ANNEX 6 – ENVIRONMENT

A. Introduction

1. The earthquake hit an area of extreme environmental vulnerability within Pakistan. The earthquake-affected areas in the North West Frontier Province (NWFP) and Azad Jammu and Kashmir (AJK) are located in the Himalayan mountain range. The ecology of the area can be described broadly as being Himalayan moist temperate and Himalayan dry temperate zones. The area is covered with pine and broad leaved trees and is rich in natural resources and biodiversity. Forests, game reserves, rivers with low water temperature, lakes and wetlands characterize the landscape. Around 4 percent of the land area in AJK has been declared as protected area. The Machiara National Park is located in the heart of the earthquake affected area. In NWFP, about 6% of the land area is designated as protected, with the Ayubia National Park located at the periphery of the earthquake affected zone. The two main rivers in the affected area in AJK are the Neelum and Jhelum rivers, while the Kunhar river falls within the affected zone of NWFP. As a result of the steep terrain and excessive deforestation, landslides are a regular occurrence. Urban development has generally occurred with little or no environmental controls and a high proportion of the population lives in shelters and neighborhoods with virtually no basic services and facilities like clean drinking water and safe disposal of liquid and solid wastes.

2. The mission team visited the affected districts of NWFP and AJK and consulted with federal, provincial and regional government officials involved in environment and natural resource management as well as NGOs and international organizations that have been working on conservation issues in the affected areas.

B. Damage Overview and Recovery Needs

3. Although the dominant losses from the earthquake were to humans and structures, this event has also resulted in adverse impacts on the environment. Examples are flora and fauna damaged as a direct result of the earthquake and its numerous aftershocks, shifts in land surfaces, and alterations in local hydrologic systems. However, losses to ecosystems and environmental assets are very difficult to estimate. There are no rapid assessment methods available to quantify the environmental or ecosystem losses that result from earthquakes or other natural disasters without detailed surveys, because ecosystem impacts are not evident in the immediate aftermath of the event. Therefore, a qualitative assessment of the environmental and ecosystem impacts has been attempted at this stage.

4. ***Debris and rubble disposal.*** The most visible consequence of the earthquake is the enormous amount of debris and rubble resulting from damaged and destroyed structures. Disposal of rubble in rural areas, where structures are constructed of mud (*kaccha* houses) and stones (*pucca* houses), presents a different challenge than in urban areas, given that the amount of rubble is much less than in urban areas and it is spread out, making the task more complex. Considering that there will be large quantities of material that can be salvaged for reconstruction, the disposal problem is far less significant than in urban areas. There was evidence of haphazard dumping of debris and rubble in rivers adjacent to the cities. This has serious environmental consequences, not only to water quality, but for clogging of waterways with potential downstream flooding impacts. In addition, there were signs of debris/rubble being disposed of alongside roads, in open fields and drainage ditches, and forested areas. This practice of uncoordinated and unauthorized dumping should be stopped immediately and a more systematic and planned approach adopted.

5. It is virtually impossible to make accurate determinations of the amount of material requiring disposal at this stage. However, based on data from similar disasters and a preliminary assessment of the

structural damage conducted by AUSAID, it is estimated that the amount of debris and rubble resulting from damaged structures could be as high as 200 million tons.

Urban Environmental Issues

6. ***Sewage and wastewater collection and disposal.*** There were no proper sewage and wastewater collection and treatment systems in any of the urban areas affected by the earthquake, except for a sewage collection system in Muzaffarabad. The cities of Bagh, Rawalakot and Balakot did have systems of rudimentary wastewater collection in open drains. These systems have suffered structural damage and may need rehabilitation (see Water and Sanitation Annex). Untreated sewage was discharged into surface water bodies in most areas. While this practice had significant adverse public health impacts, the situation has been further aggravated by the earthquake.

7. ***Solid waste management***. Since municipal solid waste (MSW) disposal sites in the affected areas were uncontained "open dumps", the earthquake would not cause any incremental environmental pollution. But the large amounts of relief supplies in the affected areas have resulted in waste that needs to be properly managed. In addition, medical waste from hospitals poses a potential heath hazard.

8. ***Underground storage tanks***. It was estimated that 10,000 liters of petroleum fuels contained in underground storage tanks have leaked due to the earthquake. Such leakage could result in soil contamination and eventual pollution of groundwater. Monitoring may be needed to assess potential groundwater contamination. Since the main source of potable water and irrigation water is from surface sources, this impact may not be significant.

Natural Environmental Issues

9. Damage to ecosystems as a result of earthquakes is often less dramatic than structural damage. Due to the relatively slower manifestation of ecosystem damage, the practice in many affected countries has been to neglect undertaking complete environmental impact assessments of earthquake damage to ecosystems, beyond the immediate reconstruction needs. Considering that the earthquake affected areas are in fragile mountain ecosystems and were environmentally vulnerable even before the earthquake, it is critically important to undertake such an assessment.

10. ***Impacts due to landslides.*** The main environmental impacts from the earthquake to the natural environment were the result of landslides which resulted in impacts to: (i) the topography/morphology of the surface of the earth; (ii) rivers, streams, forests and grasslands; and (iii) habitats of native fauna and flora both on land and in the streams and rivers. The topography/morphology of the affected areas continues to be modified by aftershocks, some large enough to be considered earthquakes rather than tremors. The landslides resulting from the earthquake have altered the characteristics of mountain slopes and drainage basins. However, quantification of the extent of environmental damage will not be possible without a detailed analysis of high resolution imagery, yet to be obtained. The exposed soil surfaces appear to be in a state of dry equilibrium at present. However, a second phase of landslides is likely with the onset of the rains and spring snow melts. Until a detailed survey is conducted, the cost of measures to stabilize exposed surfaces cannot be estimated. Additional resources may be required to address the additional damage to the environment, infrastructure and livelihoods caused by this anticipated second phase of landslides.

11. ***Impacts of landslides on stream and river environments.*** The landslides triggered by the earthquake and its associated aftershocks have adversely affected streams, rivers and other water bodies. The debris flows have had a significant impact on the distribution of sediments in stream and river channels, either by depositing sediment in the water channels or by transporting sediment farther

downstream, often to great distances. In addition, they have contributed to partial blockage of channels, local channel constriction below the points of landslide entry and may even have shifted channel configuration or blocked streams altogether. Increased sediment could also result in channel scour, large scale re-distribution of bed-load gravel, and accelerated channel erosion and bank undercutting. Communities have mentioned that there have been disappearances of some streams and new appearance of others. While these issues will have significant localized impacts on water quality and quantity and fish kills, which will affect communities and livelihoods, increased sediment transport will also contribute to accelerated siltation of the Mangla reservoir. Monitoring sediment transport and other adverse impacts, particularly during the spring snow melts, and taking necessary remedial measures is critical for sustainability of livelihoods of the local community. Wider economic impacts may result from reduced storage capacity at the Mangla reservoir.

12. ***Impacts on forest cover and wildlife.*** Large parts of the earthquake affected area have been denuded of forest cover over the last few decades as a result of encroachment, illegal timber felling, and agriculture. Therefore, the mountainsides have been vulnerable to landslides. The earthquake exacerbated an already bad situation with regard to forestry losses. Stripping of forest cover by landslides was visible, but not extensive and available satellite imagery was unable to quantify the extent. Large expanses of forest cover seemed undisturbed by the earthquake although trees may suffer damage during major earthquakes due to shaking or faulting of their substrate, which is not initially visible. Such damage may result in temporary asymmetric growth and/or reduction in the width of annual growth rings.

13. The greatest impact is likely to result from a 200-300% increase in timber demands for reconstruction. Although there is a ban on logging, the practice continues unabated. Unless there are proper controls in timber extraction so that it is sustainable, there can be a wave of denudation of forests. Lack of proper housing will lead to increased fuel wood demands for heating although traditionally, only branches are lopped for fuel wood. It is not possible to quantify these demands at this point due to a lack of demand data. In addition, potential for future landslides due to the instability of the hillsides may have serious implications to the sustainability of forest resources. With respect to wildlife, although most kinds of wildlife are able to retreat fast enough to prevent injury from all but the fastest moving landslides, all creatures are subject to landslide-caused habitat damage and destruction, the extent of which is unknown. Fish were probably the most affected because they depend on stream access and water quality for their survival, both of which have been adversely affected by the earthquake.

C. Reconstruction and Recovery Strategy

Approach

14. In developing a strategy for reconstruction and recovery, environment should not be considered as a separate sector because it is intricately linked to livelihoods of the affected communities because of their dependence on natural resources. In order to ensure the sustainability of the reconstruction and recovery process, environment and natural resource issues have to be an integral part of all sectoral plans, particularly on the transport, urban development and water supply and sanitation sectors. As a general rule, 3-7% should be added to overall sectoral costs for integration of environmental mitigation and management measures. While the country had little control over the adverse environmental impacts resulting from the earthquake, it will have complete control over the environmental and natural resource impacts of reconstruction.

Critical Issues

15. The most pressing environmental issues that need to be addressed are: (i) disposal of debris and rubble; (ii) sanitation, public health and solid waste disposal issues arising from the transitional housing

camps of affected persons to ensure that public health and the surrounding environment will not be adversely affected; (iii) immediate identification of alternative building construction material, where feasible, and identification of suitable resource extraction sites for housing material; and (iv) undertaking studies to quantify the ecological damage due to the earthquake and recommend mitigation/remediation measures for reversal, wherever possible.

Short-term Priority Actions

16. ***Disposal of rubble and debris.*** The most significant and immediate environmental management problem faced as a result of the earthquake is proper disposal of up to 200 tons of debris and rubble created from destroyed structures. A rubble and debris management plan is urgently needed which will have appropriate guidelines for diversion, site identification and monitoring of removal; identification of temporary sites for debris that can be diverted by recycling (crushing concrete for aggregate) and reuse (for housing, particularly in rural areas); provision of diversion incentives; permanent sites for disposal; and management of wastes arising from reconstruction. With implementation of a proper debris management program, recent disasters have shown that around 25% of rubble could be recycled and reused. If adequate machinery for crushing concrete to for aggregate is available, the diversion could be as high as 50%. As the unit cost of rubble removal, transport and disposal is around US$ 1/ton, this would result in significant additional savings in disposal costs and also preserve the environment. *Estimated cost Rs. 8.91 billion.*

17. ***High resolution imagery analysis***. Analysis of high resolution imagery so earthquake damage information for the studies is available. *Estimated cost Rs. 4.16 million.*

18. ***Identification of critical environmental and natural resource issues in the reconstruction and recovery program.*** Once the overall reconstruction and recovery strategy is identified by the Government of Pakistan, an assessment needs to be undertaken to identify the critical environmental issues, constraints and remedial measures to be integrated into reconstruction planning and implementation in order ensure sustainability of the program. *Estimated cost Rs. 2.0 million.*

19. ***Identification of resource extraction sites for sourcing building material for the reconstruction program.*** The reconstruction program will create demand for building materials such as timber, sand and quarry material (stones/rock) and clay. This could lead to haphazard sourcing of these resources creating irreversible environmental degradation, which could further increase the environmental vulnerability of the affected areas. Resource extraction sites need to be identified urgently to facilitate sustainable resource extraction with the requisite environmental safeguards. *Estimated cost Rs. 2.0 million.*

20. ***Ecological impact studies.*** The ecological impacts and losses due to the earthquake on forestry, aquatic and terrestrial ecosystems, including biodiversity need to be assessed and quantified so that remedial measures can be taken to restore damage. Land use plans for reducing vulnerability in the fragile mountain ecosystems is needed. Investments in ecosystem restoration cannot be made without detailed analysis. *Estimated cost Rs. 10.0 million.*

21. ***Short-term environmental monitoring***. Short term environmental monitoring is needed to monitor water quality in the three main rivers and other environmental parameters in order to determine an action plan on improving environmental quality and addressing siltation problems in the reservoirs. *Estimated cost Rs. 10.0 million.*

22. ***Institutional capacity building.*** Capacity in environmental management institutions in AJK and NWFP will require strengthening to cope with managing environmental issues of the reconstruction program. *Estimated cost Rs. 30.0 million.*

Medium to Long-term Priority Actions

23. ***Reconstruction of infrastructure of the forestry and wildlife sectors.*** The forestry and wildlife sectors have identified the following losses to public infrastructure: (i) *Damaged infrastructure*: 2 Rest Houses; 1 Range Quarters; 1 Forest Quarters; 1 Officer Quarters *(Sub Total Rs. 1.6 million)*; (ii) *Destroyed infrastructure* – 4 Rest Houses; 1 Range Office; 1 Residence; 1 Forest Quarters; 3 Forest Huts; 1 WL Hut; 5 Chowdikar and Peon Huts *(Sub Total 18.5 million). Estimated cost for reconstruction is Rs. 21.0 million*.

24. ***Investments in ecological restoration of the earthquake affected areas.*** Based on the findings of the ecological studies proposed above, investments in ecosystem restoration will be needed. *A budget cannot be determined until the studies are completed.*

D. Environmental Safeguards

25. An Environmental and Social Impact Assessment and Management Framework will be prepared and will be used as a guide to undertake environmental impact assessments for all rehabilitation and reconstruction activities to ensure adverse environmental impacts are minimized and appropriate mitigation measures are included in project design.

Table 1: Environmental Needs Resulting from the Earthquake Disaster (Rs. million)

Project Proposal	Short Term (18months)	Medium to Long Term (1-3 years)	Total (Rs.)
Disposal of Rubble and Debris	8,910.00		8,910.00
High Resolution Imagery Analysis	4.16		4.16
Identification of Critical Environmental and Natural Resource Issues in the Reconstruction and Recovery Program	2.00		2.00
Identification of Resource Extraction Sites for Sourcing Building Material for the Reconstruction Program	2.00		2.00
Ecological Impact Studies	10.00		10.00
Short-term Environmental Monitoring	10.00		10.00
Institutional Capacity Building	30.00		30.00
Reconstruction of Infrastructure Damages of the Forestry and Wildlife Sectors		21.00	21.00
Investments in Ecological Restoration of the Earthquake Affected Areas		Not Available until studies are completed	Not Available until studies are completed
TOTAL	**8,964.00**	**21.00**	**8,985.0**