly forbidden. The airport authorities in future shall install the waste water treatment plant particularly for Bumthang Airport to prevent the</li> </ul>	<ul style="list-style-type: none"> <li>Inspection of storage of hazardous and toxic waste areas</li> <li>Inspection of waste oil trap structures</li> <li>Pollution load of downstream watercourse</li> <li>Carry out water quality monitoring on the Chamkhar Chhu River, Bumthang and Lake near Yongphula airport. Pre-construction data baseline water quality data (<b>Table V-5</b>) will be the reference to assess potential subsequent impact of construction or future operation on the local water resources.</li> </ul>	Construction zone of all three airports: Bumthang, Gelephu and Yongphula	<p>Monthly</p> <p>Semi-annual</p>	<p>CSC</p> <p>NEC</p>

<u>S.No</u>	<u>Action</u>	<u>Mitigation Measures</u>	<u>Method of Monitoring</u>	<u>Location</u>	<u>Frequency</u>	<u>Responsible Party</u>
		waste water from entering the river directly. The guiding principle of these operations shall be to prevent any surface water pollution at source;				
6.	Air environment	<p>The level and significance of dust generation and nuisance can be effectively mitigated through:</p> <ul style="list-style-type: none"> <li>Regular spraying the work area; covering trucks where the haulage of material involves transport on public roads; timely and regular cleaning of public roads as required. Water for this measure for Bumthang airport construction will be used from Chamkhar Chhu. For Yongphula and Gelephu, since there is no sufficient water nearby the construction sites, the water has to be transported using tankers.</li> <li>The absolute level of construction-related ambient air pollution can be minimized by proper site management and construction organisation by good maintenance of the vehicle fleet and by immediately excluding over-aged or worn out vehicles and machinery from the construction site.</li> <li>The operation of the asphalt plant is a potential source of harmful emissions, which may affect the human and the natural environment and the health of the workforce. The site of the asphalt plant will be at a minimum distance of 100 m from any watercourse or settlement.</li> </ul>	<ul style="list-style-type: none"> <li>Site Inspection construction site and the haulage routes</li> <li>Air quality monitoring throughout construction phase. Parameters to be measured are dust, PM10 (Suspended particulate), smoke of asphalt plant, Nox and Sox (as indicated in the <b>Table V-2</b>).</li> </ul>	Construction zone of all three airports: Bumthang, Gelephu and Yongphula	<p>Monthly</p> <p>Semi-annual</p>	<p>CSC</p> <p>NEC</p>
7.	Noise Environment	<ul style="list-style-type: none"> <li>Strictly limiting the working hours to weekdays and to the relatively least sensitive daytime periods.</li> <li>The potential negative impact of construction noise on the workforce should be generally mitigated by providing the workforce with appropriate noise protection gear such as ear plugs and by using construction equipments that produces less noise.</li> </ul>	<ul style="list-style-type: none"> <li>Ambient Noise</li> </ul>	Construction zone of all three airports: Bumthang, Gelephu and Yongphula		CC

<b><u>S.No</u></b>	<b><u>Action</u></b>	<b><u>Mitigation Measures</u></b>	<b><u>Method of Monitoring</u></b>	<b><u>Location</u></b>	<b><u>Frequency</u></b>	<b><u>Responsible Party</u></b>
8.	Site Clearance including vegetation removal	<ul style="list-style-type: none"> <li>• Right-of-ways should be clearly marked to avoid removal of vegetation unnecessarily.</li> <li>• Necessary actions such as tree marking must be carried out in accordance with the forestry rules before felling of trees for the project roads. All paperwork and approvals must be obtained well ahead in time to prevent delays in construction.</li> <li>• The DFPS will prepare a survey and inventory of the commercial timber present on public lands prior to construction of any given airports, in accordance with the official procedures of the DFPS as contained in the Forest and Nature Conservation Rules (FNCR 2006). Natural Resources Development Corporation Limited (NRDCL) will be authorized to market the timbers with commercial value.</li> <li>• Compensatory plantation (of 1:5) will be carried out for trees lost for the construction of three airports. The compensatory plantation is proposed to be carried out under the banner of the Greenbelt Development Plan. The Greenbelt Development Plan will be developed during the detailed design phase.</li> </ul>	<ul style="list-style-type: none"> <li>• Review inventory and contract agreement</li> <li>• Review forestry permit</li> </ul>	Construction zone of all three airports: Bumthang, Gelephu and Yongphula	Monthly	CSC, DFPS, and DCA
9.	Wildlife Habitat	<ul style="list-style-type: none"> <li>• Due to the type of the planned development and the fact that the development of a new commercial area is intended, no effective measures can be proposed for the mitigation of the impact on wildlife. However, the availability of similar habitat in nearby areas (both Bumthang and Gelephu) will reduce the predicted impacts of wildlife.</li> <li>• The construction activities will be carried out only during day time.</li> <li>• The Master Plan or zoning plans may determine the protection or development of some areas with significance or potential for wildlife protection, e.g.</li> </ul>	<ul style="list-style-type: none"> <li>• Review contract signed between contractor and DCA.</li> <li>• Discussion with local forestry officials on occurrences of poaching.</li> <li>• Inspection of jobsite. Discussion with workers</li> </ul>	Construction zone of all three airports: Bumthang, Gelephu and Yongphula	Monthly	DFPS, CSC, DCA and NEC



<u>S.No</u>	<u>Action</u>	<u>Mitigation Measures</u>	<u>Method of Monitoring</u>	<u>Location</u>	<u>Frequency</u>	<u>Responsible Party</u>
		<p>alongside the Chamkhar Chhu River in Bumthang and Forest areas in the vicinity Gelephu airport areas.</p> <ul style="list-style-type: none"> <li>Greenbelt development programme with a compensatory plantation (of 1:5) will replace to some extent the lost wildlife habitat. The Greenbelt Development Plan will be developed during the detailed design phase. However, the main purpose of greenbelt is shield the noise and air pollution from spreading unabated out of airport sites.</li> </ul>				
10.	Community Structures	<ul style="list-style-type: none"> <li>In order to reduce impacts of demolition of Suspension bridge, the new one is being proposed to be built by the Chhoekhor geog administration to north of Bumthang airfield.</li> <li>Alternative footpath will be constructed along the eastern perimeter of the Yongphula airport boundary to mitigate the closure of the existing walkway (which used the part of the existing airfield).</li> <li>Any future airport upgradation and expansion works will consider the importance of the Yongphula water supply system. The community will be consulted if the shifting water supply line and tanks are to be shifted.</li> </ul>	<ul style="list-style-type: none"> <li>Review of detailed design proposals and contract bid documents</li> <li>Records of grievance procedure mechanism</li> <li>Inspection of jobsite</li> </ul>	<p>Chhoekhor geog, Bumthang</p> <p>Yongphula Airport</p>	Semi-annual	CSC, DA, DCA and NEC
11.	Health and Safety of Construction workers	<ul style="list-style-type: none"> <li>The construction workers will be provided with adequate and appropriate shelters which are wind and rainproof.</li> <li>Access to healthcare will be ensured with provision of first aid at the work sites. And in the event of major accidents emergency services of the district hospitals of Bumthang, Trashigang and Gelephu will be availed.</li> <li>Adequate water supply, pit toilets and solid waste disposal sites have to provided</li> </ul>	<ul style="list-style-type: none"> <li>Inspection of labor camp premises. Discussion with laborers on service adequacy</li> <li>Review of proposed programs; work place inspections to assure compliance; accident records</li> <li>Visual inspection of premises</li> <li>Review of HIV/AIDS program and its</li> </ul>	<p>At all three airport construction sites (Bumthang, Yongphula, Gelephu)</p>	<p>Monthly</p> <p>Semi-annual</p>	CSC, DCA and NEC

<u>S.No</u>	<u>Action</u>	<u>Mitigation Measures</u>	<u>Method of Monitoring</u>	<u>Location</u>	<u>Frequency</u>	<u>Responsible Party</u>
		<ul style="list-style-type: none"> <li>Monitoring of the sanitary conditions within the worker's camps is the responsibility of the DCA, who would regularly carry out surprise checks to inspect the camps.</li> <li>To minimize the risk of new infections and the spread of HIV/AIDS/STI a specific tailor-made campaign should be carried out under the Project. This would comprise of conducting HIV/AIDS/STI sensitisation sessions at the campsite including the distribution of information materials / brochures at the camp.</li> </ul>	implementation			
12.	Religious, Historical, cultural and Archeological Sites	<p>As far as possible, the destruction and demolition of important religious and cultural asset like important chorten at Yongphula airport will be avoided.</p> <p>However, if it is unavoidable, then prior to the demolition of chorten, a thorough public consultation with the local community (particularly with monastic community headed Lam Jigme Tenzin), Kanglung Geog Administration and Trashigang Dzongkhag will be carried out during the detailed design stage. The demolition and relocation issues will be jointly decided. Based on consensus the relocation of the chorten will be carried out with the assistance of the project.</p>	<ul style="list-style-type: none"> <li>Review of detailed design proposals and contract bid documents</li> <li>Records of grievance procedure mechanism</li> <li>Inspection of jobsite</li> </ul>	Yongphula Airport	Once	DCA, GA and DA
<b><u>OPERATIONAL PHASE</u></b>						
13.	Air Environment	<p>The extent of air pollution will be minimal due to limited traffic of both air and vehicular. However, following mitigation measure can still be applied:</p> <ul style="list-style-type: none"> <li>Shut down of aircraft engines to the maximum extent possible during taxiing and idling period.</li> <li>Allowing aircrafts with ICAO certified engines to land and takeoff, as far possible</li> <li>Appropriate greenbelt development with thick</li> </ul>	<ul style="list-style-type: none"> <li>Ambient air</li> <li>Total suspended particulates</li> </ul>	At all three airport construction sites (Bumthang, Yongphula, Gelephu)	Semi-annual	DCA and NEC

<u>S.No</u>	<u>Action</u>	<u>Mitigation Measures</u>	<u>Method of Monitoring</u>	<u>Location</u>	<u>Frequency</u>	<u>Responsible Party</u>
		plantation cover is one of the preferred methods to mitigate air pollution as plant serve as a sink for pollutants and also check flow of dust and also reduce the noise pollution. Greenbelt development plan will be developed during the detailed design phase.				
14.	Noise Environment	<p>The ICAO Balanced Approach concept provides airports with an agreed methodology to be used to address and manage aircraft noise problems in an environmentally responsive and economically responsible way. The Balanced Approach to noise management encompasses four principal elements:</p> <ul style="list-style-type: none"> <li>• Reduction of noise at source;</li> <li>• Land use planning and management;</li> <li>• Noise abatement operational procedures;</li> <li>• Operating restrictions on aircraft.</li> </ul> <p>The DCA will be responsible to actively address these issues in a noise management policy and programme. Under the framework for future effective noise management at all airports and airport authority shall carry out:</p> <ul style="list-style-type: none"> <li>• Airport authority will have a wide range of environmental management tasks, including the preparation and implementation of a noise management programme for the systematic reduction of operational noise impact of the airport</li> <li>• Assign a noise study based on ICAO Annex 16 procedures („Aircraft Noise'), which also is a requirement for the later certification of the airport according to the „Manual on Certification of Aerodromes';</li> <li>• By importing aircraft that make less noise such as</li> </ul>	<ul style="list-style-type: none"> <li>• Noise abatement program</li> <li>• Ambient Noise</li> </ul>	At all three airport construction sites (Bumthang, Yongphula, Gelephu)	Semi-annual	DCA and NEC

<u>S.No</u>	<u>Action</u>	<u>Mitigation Measures</u>	<u>Method of Monitoring</u>	<u>Location</u>	<u>Frequency</u>	<u>Responsible Party</u>
		<p>plane with turbo-fan rather than turbojet.</p> <ul style="list-style-type: none"> <li>To further reduce effect of noise and vibration, the DCA could implement the noise reduction barrier through plantation of trees (greenbelt) that absorbs the noise.</li> </ul>				
15.	Surface Water	<p>In general the amount wastewater will be reduced through proper and efficient use of water. Depending on the wastewater generation, the wastewater treatment plant will be installed. The capacity treatment plant and its design will be developed during the detailed design.</p>	<ul style="list-style-type: none"> <li>Inspection of operation and site</li> <li>Storage for hazardous and toxic material</li> <li>Installation of water treatment plant</li> </ul>	At all three airport construction sites (Bumthang, Yongphula, Gelephu)	Semi-annual	DCA
16.	Safety	<p>Details of the safety arrangements proposed for domestic are not yet available, but it is evident that the present arrangements of domestic airports would not meet the relevant ICAO standards. To comply with the relevant ICAO safety standards for the operation of an international airport it is thus recommended to</p> <ul style="list-style-type: none"> <li>Establish an emergency (response) plan and take all required decisions in terms of organisation, equipment, staffing, training and operational framework conditions in compliance with ICAO recommendations provided in ICAO Annex 14 (I) to ensure safe airport operations;</li> <li>Set up an effective program for the safe transport of dangerous goods in accordance with recommendations provided in ICAO Annex 18;</li> <li>Establish and implement a best practice management plan in accordance with ICAO's revised Standards and Recommended Practices (SARPS) on airport wildlife control of 2003 particularly for prevention of bird strike.</li> </ul>	<ul style="list-style-type: none"> <li>Inspection of operation and sites</li> <li>Review safety procedures</li> </ul>	At all three airport construction sites (Bumthang, Yongphula, Gelephu)	Semi-annual	DCA
17.	Religious, Historical, Cultural and	DCA will actively implement effective noise management programme through import of aircraft with	<ul style="list-style-type: none"> <li>Noise abatement program</li> </ul>	At all three airport construction sites		DA, GA , DCA and NEC

<b><u>S.No</u></b>	<b><u>Action</u></b>	<b><u>Mitigation Measures</u></b>	<b><u>Method of Monitoring</u></b>	<b><u>Location</u></b>	<b><u>Frequency</u></b>	<b><u>Responsible Party</u></b>
	Archeological sites	<p>less noise, reduction of noise at source and certify airports based on the noise study as per ICAO Annex 16 procedures („Aircraft Noise’).</p> <p>To further reduce effect of noise and vibration, the DCA could implement the noise reduction barrier through plantation of trees (as part of the greenbelt development plan) that absorbs the noise. Greenbelt development plan will be developed during the detailed design phase.</p>		(Bumthang, Yongphula, Gelephu)		

## **X. CONCLUSIONS AND RECOMMENDATIONS**

### **A. Conclusions**

306. From the current study, it is concluded that the upgrading and improvement of the existing domestic airports under Air Transport Connectivity Enhancement Project (ATCEP) will have minimum impact on environment; as the overall construction activities will be limited and carried out within the existing acquired airport boundaries. Further, as part of the IEE study, environmental impacts occurred due to the implementation of the RGOB financed domestic airports development project (namely Bumthang, Yongphula and Gelephu airports) have also been assessed. Following the important issues from the RGOB implemented components that are yet to be resolved:

- Chamkhar Chhu River has been diverted to reclaim the land for the Bumthang Airport construction. The river diversion has changed the flow pattern and has increased the volume and velocity of river flowing along the banks of Dekiling and Wangdicholing resulting in erosion of river banks and nearby agricultural fields. The existing river protection structures are said to be inadequate during peak monsoon river flow.
- The suspension bridge (footbridge) located close to Bumthang airport has been demolished to make way for airport thus affecting people (particularly school going children) on their daily movement to and from business and administrative centres. The restoration of this bridge is yet to be carried out.
- The storm water from the existing drainage constructed since 1960 for Yongphula airport has been channelled towards Yonphula settlement resulting in erosion and landslides downstream.

### **B. Recommendations**

307. The environmental impacts predicted for ADB's assisted ATCEP are predicted to be insignificant since the predicted impacts are temporary, reversible and can easily be mitigated using available methods. The mitigation measures proposed in the IEE/EMP are sufficient. However, following specific recommendations are made to resolve the pending environmental issue from RGOB components and the anticipated environment issues of future implementation of ATCEP:

#### *Recommendations for Resolving the Environmental Issues from RGOB Components*

- River training works of Chamkhar Chhu River on the Wangdicholing and Dekiling sides will need to be reviewed during detailed design phase. Proper hydrological studies shall be carried out to find out the adequacy of the existing river training structures.
- Similar hydrological studies shall be carried for Gelephu airport for the design and construction of flood protection structures.
- Suspension foot bridge near Bumthang airport shall be restored to ease hardship faced particularly school going children of Bathpalathang, Tekarzhong, Konchosum and Tamzhing settlements.
- Existing drainage structures of Yongphula airport and its impact on the local environment needs to be reviewed during the detailed design. The possibilities of diversion of storm water on both side of the airport shall be assessed for lessening the impact of concentrated storm water towards Yongphula settlement.

*Recommendations for Resolving the Anticipated Environmental Issues of ATCEP Components*

- Air and noise pollutions are expected to be major environmental issues during operation of the airports. One of the effective ways to mitigate the effects of noise and air pollutions is through the development of greenbelt in all three domestic airports. Hence, the greenbelt development plans shall be developed during the detailed design phase.
- EMP will be updated during the detailed design stage include any changes in scope of works and accordingly update the environmental impacts and the mitigation measures.
- Project Coordinators for respective subprojects (Bumthang, Yongphula and Gelephu airports) under ATCEP shall act as Environmental Monitors and report to the Overall Environmental Monitoring In-Charge (in this case Joint Director of DCA).
- DCA (or Environmental Monitoring In-Charge) shall submit an annual environmental monitoring report on EMP implementation to ADB and the relevant government agencies.
- At the implementation stage, other relevant agencies such as Dzongkhag Administration, Department of Forests and Park Services, National Environment Commission shall monitor the implementation of mitigation measures as specified under the EMP.

## Appendices

### Appendix A

#### References

Administrative Staff College of India. (February 2010). *Environmental Impact Assessment Guidance Manual for Airports*. New Delhi: Ministry of Environment and Forests, Government of India.

Chhetri, M. (2005). *EFRC Field Handbook*. Thimphu: SNV Bhutan - Netherlands Development Organisation.

Election Commission of Bhutan. (2011). *Delimitation*. Retrieved May 05, 2011, from Election Commission of Bhutan: [http://www.election-bhutan.org.bt/index.php?option=com\\_content&id=132&Itemid=84](http://www.election-bhutan.org.bt/index.php?option=com_content&id=132&Itemid=84)

NEC. (2004). *Application for Environmental Clearance Guidelines for Highways and Roads*. Thimphu: National Environmental Commission Secretariat.

NEC. (2000). *Environmental Assessment Act*. Thimphu: National Environmental Commission Secretariat.

NEC. (2002). *Regulation for the Environmental Clearance of Projects and Regulation on Strategic Environmental Assessment*. Thimphu: National Environmental Commission Secretariat.

NSB. (2010). *Annual Dzongkhag Statistics*. Thimphu: National Statistics Bureau.

Office of the Census Commissioner. (2005). *Population and Housing Census of Bhutan*. Office of the Census Commissioner. Thimphu: Kuensel Corporation Ltd. 2006.

Pradhan, R., & Wangdi, T. (1999). *Threatened Birds in Bhutan* (11nd ed.). Thimphu: RSPN.

RGOB. (1998). *Bio-Diversity Action Plan for Bhutan*. Thimphu: Ministry of Agriculture.

RGOB. (2004). *The Road Act of the Kingdom of Bhutan*. Thimphu: Department of Road.

South Asia Region Economic Policy and Poverty, The World Bank. (2010). *Small Area Estimation of Poverty in Rural Bhutan*. Thimphu: National Statistical Bureau.

Urs Schaffner, K. J. (1999). *Environmental Codes of Practice Highways and Roads*. Thimphu: Division of Roads, Ministry of Communications.



## **Appendix B**

### **Terms of Reference**

The Department of Civil Aviation (DCA) under Ministry of Information and Communications (MOIC), Royal Government of Bhutan (RGOB) has initiated a plan to improve current state of the country's domestic air transport system under the air transport connectivity enhancement project (Project) with the assistance of Asian Development Bank (ADB). Three airports (Bumthang, Yongphula and Gelephu airports) in the country have been identified for upgrading and rehabilitation, mainly based on the relative importance of these airports as domestic hubs for tourism and economic development on a regional basis.

Initial environmental examination (IEE) will be prepared under the Project Preparation Technical Assistance (PPTA) over a period of 4 months from July to October 2011 on behalf of the Department of Civil Aviation of RGoB. The Terms of Reference has been prepared in accordance with the requirements under the Environmental Assessment Act 2000, Regulation for Environmental Clearance of Projects 2002 and the National Environment Protection Act 2007.

The objective of the IEE and EMP is to ensure that all potential environmental, social and economic impacts of the Project are identified and assessed and where possible find out how adverse impacts could be avoided. Direct, indirect and cumulative impacts must be fully examined and addressed to the extent reasonably practicable.

#### **1. INTRODUCTION**

As per the Environment Assessment Act 2000, it is mandatory to get environmental clearance for certain sectors, including airport construction projects. The objective of this study is to prepare IEE/EMP to get the Environmental clearance for proposed project hereby referred to as the as Air transport connectivity enhancement Project. Therefore proposed airport upgrading and rehabilitation sub projects of Bumthang, Yonphula and Gelephu are referred to as "Project" under consideration.

#### **2. GENERAL INFORMATION**

The proposed airport development is referred as "Project" under consideration. Various aspects of the project are discussed as given below:

#### **3. BACKGROUND INFORMATION**

##### **3.1. Project Proposal**

Describe the project proposal in terms of its identification, objectives, importance and feasibilities. Also describe the aspect of its sustainability in terms of future growth of demand and commercial profitability.

- i. Whether the proposed site and its land used are covered by the Master Plan/Local Development Plan/Urban Development Plan as the case may be. If so requisite permission from competent authorities taken, with proof.
- ii. Location of National Parks, Sanctuaries, Biosphere Reserves, Wildlife Corridors, Tiger/Elephant Reserves (Existing as well as proposed), if any, within 20km of the project periphery should be clearly indicated. Necessary clearance as may be applicable to such projects due to proximity of the ecologically sensitive areas as mentioned above should be obtained.

iii. Details of Infrastructural availability for parking of transport. Expansion of approach roads and modifications of Highways if contemplated including actions to be taken by other agencies, if any, should be covered giving proof.

iv. Any alternative site proposed with details on the above aspects.

#### **4. SCOPE OF WORK**

The broad scope of the work is to carry out IEE study of the proposed Project covering environmental, social and economic aspects to predict the positive and negative impacts of the project during its construction and operation phases. Also, to craft the best possible mitigation measures in the form of Environmental Management Plan (EMP) the Project, should be based on sound environmental protection and management criteria. The scope also includes preparation of monitoring plans for the successful implementation of EMP.

Preparation of IEE Report shall be based on the baseline data of environmental parameters duly collected and examined. The baseline assessment of environmental status and baseline data shall be established by conducting regular field surveys. The secondary source information available from published literature or any authenticated documents to support the field studies will also be consulted.

The study shall cover Occupational Health and Safety aspects which is a requirement under the EA Act 2000. A section shall consist of plans to include IEE/EMP methodology, study of project alternative, comparison and justification for recommending the proposed project. The Consultants shall prepare an Environmental Management Plan (EMP) to mitigate the adverse effects, including the socio-economic aspects and R&R Plan for project affected people. They shall also come up with a Risk assessment and Disaster Management Plan (DMP) which should inter-alia; include aircraft accidents near airports, flooding of airports due to outbursts, cyclones, cold bursts, and sabotage to the aircraft and other installations in the airports. The EMP shall include a detailed costing of proposed mitigation, management, monitoring and disaster preparedness measures.

Besides, this consultant should refer the rules and regulations of Royal Govt. of Bhutan such as National Environment Protection Act 2007, Environmental Assessment Act 2000, The Regulation for Environmental Clearance for the project 2002, Mines and Minerals Management Act 1995 and its Regulation, Land Act 2007 and any other relevant laws of the Kingdom.

The scope also includes preparation of monitoring plan for implementation of EMP. The detailed scope of the work is listed below:

**For Preparation of IEE Report:** The baseline data of environmental parameter for at least four seasons shall be examined.

#### **5. STUDY AREA**

The study area for the project can be considered as:

An area contained within a minimum of 20 km radius from the periphery of the project site and, to be extended to its projected area of influence/impact during normal operation or in the event of catastrophic failure. The Study area and all analyses shall include impacts (cumulative and catastrophic) that could affect downstream infrastructure/settlement facilities.

#### **6. DETAILED PROJECT DESCRIPTION:**

A detailed description and analysis of the nature and location of the proposed project, not necessarily limited to the following:

1. The proposed project
2. The total area required for the proposed project
3. The objectives and anticipated benefits of the proposed project
4. Installed capacity
5. The physical characteristics of the proposed project and its surroundings, illustrated with a location map and site plan
6. A plan for during the adverse affects including Risk assessment Disaster Management Plan of the proposed project
7. A time table, approximate cost, and the methods and timing of construction of the project.

## **7. BASELINE DATA**

Baseline Environmental Status of the project area (core zone) and surrounding area covering 20km radial distance from the project boundary (buffer zone) delineating ecological features of forest area, agricultural land, grazing land, wild life sanctuary, national parks, migratory routes of fauna, water bodies, and human settlement shall be established based on the baseline survey on available literature/ authenticated documents supplemented by field studies for all the following elements;

### **Geological, Geophysical and Geo-hydrological Aspects**

1. Geography and physiography of the project area.
2. Regional geology and structure of the proposed site
3. Seismicity, tectonics and history of past earthquakes in the area.
4. Critical review of the geological features around the project area.
5. Impact of the project on geological environment
6. Hydrology of the basin
  - Hydro-meteorology, drainage systems
  - Catastrophic events like cloudbursts & flash floods, if any would be documented.
  - Snow-fed and rain-fed catchment to be demarcated. Rainfall-runoff data to be assess.
  - Sedimentation rate to be estimated.
  - Water availability for the project. To record the inflows/outflows, historical flows, seepage at/from the upstream projects/diversion structures. Measurements of flow from the tributaries in the study stretch and other surface water channels joining the River in the study stretch.
  - The flow measurements shall be planned and executed in such a way that average, maximum, mean maximum, mean minimum and absolute lean flows will be modelled or measured.
  - Lean season release of water for downstream will be specified. The study of comprehensive downstream impact shall also include area up to 10 km downstream of the confluence of TRC with river and shall address overall ecological impact like aquatic ecology, drinking water quality, irrigation and other aesthetic uses etc.
  - Downstream hazards (available data on floods, including design and maximum probable floods)

### **Biological Resources**

#### **Flora of the Project's Influence Area:**

The Consultant shall survey the flora, major habitats and sub-habitats, biodiversity indices, species abundance, density, composition, growth rate and phenology. To this end the Consultant shall:

1. Prepare succinct documentation on the flora and biodiversity resources of the river basin along the chamkhar chhu at Bumthang and project influence area.
2. Predominant flora, introduced exotic flora and the resultant impact.
3. Forest and forest types: Total forest cover, type of forests, change in forest cover and threats and degradation of forests.
4. Vegetation profile, number of species in the project area, etc.
5. Community Structure through Vegetation mapping
6. Endemic endangered and threatened species and their geographical distribution.
7. Impact of impoundment and construction activities on the vegetation.
8. Impact of impoundment and construction activities on the vegetation
9. Location of any Biosphere Reserve, National Parks or sanctuary in the vicinity of the project including biological corridors, if any.

#### **Fauna of the Project's Area of Influence:**

The Consultant shall survey the fauna (consisting of invertebrates, amphibians, avifauna or birds, and mammals); establish biodiversity indices, such as species abundance, density, composition, and structure and growth rate. The Consultant shall detail but not be limited to:

1. A detailed inventory of terrestrial wildlife (consisting of invertebrates, amphibians, reptiles, birds and mammals).
2. Present status of wildlife.
3. Endemic threatened and endangered species including their habitat and associations.
4. Small vertebrate or invertebrate communities.

#### **Impact on animal distribution, migration routes (if any):**

The Consultants will detail all habitat fragmentation and destruction including biological corridors due to project and ancillary building activities (project site, access/supply routes and projected distribution infrastructure).

#### **Avifauna:**

1. Status
2. Resident/Migratory/Passage migrants
3. Impact of project on threatened /endangered taxa, if any

#### **Aquatic Ecology:**

The Consultant shall perform but not be limited to the following tasks:

1. Collect and examine water samples from different sampling stations. Additional water quality samples will be collected from source of drinking water and each of the channels carrying sewage into the river;
2. Study the relevant literature and specialist documentation for existence/presence of rare, endangered, endemic or threatened aquatic fauna like macro-invertebrates, zooplankton, benthos etc.;
3. Conservation status of aquatic fauna and flora;
4. Fish mitigations (particularly for anadromous fish, if any), and a detailed analysis of fish passing hazards;
5. Pollution load in the River, the volume and quality of sewage (treated or otherwise) entering in the study stretch during the project's life.

**Conservation areas and status of threatened /endangered taxa:**

1. Biotic pressures
2. Management plan for conservation areas and threatened /endangered taxa.

A full analysis of the impacts of managed flow on water quality, shoreline vegetation (riverbank vegetation), aquatic ecology, induced erosion, sedimentation, flushing and pollution load etc.

**Remote Sensing & GIS Studies:**

The Consultant shall detail findings in Maps and GIS overlays that will include but not be limited to:

1. False colour composite map of the project area.
2. Land use and Land cover mapping.
3. Drainage pattern/map.
4. Soil map.
5. Geo-physical features slope and relief maps.

**Socio-economic aspects:**

1. Use of water: To identify all direct and indirect use of water (drinking, washing/bathing, agricultural and other purposes) in the study stretch-through consultation with local communities, government agencies;
2. Information on water borne disease through community consultation and sample household level survey;
3. Land details (agricultural or forest land required for the project);
4. Demographic profile;
5. Ethnographic profile;
6. Economic Structure;
7. Development profile;
8. Agriculture practices;
9. Cultural and aesthetic sites;
10. Existing public infrastructure and social services available to the affected population: education, health, hygiene, communication, network, etc.
11. Community use of the natural flora and fauna;
12. Detailed Public Consultation Plan The Report would include list of all project Affected Families with their names, education, land holdings, other properties, occupation and how to address their concerns including details of compensatory or other forms of measures to be undertaken by the project. A social assessment report shall be generated to adequately address social issues.

**Water, Air and Noise Environment:**

The consultants shall collect and analyse data pertaining to water (Physical, chemical and biological parameters), air and noise environment due to airport construction and aircraft operation and likely impacts during the construction and post construction period.

These data shall include but not be limited to:

Baseline information on ambient air quality in the project area covering aspects like SPM, RSPM, SO<sub>x</sub>, NO<sub>x</sub>; Noise from all sources including aircraft operation; traffic densities; and how these should be considered relative to any blasting operations envisaged.

**8. ASSESSMENT OF IMPACTS:**

The Consultants shall identify all positive and negative impacts during construction, operation and decommissioning of the project. For negative impacts, categorize them into direct and indirect impacts. Describe each negative impact in detail. The environmental assessment report should assess (in quantitative terms, to the maximum extent practicable) impacts from all aspects of the project. The assessment should include both short term and long-term impacts for all the phases of the project (e.g. acquisition, development, operation and decommissioning) and cumulative impacts of the project.

## **9. CONSTRUCTION METHODOLOGY AND SCHEDULE:**

The Consultant will provide a detailed description of the proposed construction methodology schedule and support the description with all necessary plans, diagrams, spreadsheets,

## **10. IMPACT PREDICTION:**

Impact prediction is a way of mapping the environmental consequences of the significant aspects of the project and its alternatives. Environmental impact can never be predicated with absolute certainty and this is all the more reason to consider all possible factors and take all possible precautions for reducing the degree of uncertainty.

The Consultant shall assess but not be limited to the following expected impacts of the project:

### **Air**

1. Change in ambient levels and ground level concentrations due to total emissions from point, line and area sources
  2. Effects on soils, materials, vegetation and human health.
- If diesel generator (DG) sets are to be used for construction power, then the impact of emissions on the vegetation and air environment should be predicted and assessed.

### **Noise**

1. Changes in ambient levels due to noise generated from equipment and movement of aircraft;
2. Effect on fauna and human health;

### **Water:**

1. Changes in quality due to river diversion for Bumthang airport;
2. Impact on fish fauna, their population and migratory behaviour, spawning and breeding biology.
3. Loss of riparian vegetation;
4. Impact of sewage disposal;

### **Land:**

1. Changes in land use and drainage pattern;
2. Changes in land quality including effects of waste disposal;
3. Riverbanks and their stability for Bumthang airport;
4. Land slide and flood scenario;

### **Biological:**

1. Deforestation and shrinkage of animal habitat;

2. Impact on fauna and flora (including aquatic species if any) due to change in river direction pattern;
3. Impact on rare and endangered species, endemic species, and migratory path/ route of animals, if any;
4. Impact of edge degradation and fragmentation on the natural habitats (protected or otherwise) in the vicinity of the project;
5. Impact on breeding and nesting grounds;
6. Impact of impoundment and construction activities on the vegetation;
7. Indicate the nature, magnitude and extent of any direct, indirect or cumulative impacts on the terrestrial flora and fauna of the Biosphere Reserve/other protected areas including biological corridors linking them.

**Socio-Economic:**

1. Impact on the local community including demographic changes (including food, medicinal plants, agricultural pesticides etc.);
2. Impact on cultural properties like archaeological, paleontological, historical, religious, pilgrim properties and sacred groves;
3. Impact on economic status;
4. Impact on human health, hygiene and communicable disease risks due to the construction and operation of the project;
5. Impact of the immigrant labour and project personal on the local environment and on the host population, including health risks such as HIV/AIDS;
6. Impacts expected from increased traffic in the study area and/or the area of influence.

## **11. ENVIRONMENTAL MANAGEMENT PLAN(S)**

On the basis of predicted environment impacts, Environment Management plans will be formulated with precise action plans incorporating year-wise physical and financial targets. The EMP shall include but not be limited to the following:

1. Analysis of all alternatives of projects with special reference to present proposal and no project scenario from environment angle.
2. Creation of Green Belt Plan around the periphery of the airport, colonies, approach roads, canals, etc. Including identification of floral species which can be planted shall be formulated.
3. Biodiversity Conservation and Management Plan for conservation and preservation of endemic, rare and endangered species of flora and fauna (in consultation with the Nature Conservation Division, Department of Forest, etc.). The applicable policy and legal provisions related to protection and conservation of flora, fauna and biodiversity in project area to be reviewed.
4. Resettlement & Rehabilitation (R&R) Plan along with social/community development plan. R&R plan would be framed in consultation with the Project Affected Persons (PAPs), Project authorities and relevant government agencies.
5. Muck Disposal Plan - Suitable sites for dumping of excavated materials shall be identified in consultation with National Environment Commission and Dzongkhag/district authorities including reclamation of muck disposal sites.
6. Restoration and Landscaping of Working Areas - Reclamation of borrow pits (quarry sites) and construction areas.
7. Development of public health management plan including project staff.

8. Suitable engineering and bio-engineering measures for the identified land slip zones treatment shall be provided as part of the EMP.
9. Environmental education and awareness plan for workers, supervisors, executives and contractors.
10. Measure to control water pollution due to various effluents to the discharged during construction and operation phases and preparation of water quality management plan.
11. Energy Conservation Measures.
12. Solid Waste Management Plan – Baseline data on soil analysis shall be prepared along with estimation and disposal of solid waste during construction and operation phases of the project. Identification of impacts due to contamination of soil due to solid mixing with soil. Proposed mitigation measures including storage and disposal procedure of solid waste be highlighted.
13. Compensatory afforestation in lieu of the forest land required for the project shall be proposed. Species to be planted shall be consulted with divisional forest offices.
14. Emergency preparedness plan and/or disaster management plan for hazardous materials, disaster and safety.
15. Environmental Monitoring Programme (with Physical & Financial details covering all the aspects from EMP).

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## **12. ENVIRONMENTAL MONITORING PROGRAMME**

The EIA is basically an evaluation of future events. It is necessary to continue monitoring certain parameters identified as critical by relevant authorities under an environmental monitoring programme. This would anticipate any environmental problems so as to take effective mitigation measures. An environmental monitoring programme shall be formulated for implementation during project construction and operation phases. The cost estimate and equipment necessary for the implementation of this programme shall also be covered as a part of the comprehensive/full EIA study.

The environmental monitoring plan is to be provided, clearly indicating various parameters that needs monitoring along with its frequency. A suitable management information system (MIS) shall be suggested. A laboratory facility available in the vicinity of the project site is to be identified if not suggestions for the same shall be made.



## Appendix C

### Rapid Environmental Assessment (REA) Checklists

**Instructions:**

- (i) The project team completes this checklist to support the environmental classification of a project. It is to be attached to the environmental categorization form and submitted to the Environment and Safeguards Division (RSES) for endorsement by Director, RSES and for approval by the Chief Compliance Officer.
- (ii) This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB's (a) checklists on involuntary resettlement and Indigenous Peoples; (b) poverty reduction handbook; (c) staff guide to consultation and participation; and (d) gender checklists.
- (iii) Answer the questions assuming the "without mitigation" case. The purpose is to identify potential impacts. Use the "remarks" section to discuss any anticipated mitigation measures.

**Country/Project Title:** Air Transport Connectivity Enhancement Project (TA 7633-BHU)

**Sector Division:** Transport and Communications Division

Screening Questions	Yes	No	Remarks
<b>A. Project Siting</b> Is the Project area adjacent to or within any of the following environmentally sensitive areas?			
<ul style="list-style-type: none"> <li>▪ Cultural heritage site</li> </ul>	√		<ul style="list-style-type: none"> <li>• Bumthang airport located at safe distance from Jakar Dzong, Jampa Lhakhang, Chakhar Lhakhang, Kurje and Tamshing monasteries.</li> <li>• Stupa/Chorten Yulaynamgyal is located within the Yongphula airport boundary on a small hillock southeast of the runway.</li> <li>• No cultural heritage sites are found in the vicinity of Gelephu airport</li> </ul>

Screening Questions	Yes	No	Remarks
▪ Protected Area	√		<ul style="list-style-type: none"> <li>Wangchuck Centennial and Thrumshingla National Parks are located at some 6 km and 13 km areal distances respectively from the Bumthang airport. There will no direct impact as result of airport construction and upgrading works.</li> <li>There are no protected areas that fall within 20 km radius of Yongphula airport</li> <li>Jigme Singye Wangchuck National Park and Royal Manas National Park are located at some 16.5 km and 13 km areal distances away respectively from the Gelephu airport.</li> </ul>
▪ Wetland		√	
▪ Mangrove		√	
▪ Estuarine		√	
▪ Buffer zone of protected area	√		
▪ Special area for protecting biodiversity		√	
<b>B. Potential Environmental Impacts</b> Will the Project cause...			
▪ encroachment on precious ecology resulting in loss or damage to terrestrial or aquatic habitats (e.g., wetlands or sensitive or protected areas)?	√		<ul style="list-style-type: none"> <li>Bumthang airport upgrading and runway extension will encroach into riparian habitat.</li> <li>Yongphula airport does not encroach on any sensitive habitats.</li> <li>Gelephu airport upgrading will not encroach into sensitive areas.</li> </ul>
▪ encroachment on historical/cultural monuments or areas?	√		<ul style="list-style-type: none"> <li>Bumthang and Gelephu airports do not directly affect the historical, religious and cultural monuments. However, there will be some impacts due to noise of aircraft operations particularly in Bumthang.</li> <li>Stupa/Chorten Yulaynamgyal is located within the Yongphula airport boundary on a small hillock southeast of the runway. This stupa will need to be demolished during future runway extension.</li> </ul>
▪ decrease in value of land in the area due to noise and other nuisances such as traffic congestion and degradation of environmental aesthetics?		√	

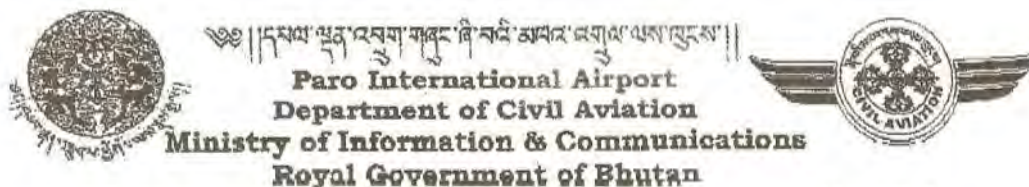
Screening Questions	Yes	No	Remarks
<ul style="list-style-type: none"> <li>dislocation or involuntary resettlement of people?</li> </ul>	√		<ul style="list-style-type: none"> <li>3.99 acres of private land belonging to 10 households has been acquired for the construction of Bumthang airport. The land substitution and cash compensation is still pending.</li> <li>No private land has been acquired for Yongphula airport</li> <li>144 households have lost around 235.48 acres of land for the ongoing airport construction works. Land substitution and cash compensation is under process. In addition, 10 households have to be permanently relocated due to loss of their houses</li> </ul>
<ul style="list-style-type: none"> <li>disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?</li> </ul>		√	
<ul style="list-style-type: none"> <li>noise and vibration disturbances?</li> </ul>	√		<ul style="list-style-type: none"> <li>Noise and vibration impact on the settlements during construction is temporary and reversible.</li> <li>Noise and vibration impact during operation phase will be insignificant since the expected air traffic in all three airports will be minimal with few weekly flights.</li> </ul>
<ul style="list-style-type: none"> <li>short-term ecological disturbances such as soil erosion, water quality deterioration (surface and groundwater), air pollution, noise and vibrations from construction equipment?</li> </ul>	√		Short term ecological disturbances due to soil erosion and air pollution are expected in all airport constructions.
<ul style="list-style-type: none"> <li>creation of slum communities following airport construction?</li> </ul>		√	
<ul style="list-style-type: none"> <li>risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during project construction and operation?</li> </ul>		√	
<ul style="list-style-type: none"> <li>communicable disease hazards?</li> </ul>		√	
<ul style="list-style-type: none"> <li>accidental disruption of utilities?</li> </ul>		√	
<ul style="list-style-type: none"> <li>traffic congestion at airport access and exit?</li> </ul>		√	
<ul style="list-style-type: none"> <li>short-term air quality degradation due to dredging-related operations?</li> </ul>	√		Dust pollution is expected during construction and haulage but with the specified mitigation measures such as sprinkling of water, covering of construction material while transporting and stockpiling material at a safe distance from settlement will reduce its impact.

Screening Questions	Yes	No	Remarks
<ul style="list-style-type: none"> <li>noise and vibration due to aircraft take-off and landing?</li> </ul>	√		<p>Certain noise and vibration result of aircraft take-off and landing is inevitable during operation. However, the impacts could be minimized by following ICAO's balanced approach to noise management:</p> <ul style="list-style-type: none"> <li>reduction of noise at source</li> <li>land use planning and management</li> <li>noise abatement operational procedures</li> <li>allowing aircrafts with ICAO certified engines to land and take-off, as far as possible</li> </ul>
<ul style="list-style-type: none"> <li>social conflicts if workers from other regions or countries are hired?</li> </ul>		√	
<ul style="list-style-type: none"> <li>large population influx of construction causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?</li> </ul>		√	
<ul style="list-style-type: none"> <li>hazards to traffic on highways near airport due to proximity of planes taking off and landing?</li> </ul>		√	
<ul style="list-style-type: none"> <li>risks to community health and safety due to the transport, storage, and use and/or disposal of materials likely to create physical, chemical and biological hazards during construction and operation?</li> </ul>		√	
<ul style="list-style-type: none"> <li>community safety risks due to both accidental and natural hazards, especially where the structural elements or components of the project (e.g., runways) are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning?</li> </ul>		√	

<b>Climate Change and Disaster Risk Questions</b>  The following questions are not for environmental categorization. They are included in this checklist to help identify potential climate and disaster risks.	Yes	No	Remarks
■ Is the Project area subject to hazards such as earthquakes, floods, landslides, tropical cyclone winds, storm surges, tsunami or volcanic eruptions and climate changes (see Appendix I)?	√		<ul style="list-style-type: none"> <li>• Bumthang airport due to its proximity to Chamkhar Chhu/River is prone to flooding and GLOF. Appropriate river protection works will help prevent damaging flooding of airport.</li> <li>• Similarly, Gelephu airport is susceptible to flooding during heavy monsoon due to two streams that intersects the airport. Detailed hydrological study, design and construction of appropriate river bank protection will help prevent flooding of the airport.</li> </ul>
■ Could changes in precipitation, temperature, salinity, or extreme events over the Project lifespan affect its sustainability or cost?	√		
■ Are there any demographic or socio-economic aspects of the Project area that are already vulnerable (e.g. high incidence of marginalized populations, rural-urban migrants, illegal settlements, ethnic minorities, women or children)?		√	
■ Could the Project potentially increase the climate or disaster vulnerability of the surrounding area (e.g., increasing traffic or housing in areas that will be more prone to flooding, by encouraging settlement in earthquake zones)?	√		The river diversion works carried out as part of airport constructions particularly for Bumthang airport is affecting the nearby settlements of Wandicholing and Dekiling. River bank protection structures built is said to be ineffective and insufficient particularly on Wangdicholing side. Therefore, the site appropriate design and construction of river bank protection walls will be carried out further.

## Appendix D: Public Involvement Documentation

### 1. Letter to Dzongkhags



PAP/DA/AS/046/011/305

15/07/2011

Dasho Dzongdag  
Dzongkhag Administration  
Bumthang

Dasho Dzongdag  
Dzongkhag Administration  
Trashigang

Dasho Dzongdag  
Dzongkhag Administration  
Sarpang

**Subject: Fielding of Consultants for Ground Reconnaissance Study- TA 7633-BHU:  
Air Transport Connectivity Enhancement ADB Project.**

Dasho(s),

The Asian Development Bank (ADB) has signed the contract for consulting services for preparing the PPTA study for Air Transport Connectivity Enhancement ADB Project mainly at Bumthang (Batpalathang), Trashigang (Yungphula) and at Sarpang (Gaylephug).

In this connection, the ADB has recruited national individual consultants namely Mr. Karma Chogyel (Environmental Specialist) and Mr. Rajesh Pradhan (Social/Resettlement Specialist) effective 15<sup>th</sup> July 2011 to carry out the socio-economic/Resettlement as well as environmental studies for the proposed sites mentioned above. The consultants' tentative travel schedules are provided for Dashos' kind information and necessary action.

Their tentative travel schedules are shown below:

Tentative travel dates	Description of field activities	Proposed halt	Dzongkhag	Remarks
24/07/2011	Journey from Thimphu to Bumthang	Bumthang	Bumthang	Travel by car and halt.
25/07/2011 to 30/07/2011	Visit Dasho Dzongdag and other relevant stakeholders. Site visit at Batpalathang for social/resettlement study/environmental study, Focus Group discussion, documentation of APs (affected people) etc.	Bumthang	Bumthang	Halt at Bumthang
31/07/2011	Travel to Trashigang	Trashigang	Trashigang	Travel by car and halt.
01/08/2011 to 06/08/2011	Visit Dasho Dzongdag and other relevant stakeholders. Site visit at Yungphula for social/resettlement study/environmental study, Focus Group discussion, documentation of APs (affected people) etc.	Trashigang	Trashigang	Halt at Yungphula
07/08/2011	Travel to Samdrupjongkhar	S/jongkhar	S/jongkhar	Halt at S/jongkhar
08/08/2011	Travel to Gaylephug	Gaylephug	Gaylephug	Halt at Gaylephug
09/08/2011 to 19/08/2011	Visit Dasho Dzongdag/Dasho Dunga and other relevant stakeholders. Site visit at Gaylephug for social/resettlement study/environmental study, Focus Group discussion, documentation of APs (affected people) etc.	Gaylephug	Gaylephug	Halt at Gaylephug
21/08/2011	Travel to Thimphu	Thimphu	Thimphu	

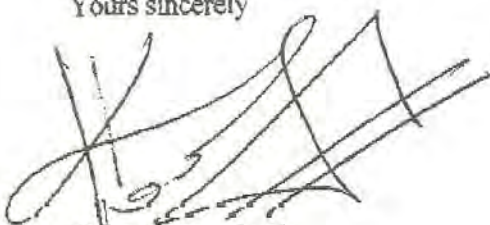


The Social/Resettlement Consultant will be carrying out the poverty and social assessment (20% socio-economic profile, 10% socio-economic survey of the affected persons, 20% seriously affected persons and 100% census survey) and will also be assessing the impacts on the people, properties, common properties resources and loss of livelihood. Similarly, the Environmental Specialist will carry out the data collection on physical, biology and socio-cultural or historical data to update existing Environmental Impact Assessment studies to meet the ADB's environmental requirement.

Therefore, all the concerned Dasho(s) are requested to kindly render necessary help by timely informing the respective officials including Land Record Officers, Dzongkhag Engineers, Dzongkhag Survey Officers, Gups, Tshogpas and other stakeholders' to process data collection and public consultation for successful and timely completion of the proposed study.

Thank you

Yours sincerely



Karma Wangchuck  
(Offg Director General)

Copy to:

1. Hon'ble Secretary, MoIC, Thimphu for kind information.
2. Dasho Dungpa, Dungkhag Administration, Gaylephug for kind information and necessary action please.
3. Mr. Gyem Dorji, Project coordinator, for information and necessary action.
4. Mr. Karma Chogyel, Environmental Specialist, ADB TA 7633 for information.
5. Mr. Rajesh Pradhan, Social/Resettlement Specialist, ADB TA 7633 for information.
6. Land Record Officer(s), Bumthang /Trashigang /Sarpang Dzongkhag for information and necessary assistance.
7. Dzongkhag Engineer(s), Bumthang /Trashigang /Sarpang Dzongkhag for kind information and necessary assistance.
8. Dzongkhag Survey Officer, Bumthang /Trashigang /Sarpang Dzongkhag for kind information and necessary assistance

## 2. Letter to Geogs from Dzongkhag



ROYAL GOVERNMENT OF BHUTAN  
DZONGKHAG ADMINISTRATION  
TRASHIGANG

ཡིག་ཡང་དྲི་ཞེ་གི་ཡི་ཞེ་ཡི་ཞེ་ ༢༦/༢༠༡༡/ 706

སྤྱི་ཚེས ༠༤-༠༤-༢༠༡༡

༄ བཀའ་ལུང་དང་ ལ་སྒྲིང་ཆོས་ལྷན་ལུ། རོན་དག་ དེ་ནི་ ཡོན་ལུ་ལ་ གནམ་གྱུ་ཐང་གྱུ་བསྐྱེད་ ལས་འགུལ་གྱི་དོན་  
ལས་ མི་སེར་ཚུ་ལས་ བསམ་འཆར་བསྟུ་ལེན་གྱི་དོན་ལུ་ རྒྱལ་ས་ལྷེ་བ་ལས་ འགོ་དཔོན་དག་པ་གཅིག་འོང་དོ་ཡོད་པ་ལས་ དེ་  
བསྐྱར་ ཁྱེད་ཆོས་ལྷན་ལུ་འགོ་འདྲན་ཐོག་ གོ་གསལ་རམ་ཚུ་གང་དུག་འབད་དགོ་པ་ཡིད་མངའ་འཆོལ།

(ཕུར་པ་དོན་མེད་)  
ཚུང་བདག་རོཝ་བ།





གསལ་སྤང་རྫོང་ཁག་།

**DZONGKHAG ADMINISTRATION**

**SARPANG SHOMPANGKHA-DZONG**



ଉତ୍ତରା  
ଶିଖା ଶ୍ରୀ ଶ୍ରୀ ଶ୍ରୀ

ਭੀਸ਼ਮ- ਕਾਮਾਖੰਡ/ਸਧਾਰਣੇ/੩੩-੨੦੨੨-੨੦੨੩/ ੮੫੫

ရက်စွဲ: ၁၈/၂/၂၀၂၂

[illegible]

(ཀྱུ་མཐུང་དཔང་འཛུལ་)

35-

၁၃ ရဲဘော်လေးများအား ရဲဘော်အဖွဲ့အစည်းများ

## 3. No Objection Letters

a) Chhoekhor Geog, Bumthang

(3) གནོད་པ་ལྔ་པ་མཆོག་གི་ཕྱུ་  
 (31

ལུང་ལྔ་

གཏོ་གྲི་ མཁའ་ རྩོམ་མཆོག་ ལྟ་བུ་ལྟ་  
 གཏོ་གྲི་ གཏོ་གྲི་ བཅས་ཀྱི་མི་མེད་མེད་ལྟ་  
 ལྟ་ སྐད་ཀྱི་ལྟ་ལྟ་ བཅས་ཀྱི་ལྟ་ལྟ་  
 གནོད་པ་ བཅས་ཀྱི་ལྟ་ མཆོག་གི་ལྟ་  
 ལྟ་ལྟ་ལྟ་ལྟ་ ལྟ་ལྟ་ལྟ་ལྟ་

སྐད་ཀྱི་ལྟ་ ལྟ་ ལྟ་ ལྟ་ ལྟ་

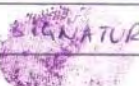

























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## FOCUS GROUP DISCUSSION





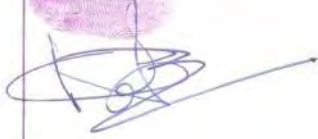
DATE: -28.7.2011

GENRE:- CHOEKOR

DZONG KHAG:- BUMTHANG. (01)


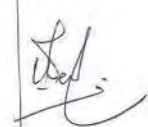





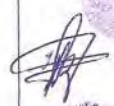

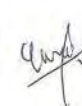

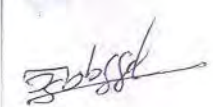
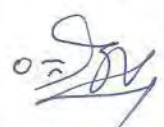
SL.NO	NAME	AGE	SEX	SIGNATURE
1	Pema Lhamo (Tekar)	55	F	
2	Ugyen Dema (Kenchosum)	30	F	
3	Tshomo (Tamshing)	35	F	
4	Sangjam (Tekarshong)	56	F	
5	Tshering Choki (Kenchosum)	53	F	
6	Kiley Dema ( " )	32	F	
7	Dechen Sayden ( " )	60	F	
8	Tshering Pema (Tekarshong)	31	F	
9	Sangjam Choden ( " )	22	F	
10	<del>Chetkeymo</del> Chetkeymo ( " )	47	F	
11	Karma ( " )	53	F	
12	Tashi Chenzo ( " )	30	F	
13	Ugyen Wangmo ( " )	20	F	
14	Rinzin Wangmo (Tamshing)	26	F	
15	Rinchen Dema (Tekarshong)	43	F	
16	Soram ( " )	32	F	
17	Yeshay Tshomo (Kenchosum)	22	F	
18	Soram Dema ( " )	25	F	
19	Ugyen Chaden (Tamshing)	27	F	
20	Tenzin Lhamo (Kenchosum)	44	F	
21	Tenzin (Tekarshong)	52	M	
22	Dorji (Kenchosum)	75	M	
23	Tawla ( " )	63	M	
24	Rinchen Phurpa ( " )	72	M	
25	Tshewang Rinzin ( " )	25	M	
26	Rinchen (Kenchosum)	39	M	


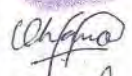
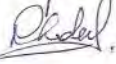















(02)

SL NO	NAME	AGE	SEX	SIGNATURE
27	Tashi Tenzin (Tamzhing)	30	M	
28	Samthamo (Kharsum)	25	F	
29	Pema Yangchen (Tamshing)	31	F	
30	Yeshey Lhamo (Kharsum)	26	f	
31	Sherab Wangdi (Tamshing) (Tshokpa)	77	M	





Sl no.	Name	Age	Sex	Village	Signature
19	Gembo Dorji	33	M	Shingchengonpa	
20	Ugyen Tenzin	37	M	"	
21	Pema Tshering	36	M	"	
22	Thinley	35	M	"	
23	Soram	41	M	Tshokama (0 point)	
24	Sangay Thinley	63	M	"	
25	Ugyen Phuntsok	52	M	Shingchengonpa	
26	Nawang Dorji	53	M	Yonphula	
27	Soram	42	M	Shingchengonpa	
28	Samdrup	37	M	Tshokama (0 point)	
29	Daynagla	76	M	Yonphula	
30	Tshewang <del>Soram</del> Tobgy	66	M	Yonphula	
31	Zepa	67	M	Yonphula	

Sl.no.	Name	Age	Sex	Village	Signature
1	Ugyen Lhamo	35	F	Yonphula Lachang	
2	Ugyen Lhamo	26	F	Brangsamtsam Gonpa	
3	Nawang Choden	36	F	Shingchengonpa	
4	Cheni Wangmo	25	F	"	
5	Tshering Dama	29	F	Yonphula	
6	Ugyen Zangmo	60	F	Yonphula	
7	Tendi	35	F	Shingchengonpa	
8	Leki Dama	22	F	"	
9	Sonam Chaden	47	F	Yonphula	
10	Dorji Lhamo	47	F	Yonphula	
11	Sonam Deki	32	F	Yonphula	
12	Ugyen Zangmo	26	F	Yonphula	
13	Ugyen Namgay	26	M	Shingchengonpa	
14	Tshering Pem	28	F	"	
15	Yangzom	28	F	Yonphula	
16	Sonam Chaden	37	F	Yonphula	
17	Kezang	36	M	Yonphula	
18	Phurpa Dorji	49	M	Shingchen Gonpa	

S/no.	Name	Age	Sex	Village	Signature.
32	Nawang Tenzin	36	M.	Shing Chen Gonpa.	



c) **Samtenling/Bhur Geog, Sarpang Dzongkha**

གསལ་སྤྱོད་ལག་  
SARPANG DZONGKHAG  
བསམ་གཏན་གྱི་རྒྱུ་ལྟར་ལྟ་སྟངས་ལྟར་

GEOG ADMINISTRATION, SAMTENLING

SD/SG/ Pa-1-(13)2010-2011/ 59

Date: 21/ 08/2011

Dasho Dzongdag,  
Dzongkhag Admn.,  
Sarpang.

Subject : Minutes of public discussion.

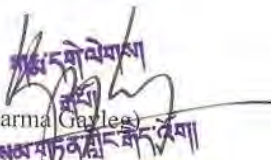
Dasho,

This is to inform you that upon the request of a team of ADB Consultants led by Mr. Karma and Mr. Rajesh Pradhan from Thimphu, public meeting was conducted at the gewog centre on 21st August 2011. During the meeting issues related to Airport development and its impact were discussed. Out of a total of 128 residents, 20-25 residents were from the Airport affected area and they discussed on behalf of those who could not be present at the meeting. Their grievances were jointly discussed with the consultants and other concerned senior citizens of the geog. The consultants recorded individual cases and after completing their formalities assured the people that their grievances shall be taken as priority basis and will inform on further developments.

Submitted for Dasho's kind notice and information.

Thanking you.

Yours faithfully,

  
(Karma Gayles)  
བསམ་གཏན་གྱི་རྒྱུ་ལྟར་ལྟ་སྟངས་ལྟར་  
Cc: གསལ་སྤྱོད་ལག་ ADB Consultants, for their information.



Name list of Person those who are attend Di-  
the meeting about Nhamoluthang. 20/12/2011

<u>No.</u>	<u>Names</u>	<u>Village</u>	<u>Sig.</u>
①	Pasupati Bonjan -	Dzonglithang.	Ng
②	Rajesh Sangrola -	-11-	ful
③	Tilarupa -	-11-	
④	Mohan Singh Newar	-11-	ful
⑤	Mohaulal Pradhan	-11-	ful
⑥	Nimalchamo	-11-	ful
⑦	Ram Chandra Leming	Lemathang.	ful
⑧	Kingin Zangmo -	-11-	ful
⑨	Gaysay Dulpa -	Lekithang.	ful
⑩	Dilliram Lepcha - Rai.	-11-	ful
⑪	Ugyen -	-11-	ful
⑫	Dhanbir Lepcha -	-11-	ful
⑬	Bhadra Maya Cheung	-11-	ful
⑭	Dorji Tamang	-11-	ful
⑮	Nir Maya Tamang	-11-	ful
⑯	Pancham Rai -	-11-	ful
⑰	Indra Rai -	-11-	ful
⑱	Cal Bor Newar	Dzonglithang	ful
⑲	Makar Singh Gurung	-11-	ful
⑳	Mohaulal Pradhan	-11-	ful
	Ramlal Kumar -	Lekpa	ful
	Ganga Bir Rai	Dzonglithang.	ful
	USha		ful



	Name	Village	Engine
1	Phuntsho Dorji	Pekithung Khemay	<i>Ph</i>
2	Karsingh Mongar	"	<i>Karsingh</i>
3	Karma yeden	"	<i>Karma</i>
4	Kado	"	<i>Kado</i>
5	KN Khatsiwar	"	<i>Kh</i>
6	Manath Khattal	"	<i>Manath</i>
7	Dhanapiti Khattal	"	<i>Dhan</i>
8	Tshawang Peden	"	<i>Tshawang</i>
9	Tenzin Thunsey	"	<i>Tenzin</i>
10	Thukten Nanda	"	<i>Thukten</i>
11	Kuenzang choden	"	<i>Kuenzang</i>
12	Deki Khaden	"	<i>Deki</i>
13	Sungay Wangdi	"	<i>Sungay</i>
14	Nima	"	<i>Nima</i>
15	Namgay Rinzin	"	<i>Namgay</i>
16	Karma Tshedup	"	<i>Karma</i>
17	Tshering Zedrup	"	<i>Tshering</i>
18	Santi Ram Khattal	"	<i>Santi Ram</i>
19	Teka Ram Khattal	"	<i>Teka Ram</i>
20	Lachi Maya Ghanara	"	<i>Lachi</i>
21	Yanka	"	<i>Yanka</i>
22	Sungay Norbu	"	<i>Sungay</i>
23	Ghang Dema	"	<i>Ghang</i>
24	Zhang Jachu	"	<i>Zhang</i>
25	Phanma Sengye	"	<i>Phanma</i>
26	Sonam Dzakpa	"	<i>Sonam</i>
27	Rinzen	"	<i>Rinzen</i>

	<div> <div>DATE</div> <div>PAGE NO.</div> </div> Rebithang' Khelood
1	Gashu Gobgar <del>Doi</del>
2	Penjor <del>Doi - Gung</del>
3	Ishering Doi <del>Doi</del>
4	Iara Btr Gung <del>Doi</del>

#### 4. Other Key Stakeholders or Officials Consulted

Sl. No.	Name	Designation	Department/Agency
1	Karma Wangchuk	Joint Director	Department of Civil Aviation (DCA)
2	Gembo Dorji	Project Coordinator	Gelephu Airport Project, DCA
3	Pem Tshering	Project Coordinator	Bumthang Airport Project, DCA
4	Sangay Thinlay	Dasho Dzongdag	Bumthang Dzongkhag
5	Tenzin Wangmo	Offt. Dzongda/Planning Officer	Bumthang Dzongkhag Administration
6	Kinzang Lhendup	Land Record Officer	Bumthang Dzongkhag Administration
7	Gaylong	Dzongkhag Agriculture Officer	Bumthang Dzongkhag Administration
8	Sacha Gyeltshen	Dzongkhag Cultural Officer	Bumthang Dzongkhag Administration
9	Cheki Tashi	Dzongkhag Engineer	Bumthang Dzongkhag Administration
10	Tenzin	Dy. Chief Statistical Officer	Bumthang Dzongkhag Administration
11	Dhendup Tshering	Chief Forest Officer	Range Office, Department of Forests and Park Services
12	Jigme Dorji	Geog ADM	Chhokhor Geog, Bumthang
13	Pema Doengyel	Gaydrung/Geog Clerk	Chhokhor Geog, Bumthang
14	Jigme Wangchuk	Program Director	RNR-RDC, Jakar, Bumthang
15	Jambay Gyeltshen	Programme Director	National Feed and Fodder Development Programme
16	Tshewang Penjor	Farm Manager	Brown Swiss Cattle Farm, National Horse and Brown Swiss Cattle Breeding Programme
17	Ugyen Tshewang	Livestock Supervisor/Diary Incharge	Brown Swiss Cattle Farm, National Horse and Brown Swiss Cattle Breeding Programme
18	Gembo	Khenpo	Pedtsheling Goenpa, Bumthang
19	D.S. Rai	Chief Forestry Officer	Wangchuck Centennial Park, Bumthang
20	Phub Dorji	Officiating Dzongdag	Trashigang Dzongkhag
21	Tsheten Dorji	Land Record Officer	Trashigang Dzongkhag Administration
22	Dewan Subha	Surveyor	Trashigang Dzongkhag Administration
23	Tandin Dorji	Environment Offier	Trashigang Dzongkhag Administration

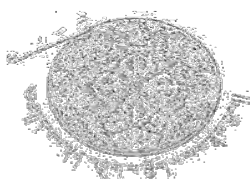
24	Karma Wangdi	Geog ADM	Kanglung Geog, Trashigang
25	Kinzang Tobgay	Mangmi	Kanglung Geog, Trashigang
26	Hanchung	Gaydrung	Kanglung Geog, Trashigang
27	Kunzang Tenzin	Communication Assistant	Yongphula Airport
28	Sherab Gyeltshen	Foreman	Yongphula Airport
29	Kunzang Dorji	Dasho Dzongdag	Sarpang Dzongkhag
30	Sangay Tshering	Officiating ADM	Sarpang Dzongkhag Administration
31	Ugyen	Land Record Officer	Sarpang Dzongkhag Administration
32	Tenzin Dorji	Officiating Drungpa	Gelephu Drungkhag Administration
33	Jamtsho	Land Record Assistant	Gelephu Drungkhag Administration
34	Chencho Nidup	Range Officer,	Range Office, Gelephu
35	Sangay Lhajay	Forester	Range Office, Gelephu
36	B.M. Rai	Forester	Range Office, Gelephu
37	Sonam Wangdi	Officiating Park Manager	Royal Manas National Park, Gelephu
38	Pema Wangdi	Site Incharge	Gelephu Airport Construction
39	Karma Galeg	Gup	Samtenling Geog, Sarpang Dzongkhag
40	Chandralal Khatiwari	Tshogpa	Samtenling Geog, Sarpang Dzongkhag
41	Tashi	Gup	Gelephu Geog, Sarpang Dzongkhag



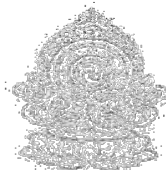


## Appendix E: Environmental Clearances Issued for RGOB Components

### 1. Environmental Clearance for Bumthang Airport (Bathpalathang)



འབྲུག་རྒྱལ་ཁབ་འཛུགས་གཞིར་གནས་པའི་འབྲུག་རྒྱལ་ཁབ་འཛུགས་ཀྱི་འཕྲུལ་གཞི་ལྷན་ཁག་  
 National Environment Commission  
 Royal Government of Bhutan



NEC/ESD/MOIC/1960(Bathpalathang)/2012/27/17

26 January 2011

### ENVIRONMENTAL CLEARANCE

The National Environment Commission (NEC) is pleased to issue environmental clearance in respect of Director General, Department of Civil Aviation as per the decision of the Environmental Assessment Technical Committee during its meeting on 13 January 2012 for the construction of Domestic Airport at Bathpalathang under Bumthang Dzongkhag with following terms and conditions;

1. As per section 28.3 of the Regulation for the Environmental Clearance of Projects, 2002; any modification of proposal/application shall take place only with prior approval from NEC;
2. The holder shall ensure that construction of Airport is in line with the National Environment Protection Act 2007, Environmental Assessment Act 2000 & its Regulation 2002, Waste Prevention and Management Act of Bhutan 2009, The Water Act of Bhutan 2011, Forest and Nature Conservation Act 1993, its Regulation 2006 & amended Rules 2008 and any other acts and regulations that have direct or indirect relevance to the project;
3. The holder shall ensure that construction of the Airport comply with Environmental Standards 2010;
4. The holder shall ensure compliance to all the terms and conditions of stakeholder clearances at all times;
5. The holder shall ensure that this environmental clearance is valid only for construction of Domestic Airport;
6. The holder shall ensure that the activity is confined within the leased area only;
7. The holder shall be solely responsible to resolve any disputes that arise due to the construction of Airport;
8. The holder shall ensure that the activity does not affect the public, private parties, religious/historical sites and aesthetics of the surrounding area;
9. The holder shall ensure that the construction of Airport conforms to the International Civil Aviation Standards, Safety Rules and Norms;
10. The holder shall ensure that the construction and operation of the airport does not affect/pollute the river at all times;
11. The holder shall ensure that the construction site is completely barricaded prior to commencing any activity at the site;
12. The holder shall ensure that the water resources in the vicinity of the project area are properly managed. Further, the following activities are prohibited:
  - (a) Blocking, storing or diverting any river, stream, irrigation channel, water fall, underground water or any other water resources.
  - (b) Discharging effluents or wastes of any form into any water resources or water bodies.

- banks of Chamkharchhu as proposed in the Environmental Assessment Report;
14. The holder shall ensure that compliance to the flight path management as proposed in the Environmental Assessment Report to minimize disturbance to wildlife in the Wangchuck Centennial Park;
  15. The holder shall ensure that excavated top soils are stored separately within the leased area and protected from wind and rain for use during landscaping and revegetation;
  16. The holder shall ensure that extra excavated spoil materials are loaded, hauled and dumped at the preidentified / approved dump sites;
  17. The holder shall ensure that adequate protection structures/check dams are constructed at the dump sites prior to dumping any materials to avoid downstream environmental damages;
  18. The holder shall ensure that dump sites are stabilized, landscaped and vegetated with local plant species and landscaping to prevent potential soil erosion and to blend in with the surrounding environment;
  19. The holder shall ensure the construction of side drains, cross drains, causeways, culverts and other supporting structures such as retaining and breast walls at all required areas along the approach road to prevent soil erosion/landslide, improve usability and sustainability of the road;
  20. The holder shall ensure that electrical power lines are laid underground with adequate insulation;
  21. The holder shall ensure that adequate facility is put in place for the treatment of sewage and other liquid wastes prior to their discharge into the surrounding environment;
  22. The holder shall ensure that adequate drains and channels are constructed for proper storm water drainage;
  23. The holder shall ensure that felling of trees, if required are done only upon obtaining approval from the concerned Division/Office of the Department of Forest and Park Services;
  24. The holder shall ensure that dusts generated during the construction are adequately suppressed by spraying water and screening of working areas as proposed to minimize their impact on human health and surrounding area;
  25. The holder shall ensure that blasting is strictly prohibited;
  26. The holder shall ensure that general housekeeping, cleanliness, hygiene and sanitation are maintained around the compound at all the time;
  27. The holder shall ensure that adequate sanitation facility is provided for workers and employees;
  28. The holder shall ensure that wastes generated from the labour camps and site offices are managed as required under the Waste Prevention and Management Act of Bhutan 2009 and littering is avoided at all times;
  29. The holder shall ensure that biodegradable wastes (non-toxic) generated during the construction and operation are properly collected and disposed-off at designated facilities and sites;
  30. The holder shall ensure that non-biodegradable waste (such as used oil and metallic pieces) are stored and disposed off at approved sites;

31. The holder shall ensure that all the measures, norms and standards mentioned in the

32. The holder shall ensure that adequate fire fighting facilities are installed and their expiry dates are checked and kept valid at all times;
33. The holder shall ensure that plantations are carried out at the periphery upon consultation with concerned offices of the Department of Forest and Park Services to maintain greenery and visual aesthetics;
34. The holder shall ensure that adequate safety gadgets and outfits are provided to all the workers and any other person entering the plant such as safety helmets, eye goggles, breathing masks, ear muffs, safety boots, etc.;
35. The holder shall ensure that underage workers are never employed;
36. The holder shall ensure that first aid-kit is made available at the site;
37. The holder shall ensure that safety signs are posted at the strategic locations within the area with sign boards indicating areas where specific safety gadgets are required;
38. The holder shall ensure that signboard is erected at the main entrance to the Airport showing the name of the project and its contact address;
39. The holder shall ensure that a copy of the environment clearance is framed and displayed at the workplace at all times;
40. The holder shall ensure that this environmental clearance is renewed at least 1 (one) month prior to its expiry in case the construction is not completed within the specified validity period;
41. The holder shall ensure strict implementation of the terms and conditions of this environmental clearance at all times;

*Failure to comply with any of the above terms and conditions shall constitute an offence under the Environmental Assessment Act 2006, its Regulations 2002, the National Environment Protection Act 2007 and any other relevant laws. Penalties for such offences shall include but not limited to suspension and/or revocation of environmental clearance in part or whole without any liability on the part of the Royal Government.*

This environmental clearance is valid up to 25 January 2013 and is subject to review and changes.

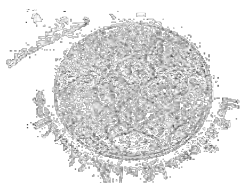


*[Signature]*  
 Office Head  
 Environment Services Division

To,  
 The Director General  
 Department of Civil Aviation  
 Ministry Of Information and Communication  
 Para

Copy to:

## 2. Environmental Clearance for Yongphula Airport



ལྷན་ཁོངས་མཐུན་འཛིན་གནས་སྡེ་ལྷན་ཁོངས་  
 རྒྱལ་ཁྲིམས་ལྷན་ཁོངས་  
**National Environment Commission**  
 Royal Government of Bhutan



NEC/ESD/MOICA/1960 (Yongphula)/2012/2918

26 January 2011

### ENVIRONMENTAL CLEARANCE

The National Environment Commission (NEC) is pleased to issue environmental clearance in respect of Director General, Department of Civil Aviation as per the decision of the Environmental Assessment Technical Committee during its meeting on 13 January 2012 for the construction of Domestic Airport at Yongphula under Trashigang Dzongkhag with following terms and conditions:

1. As per section 28.3 of the Regulation for the Environmental Clearance of Projects, 2002; any modification of proposal/application shall take place only with prior approval from NEC;
2. The holder shall ensure that construction of Airport is in line with the National Environment Protection Act 2007, Environmental Assessment Act 2000 & its Regulation 2002, Waste Prevention and Management Act of Bhutan 2009, The Water Act of Bhutan 2011, Forest and Nature Conservation Act 1995, its Regulation 2006 & attended Rules 2008 and any other acts and regulations that have direct or indirect relevance to the project;
3. The holder shall ensure that construction of the Airport comply with Environmental Standards 2010;
4. The holder shall ensure compliance to all the terms and conditions of stakeholder clearances at all times;
5. The holder shall ensure that this environmental clearance is valid only for construction of Domestic Airport;
6. The holder shall ensure that the activity is confined within the leased area only;
7. The holder shall be solely responsible to resolve any disputes that arise due to the construction of Airport;
8. The holder shall ensure that the activity does not affect the public, private parties, religious/historical sites and aesthetics of the surrounding area;
9. The holder shall ensure that the construction of Airport conforms to the International Civil Aviation Standards, Safety Rules and Norms;
10. The holder shall ensure that the protection wall as proposed in the Environmental Assessment Report is constructed around the Yongphula lake to avoid pollution and contamination of the lake due to construction and operation of the airport;
11. The holder shall be solely responsible to ensure cleanliness of the Yongphula lake at all times;
12. The holder shall ensure that the construction site is completely barricaded prior to commencing any activity at the site;
13. The holder shall ensure that the water resources in the vicinity of the project area are properly managed. Further, the following activities are prohibited:
  - (a) Blocking, stoning or diverting any river, stream, irrigation channel, water fall, underground water or any other water resources.

- (b) Discharging effluents or wastes of any form into any water resources or water bodies.
14. The holder shall ensure that excavated top soils are stored separately within the leased area and protected from wind and rain for use during landscaping and revegetation;
  15. The holder shall ensure that extra excavated spoil materials are loaded, hauled and dumped at the preidentified / approved dump sites;
  16. The holder shall ensure that adequate protection structures/check dams are constructed at the dump sites prior to dumping any materials to avoid downstream environmental damages;
  17. The holder shall ensure that dump sites are stabilized, landscaped and vegetated with local plant species to prevent potential soil erosion and to blend in with the surrounding environment;
  18. The holder shall ensure the construction of side drains, cross drains, causeways, culverts and other supporting structures such as retaining and breast walls at all required areas along the approach road to prevent soil erosion/landslide, improve usability and sustainability of the road;
  19. The holder shall ensure that electrical power lines are laid underground with adequate installation;
  20. The holder shall ensure that adequate facility is put in place for the treatment of sewage and other liquid wastes prior to their discharge into the surrounding environment;
  21. The holder shall ensure that adequate drains and channels are constructed for proper storm water drainage;
  22. The holder shall ensure that felling of trees, if required are done only upon obtaining approval from the concerned Division/Office of the Department of Forest and Park Services;
  23. The holder shall ensure that dusts generated during the construction are adequately suppressed by spraying water to minimize their impact on human health and surrounding areas;
  24. The holder shall ensure that blasting is strictly prohibited;
  25. The holder shall ensure that general housekeeping, cleanliness, hygiene and sanitation are maintained around the compound at all the time;
  26. The holder shall ensure that adequate sanitation facility is provided for workers and employees;
  27. The holder shall ensure that wastes generated from the labour camps and site offices are managed as required under the Waste Prevention and Management Act of Bhutan 2009 and littering is avoided at all times;
  28. The holder shall ensure that biodegradable wastes (non-toxic) generated during the construction and operation are properly collected and disposed-off at designated facilities and sites;
  29. The holder shall ensure that non-biodegradable waste (such as used oil and metallic pieces) are stored and disposed-off at approved sites;
  30. The holder shall ensure that 3R (Reduce, Reuse and Recycle) principle is adopted for waste management;
  31. The holder shall ensure that adequate fire fighting facilities are installed and their expiry dates are checked and kept valid at all times;

32. The holder shall ensure that plantations are carried out at the periphery upon consultation with concerned offices of the Department of Forest and Park Services to maintain greenery and visual aesthetics;
33. The holder shall ensure that adequate safety gadgets and outfits are provided to all the workers and any other person entering the plant such as safety helmets, eye goggles, breathing masks, ear muffs, safety boots, etc.;
34. The holder shall ensure that underage workers are never employed;
35. The holder shall ensure that first aid kit is made available at the site;
36. The holder shall ensure that safety signs are posted at the strategic locations within the area with sign boards indicating areas where specific safety gadgets are required;
37. The holder shall ensure that signboard is erected at the main entrance to the Airport showing the name of the project and its contact address;
38. The holder shall ensure that a copy of the environment clearance is framed and displayed at the workplace at all times;
39. The holder shall ensure that this environmental clearance is renewed at least 1 (one) month prior to its expiry in case the construction is not completed within the specified validity period;
40. The holder shall ensure strict implementation of the terms and conditions of this environmental clearance at all times;

*Failure to comply with any of the above terms and conditions shall constitute an offence under the Environmental Assessment Act 2000, its Regulations 2002, the National Environment Protection Act 2007 and any other relevant laws. Penalties for such offences shall include but not limited to suspension and/or revocation of environmental clearance in part or whole without any liability on the part of the Royal Government.*

This environmental clearance is valid up to 23 January 2013 and is subject to review and changes.



*[Signature]*  
 Offg. Head  
 Environment Services Division

To;  
 The Director General  
 Department of Civil Aviation  
 Ministry of Information and Communication  
 Pano

Copy to:

### 3. Environmental Clearance for Gelephu Airport



ཀྲུལ་ཡོངས་མཐའ་འཁོར་གནས་སྤངས་ལྷན་ཚོགས།  
 དཔལ་ལྷན་འབྲུག་གཞུང་།  
**National Environment Commission**  
 Royal Government of Bhutan



NEC/ESD/DCA/2011/ 375

22 June 2011

#### Environmental Clearance

The National Environment Commission (NEC) is pleased to issue environmental clearance in respect of Director General, Department of Civil Aviation as per the decision of the Environmental Assessment Technical Committee during its meeting on 16 June 2011 for the construction of Domestic Airport at Bhur (Samteling), Gelephu Gewog, Sarpang Dzongkhag with following terms and conditions;

1. As per section 28.3 of the Regulation for the Environmental Clearance of Projects, 2002; any modification of proposal/application shall take place only with prior approval from NEC;
2. The holder shall ensure that construction of Airport is in line with the National Environment Protection Act 2007, Environmental Assessment Act 2000 & its Regulation 2002, Waste Prevention and Management Act of Bhutan 2009, Forest and Nature Conservation Act 1995, its Regulation 2006 & amended Rules 2008 and any other acts and regulations that have direct or indirect relevance to the project;
3. The holder shall ensure that construction of the Airport comply with Environmental Standards 2010;
4. The holder shall ensure compliance to all the terms and conditions of stakeholder clearances at all times;
5. The holder shall ensure that this environmental clearance is valid only for construction of Domestic Airport;
6. The holder shall ensure that the activity is confined within the leased area only;
7. The holder shall ensure that the construction of Airport conforms to the International Civil Aviation Standards, Safety Rules and Norms;
8. The holder shall ensure that airport runway is limited between Sanu Auipoli and Thrulo Auipoli streams;
9. The holder shall be solely responsible to resolve any disputes that arise due to the construction of Airport;
10. The holder shall ensure that the activity does not affect the public, private parties, religious/historical sites and aesthetics of the surrounding area;
11. The holder shall ensure that the construction site is completely barricaded prior to commencing any activity at the site;
12. The holder shall ensure that the water resources in the vicinity of the project area are



NEC, PO Box 466, Thimphu, Bhutan  
 (975-2) 323384/325856/324323/326993 Fax: (975-2) 323385  
 www.nec.gov.bt

*[Handwritten signature]*



properly managed. Further, the following activities are prohibited:

- (a) Blocking, storing or diverting any river, stream, irrigation channel, water fall, underground water or any other water resources.
  - (b) Discharging effluents or wastes of any form into any water resources or water bodies.
13. The holder shall ensure that excavated top soils are stored separately within the leased area and protected from wind and rain for use during landscaping and revegetation;
  14. The holder shall ensure that excavated spoil materials (sub soil and sub grade) are used for river protection works as stated in Figure 5.1 of the Environmental Assessment Report;
  15. The holder shall ensure that extra excavated spoil materials are loaded, hauled and dumped at the preidentified / approved dump sites;
  16. The holder shall ensure that dump sites are provided adequate protection structures/check dams prior to dumping of any materials to avoid downstream environmental damages;
  17. The holder shall ensure that dump sites are stabilized and vegetated with local plant species to prevent potential soil erosion and to blend in with the surrounding environment;
  18. The holder shall ensure that approach road and tapping of the electrical power line is done as specified in the site plan;
  19. The holder shall ensure that approach road is constructed over the embankment adjacent to river protection structures;
  20. The holder shall ensure the construction of side drains, cross drains, causeways, culverts and other supporting structures such as retaining and breast walls at all required areas along the approach road to prevent soil erosion/landslide, improve usability and sustainability of the road;
  21. The holder shall ensure that electrical power lines are laid underground with adequate insulation;
  22. The holder shall ensure that adequate facility is put in place for the treatment of sewage and other liquid wastes prior to their discharge into the surrounding environment;
  23. The holder shall ensure that adequate drains and channels are constructed for proper storm water drainage;
  24. The holder shall ensure that felling of trees, if required are done only upon obtaining approval from the concerned Division/Office of the Department of Forest and Park Services;
  25. The holder shall ensure that dusts generated during the construction are adequately suppressed by spraying water to minimize their impact on the surrounding area;
  26. The holder shall ensure that blasting is strictly prohibited;





43. The holder shall develop detailed implementation plan (DIP), focusing on the implementation of terms and conditions of this environmental clearance and submit to NEC within 3 (three) months from the date of issue;
44. The holder shall ensure strict implementation of the terms and conditions of this environmental clearance at all times;

*Failure to comply with any of the above terms and conditions shall constitute an offence under the Environmental Assessment Act 2000, its Regulations 2002, the National Environment Protection Act 2007 and any other relevant laws. Penalties for such offences shall include but not limited to suspension and/or revocation of environmental clearance in part or whole without any liability on the part of the Royal Government.*

This environmental clearance is valid up to **21 June 2012** and is subject to review and changes.

*Thinley Dorji*  
(Thinley Dorji)  
Offg. Head

**Environment Services Division**

To,  
The Director General  
Department of Civil Aviation  
Ministry Of Information and Communication  
Paro

Copy to:

1. The Team Leader, Monitoring Team, NEC, Thimphu for necessary action.
2. The Dzongkhag Environment Officer, Dzongkhag Administration, Sarpang for necessary action.

