

Summary Initial Environmental Examination

Federally Administered Tribal Areas Rural Development Project In Pakistan

March 2005

CURRENCY EQUIVALENTS

(as of 14 February 2005)

Currency Unit	–	Pakistan rupee/s (PRe/PRs)
PRe1.00	=	\$0.017
\$1.00	=	PRs59.37

ABBREVIATIONS

ADB	–	Asian Development Bank
DC	–	during construction
EMP	–	environmental management plan
EPA	–	Environmental Protection Agency
FATA	–	Federally Administered Tribal Areas
IEE	–	initial environmental examination
LA	–	line agency
O&M	–	operation and maintenance
PIU	–	project implementation unit
PMU	–	project management unit
PPTA	–	project preparatory technical assistance
SC	–	supervision consultant
SIEE	–	summary initial environmental examination

NOTE

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

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I. INTRODUCTION

1. This report presents a summary initial environmental examination (SIEE) completed in November 2004 and carried out as part of the procedures required under the Asian Development Bank's (ADB's) *Environment Policy*. The main purpose of this report is to summarize the most significant findings of the initial environmental examination (IEE) report and the recommendations proposed to manage them.

2. Prior to the development of this SIEE, a thorough environmental assessment was conducted, leading to preparation of an IEE¹ for the proposed Project. The major focus of this assessment was to concentrate on a thorough review, documentation, study, and analysis of the environmental and social aspects directly and indirectly related to the proposed project interventions. The specific guiding objectives employed during this process included (i) determining potential environmental impacts of proposed project interventions, (ii) proposing suitable mitigation and protection measures, and (iii) contributing to the enhancement of the Federally Administered Tribal Areas (FATA) Rural Development Project environment. The SIEE was conducted according to ADB environmental guidelines and the sector guidelines of the Environmental Protection Agency (EPA), Government of Pakistan. An environmental assessment and review procedures report was prepared to guide the environmental screening of each subproject and facilitate institutional arrangements and compliance with the environmental assessment requirements of ADB and the Government of Pakistan.

3. The capacity of respective institutions to carry out environmental management and monitoring plans was also assessed as part of this initiative. Based on these findings, this report attempts to make suitable recommendations for institutional reforms that would ensure and strengthen environmental monitoring and management to facilitate informed decision making and monitoring in the postcompletion operation and maintenance (O&M) period.

4. In consideration of ADB's *Environment Policy*, the Project was classified as B sensitive.² Although the Project's proposed infrastructure interventions are likely to have minimal environmental impacts, which can easily be mitigated if the recommended measures are put into place, the proposed Project is noted as being sensitive since land acquisition will be involved, and this will entail some degree of involuntary resettlement.

II. DESCRIPTION OF THE PROJECT

5. The FATA Rural Development Project covers the three northern FATA agencies of Bajaur, Khyber, and Mohmand. These agencies comprise almost half (46%) of the estimated population of the FATA, contain half of the cultivated area (49%), and make up collectively less than one quarter of the total land area of the FATA.

6. The proposed Project was designed to include a number of initiatives aimed at improving the quality of life of the rural inhabitants. Activities include establishing sustainable productive technologies with arrested environmental and resource degradation through the employment of integrated resource management, including agriculture and livestock production and farm and community forestry. In addition, providing appropriate infrastructure for production and communications, as well as drinking water supply, small-scale irrigation, and link roads, are all

¹ A copy of the IEE is available on request.

² The environmental categorization was reclassified from B to B sensitive because of the involuntary resettlement impacts expected in some subproject areas.

significant components of the Project. The project management structures that will be put into place should operate closely with existing government line agencies to implement the proposed Project through community mobilization, allowing greater opportunity for the poor to participate in community improvements and wider service delivery.

7. Human and institutional capacity building will be provided, as well as training in community organization, strengthened project management skills and improved institutional capabilities for line departments. This will allow these departments to better address the needs of the poorer segments of the society, which is an important activity of the proposed Project. Since field studies reveal that significant human-induced ecosystem modifications have occurred in the project area in the past, the project interventions proposed may well have wider benefits that may indirectly contribute to restoring already degraded environments. These measures may even contribute toward ameliorating certain existing environmental problems in the area that are not directly linked to the proposed Project.

III. DESCRIPTION OF THE ENVIRONMENT

8. The proposed Project will focus on three of the seven FATA agencies situated in the northern part of the country (i.e., Bajaur, Khyber, and Mohmand). The project area is located along the northeast to southwest, across the Hinduraj Mountains, between latitude 33°44' north and latitude 34°58' north and longitude 70°26' east and longitude 71°48' east. The environment is hot and arid, with temperatures known to reach as high as 40° Centigrade in June and July. The main valley bottoms are mostly frost free, but side valleys at higher elevations may encounter subzero temperatures.

9. High rural poverty, low crop productivity and livestock yields, depleted forest fuelwood reserves, insufficient rangelands, inadequate and poorly maintained rural roads, inadequate supplies of drinking water, poor general hygiene conditions, and limited nonfarm employment opportunities are all features characteristic of the project area.

A. Forest Cover

10. The project area comprises a total of 616,200 hectares (ha), of which 154,289 ha are under cultivation, thereby constituting 25.0% of the project area's total land. Natural forest cover amounts to approximately 6,134 ha, forming 1.0% of the total area. Forest Department records indicate that 26,430 ha were reforested, representing 4.3% of the project area. Due to the shortage of fuelwood, 90.0–95.0% of fuel comes from cow dung. The FATA does not fall under the jurisdiction of the Pakistan Forest Act 1927.

B. Wildlife Population

11. In the past, the FATA was known for its rich diversity of wildlife, which was in part attributed to the relatively sparse population levels and distribution in the area. In recent times, however, largely as a result of increasing population levels, including a sudden influx of Afghan refugees, a decline in forest cover was noted, with concomitant decreases in associated wildlife populations.

C. Geology and Soils

12. The project area is noted for its interesting geological formations. The Bajaur Agency consists of diorite rocks, which indicates a continuation of metamorphic and igneous rocks

consistent with the northern mountain chain. The basic rock stratum of the Mohmand Agency is composed of sedimentary formations, with recent intrusions and metamorphic changes giving rise to young shale formations. Valley beds of all three agencies exhibit young alluvium soil deposits, with varying organic contents, moisture-retention characteristics, and acidity values.

13. Soils in the Bajaur Agency are considered to be generally fertile, varying from silt loam to loam containing a medium degree of organic matter. In the adjacent Mohmand Agency, fine clayey characteristics are predominant, with occasional and isolated pockets of sandy loam. Owing to a general lack of organic matter, this type of soil demonstrates good percolation properties but poor water-retention characteristics. The medium alluvium soils of the Khyber Agency are noted to be shallow to moderately deep.

IV. FORECASTING ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

14. To comply with ADB's environmental assessment requirements, appropriate guidelines were selected and used to assess potential impacts and recommend possible mitigation measures to overcome these.

15. Field studies revealed that if infrastructure and irrigation interventions are executed without addressing the necessary mitigation measures proposed, adverse environmental impacts are likely to be experienced. All other project interventions are more likely to have positive effects, which could in fact contribute toward improving the existing degraded environment. Overall, road construction was assessed as the intervention that is likely to have the most significant environmental impacts. This is largely due to the fact that road construction covers wider areas by virtue of its linear spread, and, as such, construction works are likely to entail heavy disturbance to natural soils, flora, and fauna and associated ecological habitats.

A. Infrastructure Components

1. Roads

16. Two categories of roads were proposed: (i) 120 kilometers of newly constructed shingled link roads and (ii) 72 kilometers of upgraded link roads. The Works and Services Department will be responsible for O&M.

17. Since the roads to be constructed or upgraded are considered to be short in length, this will involve a lesser degree and quantum of earthwork. Thus, such roads are not likely to have any significant adverse environmental impacts, provided suitable mitigation measures as per ADB environmental guidelines (Appendix 1) are adopted at different stages of the construction work.

2. Water Supply

18. The lack of a potable drinking water supply system is a major problem experienced in the project area, where the majority of the inhabitants do not have access to safe drinking water supplies. The ill effects of this situation were noted by the health service facilities operating in all three agencies, which indicated that many patients suffer from waterborne diseases. Among the proposed water supply interventions designed to address these problems are (i) gravity flow (natural water springs); (ii) dug wells; (iii) hand pumps; and (iv) tube wells (a limited number), which may serve an additional irrigation function.

19. Minor environmental impacts may easily be mitigated at various stages of the scheme by adopting proposed mitigation measures (Appendix 2).

3. Irrigation Schemes

20. Due to the lack of irrigation resources, vast stretches of land are either barren or under limited cultivation. The proposed Project intends to make a significant contribution toward irrigation development, thereby increasing the overall command area and crop yield. In this way, farmers will have increased income, which will improve their overall quality of life and thereby contribute to reducing existing poverty levels.

21. In view of the small scale and quantum of the irrigation schemes proposed, most of the previously mentioned environmental impacts were assessed to be minimal and thus not of great significance. Nevertheless, mitigation measures proposed are presented in the checklists in Appendix 3.

B. Other Components and Activities

1. Agriculture

22. Since the envisaged agriculture component that falls under the Project is significant, environmental awareness training for farmers should form an integral component of the overall management plan. The associated environmental impacts of pesticide contamination and its toxic effects, increasing costs, and pest resistance are widely acknowledged throughout the world. The Project should therefore adopt a proactive role in providing adequate and structured information to the farmers in this regard. In addition, the Project, together with the Agriculture Department and EPA, should play an active part in education and awareness raising programs targeting local communities, alerting them to the adverse environmental and health impacts associated with agrochemical use (Appendix 4). This aspect was accommodated in the project design.

2. Livestock

23. In view of the overall negligible impacts associated with activities under this intervention, no need exists for any further assessment of the livestock component.

3. Forestry and Range Management

24. The envisaged forestry and range management components are likely to make positive environmental contributions to the Project by propagating thin forest cover and improving rangelands as a whole. Enhanced forest cover will result in long-term tangible benefits by providing sources of fuelwood, fodder, and timber. Better practices adopted in range management will ensure increased grazing pastures and, thus, healthier cattle. A combination of both will provide enhanced benefits to the communities. At the same time, existing soil cover will be stabilized, and accelerated erosion will be arrested.

25. In the past, the Forest Department was involved in plantation management schemes that were mostly focused on the introduction of exotic species, such as eucalyptus. Given the risks associated with introducing alien species into natural habitats, future plantations should be established based on the natural ecosystem, and indigenous species should be given due priority. Emphasis is made on the use of local farmer knowledge in this respect.

4. Land Acquisition

26. The proposed Project will involve land acquisition. The level of land acquisition required (482.9 ha) is expected to vary from significant to nonsignificant, depending on individual project interventions. In general terms, the affected people will be compensated for the loss of their land and trees and assisted financially to restore their affected structures and/or assets and livelihoods to at least preproject levels. Female-headed households and other vulnerable households will be eligible for further cash assistance for relocation and house or structure reconstruction. Plans for subproject resettlement will be based on a full evaluation of the impacts of proposals and contain a complete list of all affected people, together with the type and size of losses, and the amount of compensation and/or financial assistance assessed for each affected person. A resettlement framework was prepared and made available at local government offices. The resettlement framework will appear on ADB's Web site, upon Board approval.

V. ENVIRONMENTAL MONITORING AND MANAGEMENT PLAN

A. Institutional Requirements and Environmental Monitoring

27. The proposed Project seeks to address all issues having an environmental dimension, with a focus on poverty alleviation. Additional considerations of environmental issues, with suggested mitigation measures, will provide additional benefits to local residents that will continue to be felt over the longer term. These include (i) roadside plantations, (ii) community participation (including those components being executed by line agencies), and (iii) environmental training of all stakeholders.

28. The project management unit (PMU) in Peshawar and North-West Frontier Province, with support from the agency-based project implementation unit (PIU), will have overall implementation responsibility for the environmental management plan (EMP). Other parties to be involved in implementing the EMP will include (i) various contractors (responsible for implementing all measures required to mitigate environmental impacts during construction); (ii) beneficiary communities (since a major part of the work will be implemented through community participation); (iii) line departments (responsible for their respective parts of particular interventions [e.g., link roads or irrigation channels]); (iv) provincial environmental protection agencies (responsible for environmental clearance and periodic monitoring inspections of the proposed Project, ensuring that the EMP is adhered to); and (v) Forest and Wildlife Department (which will provide inputs in specific areas endowed with wildlife, when any threat to wildlife species exists). In addition, infrastructure supervision consultants should have environmental consultants as members of their teams, and these individuals should help the PMU and PIUs implement the EMP.

29. The institutional requirement, from an environmental standpoint, is the incorporation of an awareness-building program for all participants in project design and implementation. This must begin with a reorientation of those involved in various project components, so they will understand that environment is not a separate project component but encompasses the total physical, biological, and social matrix within the Project. In this connection, an appropriate training program for the implementation agencies is a key requirement. To ensure meaningful environmental protection and conservation of biophysical resources in the target areas, the following will be required:

- (i) short courses and workshops, followed by ongoing environmental awareness

- training of implementing staff members and community residents, including women;
- (ii) environmental safeguards in design criteria for all interventions;
- (iii) strict adherence to environmental protection considerations and criteria during construction and operation stages;
- (iv) environmental protection provisions in contracts and agreements; and
- (v) strict system of compliance monitoring under the proposed Project.

B. Environmental Management Plan

30. As a result of the community-based and phased manner in which the proposed Project is to be implemented, environmental monitoring of individual interventions cannot be undertaken as a regularly scheduled activity. A national environmental specialist should therefore be contracted to carry out initial reviews and periodic monitoring of specific project activities, on an as-needed basis. During the construction phase, the constructor will be responsible for conducting the monitoring, and the environmental specialist will be responsible for coordinating the environmental monitoring. During the actual operation period, relevant government institutions will be responsible for these activities. Further details are provided in the EMP table (Appendix 5).

31. Overall project implementation, management, and monitoring will be carried out by the PIU in each agency and will cover all subprojects and their various components. The environmental management program will form an integral part of these activities. In addition to other aspects of the Project, the environmental specialist will adopt approaches to address issues of environmental management, starting from design up to completion and including associated O&M work.

32. In an effort to further reinforce the already proposed mitigation measures, a number of further environmental enhancement measures will be undertaken, including roadside tree planting, with community participation and involvement, and capacity-building courses for line agency staff members and consultants involved in the proposed Project and construction managers.

33. Provision was made for a total allocation of \$277,766 over 5 years to contribute toward the costs of environmental assessments and monitoring and review of subproject interventions. A further \$46,533 was allocated for a period of 10 person-months to cover the costs of an environmental specialist. In addition, other consultant inputs will be added in areas such as watershed planning and management and hydrology. The consultants will coordinate their work with the environmental specialist.

VI. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

34. Since independence in 1947, the Government of Pakistan administered the FATA through the institution of political agents, with the result that all public sector development and recurrent expenditure is managed through the Political Agents, tribal chiefs, and/or *maliks* (subtribal chiefs). Only in recent years has representation from FATA to the national assembly been based on a popular vote, as apposed to election among the notified tribal chiefs and/or maliks. At present, the FATA population's interface with the Government and access to public resources is facilitated through maliks.

35. Thus, a unique social structure exists in the FATA (which lends itself to tribe, subtribe, and clan unification, and where outside challenges and ideas run into deep conservatism), that does not acknowledge participatory and democratic decision making. In these circumstances, stakeholder consultations conducted in a fully transparent manner are of paramount importance.

36. In addition to informal meetings and interviews with local communities in the FATA, which supplemented this process, three main stakeholder consultations took place during the project preparatory technical assistance (PPTA). The first consultation took place within 1 month of commencement of the PPTA (April 2003) and was used as a means to brief the stakeholders. This consultation included representation by notables and maliks from the agencies, farmers, traders, and officials from line departments. Social activists and political agents were also represented. Approximately 90 participants attended this first consultation meeting, at which the discussion covered details of the proposed Project and kinds of approaches that may be adopted in design, including the use of participatory means in identifying needs and priorities and the potential sectors that would be covered under the Project. During this meeting, participants were encouraged to raise questions and seek clarification on the approach and issues that would be covered during the design phase, and recommendations and suggestions were solicited. This initial meeting was conducted on an informal basis, with an emphasis on providing as much information about the Project and the process that would follow during the PPTA.

37. As part of an effort to ensure representation of all segments of each agency, a thorough socioeconomic survey and a poverty assessment of the villages comprising each agency were conducted. In each selected village, a focus group was conducted to solicit beneficiary views on priorities for project support and inputs based on perceived needs. Based on these survey findings, representation was encouraged from each of these individual villages, in addition to the participants proposed in the lists compiled with the assistance of the local government agents.

38. This process was followed by a second set of stakeholder consultations, conducted between May and June 2003 in the three agencies of Bajaur, Khyber, and Mohmand. During the second set of stakeholder workshops, project team members made presentations relating to the different envisioned components of the Project, including the proposed natural resource management and infrastructure interventions, in an attempt to provide the participants with a clearer idea of the proposed work. The participants were then divided into sector-related groups, and group discussions were conducted to enable participants to raise issues and seek clarification on project scope and design. During these sessions, the group facilitator employed a variety of participatory techniques, including mapping exercises and participatory observation. The group representatives, selected by the participants, presented their observations, comments, and recommendations for consideration and incorporation in the final design.

39. The final stage in the stakeholder consultation process was conducted as part of the overall environmental assessment. For this purpose, a series of structured public consultation sessions relating to project design were conducted during 13–22 August 2003 in all three agencies covered under the Project. In these workshops, the stakeholders were briefed about the project design and implementation arrangements. During this period, participatory scoping sessions were simultaneously carried out at all major and minor public gatherings. Emphasis on ensuring a multifocal composition was maintained throughout. The stakeholders consulted were chosen to be representative of the major groups living in the area. In addition, balance was

achieved in terms of age groups and employment.³ Noted tribal leaders and representatives also attended these meetings. Full details of these consultations appear in Appendix H of the IEE.

40. In addition to these consultations, meetings were held with agency-level field officials of the Agriculture Extension Department, Forestry and Wildlife Department, Irrigation Department, Livestock and Animal Husbandry Department, Local Government and Rural Development Department and the Works and Services Department (for roads and drinking water supply). At times, these officials also participated in some of the informal scoping sessions mentioned previously.

41. The consultative and scoping sessions were designed specifically to provide project information to the public. These sessions were designed to be informal, in an effort to encourage a free atmosphere in which participants were comfortable raising questions. Participants were encouraged to express their opinions and concerns relating to the Project and seek clarification on issues that concerned these individuals. The format of these consultations and meetings began with the participants being briefed on salient features of the Project and the associated environmental impacts. Most of the clarifications and/or questions raised during these meetings related mainly to the construction of roads and alignment routes. During informal question and answer sessions, the participants were asked to articulate in order of priority what they perceived to be the most significant environmental impacts associated with the Project, from their individual point of view as stakeholders. These findings were incorporated in the mitigation measures proposed and the EMP (IEE, Appendix G).

42. During the course of the environmental field survey, a number of state officials, concerned villagers, and other informal respondents were interviewed. The topics discussed were diverse, ranging from water resources, cropping patterns, and agricultural production to wildlife issues, protected areas, forest issues, nontimber forest products, illegal logging, transportation matters, and others. Inquiries were also made relating to the current use of pesticides and chemical fertilizers and road-related issues, as well as future problems anticipated once the Project enters into its operational phase.

43. In general, these consultations proved useful in clarifying issues and were conducted in a highly participatory and positive manner, and they included concerns for the loss of trees in the construction of roads. Actions proposed in response to these concerns include tree planting programs, to compensate for any such loss. Another concern voiced included the selection of appropriate grain crops and vegetable varieties. In line with this, attempts will be made by the agronomy team to base decisions on consultation and research. A full record of these concerns and possible means to address them are reflected in Appendix H of the IEE.

44. A strong consensus was reached on the need to encourage initiatives such as these, which would develop the project area and associated environs. However, a small group of individuals did express their concern for general environmental degradation and slack governmental controls. Such concerns were conveyed to the respective state functionaries. However, in general terms, a consensus was expressed by a larger segment of the local

³ Due to strict cultural barriers and social codes of conduct operating in the project area, women were not able to participate in the public meetings, nor could male members of the PPTA team contact them during the Project's design and environmental assessment. However, in an effort to ensure fair representation of their views and concerns, female PPTA members were assigned to interview women to ensure that their opinions and concerns were captured and addressed through proposed interventions in the EMP.

inhabitants that the Project is likely to deliver significant benefits to the area, which far outweigh the costs.

VII. ENVIRONMENTAL ASSESSMENT AND REVIEW PROCEDURES

45. The environmental assessment regulations as prescribed under the sector guidelines of EPA, Government of Pakistan do not apply to the individual subprojects, since most of these subprojects are community-based and on a small scale. Hence, the environmental impacts, if any, are likely to be minimal. However, environmental assessment guidelines will be developed for each subproject, to ensure environmentally sustainable implementation of each.

46. Overall implementation responsibilities of the EMP will rest with the PMU. Other parties to be involved in implementing the EMP will include various contractors, beneficiary communities, line agencies, Forest Department, and Wildlife Department.

47. Since the proposed Project carries a classification of B sensitive, no category A or B sensitive subprojects will be selected based on their potential environmental impacts during implementation.

48. The PMU, with assistance from the environment specialist, will have overall responsibility for environmental screening and ensuring that assessments are conducted based on environmental guidelines that will be developed during the inception phase. All necessary mitigation measures and monitoring plans will be developed based on the IEE and the EMP, and environmental clearance will be obtained for EPA or other relevant agencies, as deemed necessary. Environmental assessment reports will be submitted and revised by the PMU, to determine the adequacy of the proposed measures and identify the need for IEE and environmental clearance from EPA or other relevant agencies.

49. In accordance with the EMP developed under each subproject, PIUs will be responsible for conducting environmental monitoring. The environmental specialist will assist the PIU in monitoring and reporting to the PMU and carrying out necessary coordination with other relevant organizations. If during the course of the Project the PIUs come across any unintended environmental impacts, they will consult with the PMU and act accordingly.

50. Since the community will be a focal part of this work, which is integral to the preparation and implementation of projects, consultation will be a vital process used to integrate the needs and concerns of the community.

VIII. FINDINGS AND RECOMMENDATIONS

51. During the environmental assessment process, a number of investigative methods were used, including field visits, literature reviews, team member interaction, and discussions with various professionals and communities. During the course of this work, the following issues were identified and suitable mitigation measures proposed.

52. **Infrastructure interventions.** Some of these, roads being the foremost, may cause significant but small environmental impacts. Under the current scenario, no further study or detailed environmental impact assessment for these interventions is required. However, careful planning, design, construction, and O&M should be practiced for each type of intervention. Specific models should be developed at the beginning of the project implementation phase, to avoid any environmental damage from each intervention.

53. **Access to clean and reliable drinking water.** This was expressed as a top priority. Provision of village water schemes should be the highest priority. Separation of livestock watering sites from human drinking water supplies must be made a mandatory requirement. An awareness-raising program for waterborne diseases and sanitation should be implemented and periodically repeated in conjunction with the installation of all village-based water supply facilities.

54. **Other interventions.** Most of these proposed under the Project will not have significant environmental impacts. Careful planning and monitoring of specific project activities will be required to ensure that the intended benefits are fully realized. Coordinating officers, established as part of project implementation, should be used as entry points for awareness training for the target groups and enhancement of environmental benefits.

55. **Firewood collection and commercial logging.** These are significant causes of environmental decline throughout the project area. For meeting fuelwood needs and allowing crop residues and manure to be returned to the soil, the Project should investigate possibilities of alternative fuel sources. At the same time, attention should be paid to introducing fuel-efficient cooking stoves and biogas technology.

56. **Plantation development.** The Forest Department has been involved in plantation development, based on monoculture of exotic species. For preservation and propagation of natural ecosystems, a balance must be maintained between exotic and indigenous tree species. Any future plantations should be consistent with naturally occurring ecosystems that are adapted to the area and based on multicropping practices.

57. **Afforestation programs.** In the past, the Forest Department carried out various afforestation programs, as per their own choice of tree species, and the selection of tree species was on an ad hoc basis. Well in advance of undertaking the afforestation program that falls under the Project, a farmers' tree-species choice survey should be conducted by the Project, in collaboration with the Forest Department.

58. **Private sector plant nurseries.** Hardly any private sector plant nurseries were found in the project area. The interested farmers must be encouraged to practice nursery development, and the Forest Department can play a key role in terms of technical guidance.

59. **Irrigation expansion.** Due to irrigation expansion, the trend toward the use of agrochemicals, including pesticides, will grow. Farmers' training in the use of agrochemicals is an inescapable requirement. Educating farmers in integrated pest management, minimal use of agrochemicals, and related environmental and health impacts involved in incorrect use is therefore vital.

60. **Environmental monitoring program.** An environmental monitoring program will be required. An environmental specialist qualified in environmental assessment and monitoring should be retained by the proposed Project for its entire duration. In addition to the specialist's primary work on monitoring project activities, the development of environmental indicators would be an initial task. The environmental specialist would also assist in capacity-strengthening activities for project staff members and community leaders.

61. **Environmental awareness.** The level of environmental awareness of the target group needs substantive improvement. Environmental awareness should be an integral component of community organization and social mobilization activity. The terms of reference for the

community development work should explicitly incorporate environmental awareness as a key component.

IX. CONCLUSION

62. The proposed Project will have low environmental risks and large economic, social, and environmental benefits. This conclusion is based on an approach to that incorporates (i) environmentally sound technology, (ii) adequate training and protective measures, (iii) public information provision, and (iv) careful monitoring of any adverse environmental impacts. An environmental monitoring program will be set up under the Project, and this program will be supported by a locally contracted expert with suitable experience and expertise. The mitigation actions and measures (Appendixes 1–5) will be covenanted, as appropriate, in ADB's loan documentation.

CHECKLIST OF ENVIRONMENTAL PARAMETERS FOR ROADS

Actions Affecting Environmental Resources and Values	Potential Damage to Environment	Recommended Mitigation Measures	Initial Environmental Examination			
			No Significant Effect	Significant Effect		
				Small	Moderate	Major
A. Environmental Problems due to Location						
1. Soil and hydrology	Soil erosion	Investigation and studies		√		
2. Dislocation	Resettlement	Change of alignment		√		
3. Destruction of fields and/or lands	Livelihood	Construction management		√		
B. Environmental Problems due to Design and Specifications						
1. Crossing places	Safety and accident hazards	Provision of crossing places		√		
2. Excessive earthwork and vegetative destruction	Ecological damage and marred landscape	Balanced earthwork, with two-thirds useful cut and vegetation program				√
3. Induced and/or ribbon development	Slum populations, traffic bottlenecks, and road safety	Civic amenities to local population				√
4. Archaeological, cultural, and religious sites	Loss of heritage	Careful planning (as per rules and cultural norms)			√	
C. Environmental Problems due to Construction Activities						
1. Loosely stored and/or kept toxins, fuels, solvents, oils, paints, and other chemicals	Runoff poisons enter food chains of biota	Runoff controls, vegetation buffers, sedimentation basins, and education to all stakeholders		√		
2. Dust, noise, vibrations, and toxic emissions	Disturbance and health hazards to people near road	Water sprinkling, noise abatement, engine tune-ups, and vegetation buffer zones		√		
3. Damage to mature trees	Habitat disturbances and loss of biodiversity	Planning and education for foliage conservation		√		
4. Borrow pits	Water stagnation (disease vector)	Refilling and landscaping		√		
5. Disruption of economies and accessibilities	Livelihood and inconvenience	Careful planning and alternative routes		√		

Actions Affecting Environmental Resources and Values	Potential Damage to Environment	Recommended Mitigation Measures	Initial Environmental Examination			
			No Significant Effect	Significant Effect		
				Small	Moderate	Major
6. Scarred layers of organic soil	Loss of indigenous varieties of grasses and/or shrubs	Careful storage and reapplication upon road completion		√		
D. Environmental Problems due to Operations						
1. Safety and high operating speeds	Accident and/or collision hazards	Traffic discipline, speed bumps, and shoulder lanes for slow-moving traffic		√		
2. Increased accessibility	Negative changes in biodiversity	Vegetation control and resource conservation		√		
3. Dust, noise, and emissions	Health hazards and disturbances	Engine tune-ups and roadside tree plantations		√		
4. Induced and/or ribbon developments	Slum populations and traffic bottlenecks	Civic facilities				√
5. Deforestation and habitat loss	Negative changes in biodiversity	Environmental awareness			√	
6. Surface runoff	Water contamination	Periodic water testing	√			
7. Influx of visitors and/or tourists	Communicable diseases and changes in life style	Education for cultural values and awareness		√		
E. Additional Considerations						
1. Barren and/or denuded roadsides and soil stability	Road safety, soil erosion, and poor aesthetics	Tree plantations in rows and atop embankments				√
2. Road construction works and location of camps	Degraded environment and social disagreements	Environmental education and consultative campsites		√		
3. Road designs, specifications, and construction, as well as environmental monitoring plan and road operations	Negative changes in biodiversity and disturbance to local ecosystem	Institutional capacity building		√		
4. Various aspects of planning, designing, constructing, and operating and maintaining	Degradation of road-related environments	Knowledge and know-how of road-related environments and training				√

Source: Asian Development Bank estimates.

CHECKLIST OF ENVIRONMENTAL PARAMETERS FOR WATER SUPPLY SCHEMES

Actions Affecting Environmental Resources and Values	Potential Damage to Environment	Recommended Mitigation Measures	Initial Environmental Examination			
			No Significant Effect	Significant Effect		
				Small	Moderate	Major
A. Environmental Problems due to Design and Location						
1. Hydrology	Water table depletion	Investigation and studies		√		
2. Water quality and/or quantity	Health hazards	Testing and measurements		√		
3. Groundwater contamination	High health risks	a. Proper disposal of wastewater		√		
		b. Wells located away from latrines, soakage pits, and animal troughs		√		
		c. Periodical testing		√		
4. Spring water	Contamination	a. Protection to recharge area		√		
		b. Closer intake to spring		√		
B. Environmental Problems due to Construction Activities						
1. Water Wells Water contamination	Health risks	a. Surface casing up to 4.0 meters in depth		√		
		b. At least 0.5-meter raised platform		√		
		c. At least 1.0-meter concrete slab ground overlap		√		
		d. Safe disposal of overflow and wastewater		√		
2. Water Springs a. Development of catchment area	Loss of biota and ecosystem and habitat disturbances	Least possible disturbances		√		
		Water intake should have overflow pipe, flushing and washing outlet, bottom sump, ventilation arrangements, inspection access, solid fencing (prevent livestock and wildlife contamination)		√		
b. Water contamination	Health risks					
c. Water stagnation	Health vector	Proper overflow disposal into natural streams		√		

Actions Affecting Environmental Resources and Values	Potential Damage to Environment	Recommended Mitigation Measures	Initial Environmental Examination			
			No Significant Effect	Significant Effect		
				Small	Moderate	Major
C Environmental Problems due to Operations						
1. Water contamination	Health risks	The following may be ensured: adequate education for women concerning waterborne diseases and related hazards, periodic water testing in a laboratory, and periodic cleaning and/or disinfection of intake and distribution tanks		√		
2. Water waste	Resource loss	Water discipline			√	

Source: Asian Development Bank estimates.

CHECKLIST OF ENVIRONMENTAL PARAMETERS FOR SMALL DAMS AND OTHER IRRIGATION SCHEMES

Actions Affecting Environmental Resources and Values	Potential Damage to Environment	Recommended Mitigation Measures	Initial Environmental Examination			
			No Significant Effect	Significant Effect		
				Small	Moderate	Major
A. Environmental Problems due to Location						
1. Soil and hydrology	Disturbance to soil and hydrological regimes	a. Soil investigations b. Hydrological regime studies c. Monitoring of water table d. Regular discharge measurements		√ √ √ √		
2. Water pollution	Health risks and poisoning food chains	a. Reasonably far from pollution sources b. Periodic water testing		√ √		
3. Seepage	Water losses	Stone water lining to conserve scarce water resource, increase water discharge, and increase command area		√		
4. Spillover (due to debris and silt deposits)	Water waste and soil erosion	a. Silt sumps at intervals b. Safe passages for rainwater disposal		√ √		
5. Dislocation of human habitats	Resettlement and disintegration of family and/or tribal structures	Careful planning, design, and location		√		
6. Impediments to movement of wildlife, cattle, and human beings	Disruption in wildlife and local economies	Careful planning, design, and location	√			
7. Conflicts in water users rights	Socioeconomic inequities	Water users associations and social homogeneity		√		
8. Regional flooding and drainage hazards	Disruption of local economies and land degradation	a. Careful planning and design b. Flood monitoring system c. Enhanced land use practices	√ √	√		
B. Environmental Problems due to Construction Activities						
1. Small Dams a. Loosely stored and/or kept construction materials, fuels, solvents, oils, paints, and others	Runoff poisons enter food chains of biota	Runoff controls, vegetation buffers, sedimentation basins, and education for all stakeholders		√		

Actions Affecting Environmental Resources and Values	Potential Damage to Environment	Recommended Mitigation Measures	Initial Environmental Examination			
			No Significant Effect	Significant Effect		
				Small	Moderate	Major
b. Dust, noise, vibrations, and toxins (emitted from heavy earthmoving machinery) c. Damage to mature trees d. Borrow pits e. Disruption of vegetation, trees, grasses, herbs, shrubs, and others f. Scarred layers of organic soil g. Rock blasting 2. Other Irrigation Schemes (Open Channel-Based) Soil digging	Disturbances and health hazards to people near road Habitat disturbances and loss of biodiversity Water stagnation (disease vector) Livelihood and inconvenience Loss of indigenous varieties of grasses and/or shrubs Safety, noise hazards, and soil strata disturbances Disturbance to nature strata	Water sprinkling, noise abatement, engine tune-ups, and vegetation buffer zones Planning and educating for foliage conservation Refilling and landscaping Careful planning and alternative routes Careful storage and reapplication upon road completion Precautions, noise abatement, and blasting (controlled) Manual excavations might be preferred; mechanized excavations might be avoided; least number of disturbances to ecosystems might occur; organized planting of grass sods, herbs, and shrubs might be undertaken; stone lining might be installed; gradual slope route might be created; rocky areas might be avoided; and proper disposal of overflow might occur		✓ ✓ ✓ ✓ ✓ ✓ ✓		
C. Environmental Problems due to Operations						
1. Water contamination	Health risks and poisoning of food chains	a. Education for waterborne diseases, b. Periodic water testing c. Restricted drinking and eating purposes d. Least use of agrochemicals		✓ ✓	✓	✓
2. Water waste	Resource degradation	Water discipline and regulation and water table monitoring		✓		
3. Overflow (due to blockage)	Soil erosion	Periodic sump cleaning and maintenance		✓		

Actions Affecting Environmental Resources and Values	Potential Damage to Environment	Recommended Mitigation Measures	Initial Environmental Examination			
			No Significant Effect	Significant Effect		
				Small	Moderate	Major
4. Downstream water quality problems	Impairments of downstream beneficial water uses	Especially careful monitoring during operations		√		
5. Land tenure and/or use problems	Social conflicts and benefits impaired	Careful monitoring and social equity (as per local norms)		√		
6. Adverse soil modifications	Soil degradation	Vigilant monitoring and lab testing		√		
7. Water-oriented disease hazards	Threat to life and health	Ongoing monitoring and lab testing		√		
D. Additional Considerations (Social Issues)						
Social conflicts due to water use	Degradation of social environment	a. Creating a water users association and its bylaws		√		
		b. Sharing proportionately water, costs, and maintenance (as per land holdings)		√		
		c. Creating links with agriculture extension staff				

Source: Asian Development Bank estimates.

CHECKLIST OF ENVIRONMENTAL PARAMETERS FOR OTHER COMPONENTS

Actions Affecting Environmental Resources and Values	Potential Damage to Environment	Recommended Mitigation Measures	Initial Environmental Examination			
			No Significant Effect	Significant Effect		
A. Agriculture						
1. Use of agrochemicals	Water contamination Poisoning of food chains	a. Periodic water testing b. Least use (as per World Health Organization and Food and Agriculture Organization prescriptions) c. Increased training of farmers d. Organic pest control e. Increased use of farmyard manure		√ √ √ √ √		
2. Exotic crop and/or vegetable species	Loss of indigenous biodiversity	a. Promotion of indigenous varieties b. Limited use of exotic varieties		√ √		
B. Livestock						
1. Cow dung being used as fuel	Loss of soil fertility Increased use of chemical s fertilizer	a. Alternative fuel sources b. Introduction of fuel-efficient cooking stoves c. Introduction of biogas technique d. Training for farmers	√ √ √ √			
2. Cattle sheds	Health risks	Cattle sheds may have reasonable segregation from human dwellings		√		
C. Forestry and Range Management						
Exotic tree and/or plant species	Loss of indigenous biodiversity	a. Indigenous species are promoted b. Least use of exotic species c. Farmers' tree species choice survey d. Promotion and training of farmers' plant nurseries e. Tapering down of departmental nurseries	√ √ √ √ √	√		
D. Gender						
1. Fuelwood collection	Ecosystem disturbances	Environmental awareness	√			
2. Water collection	Health hazards	Education about waterborne diseases		√		
E. Additional Considerations						
1. Roadside tree plantations	Improved environments	Indigenous specie plantations	√			
2. Community participation	Improved sense of ownership	Better resource use and operation and maintenance	√			
3. Lack of environmental know-how	Improved environments	Environmental training	√			

Source: Asian Development Bank estimates.

ENVIRONMENTAL MANAGEMENT PLAN

Environmental Issues and Components	Remedial Measures	Approximate Location	Time Frame	Institutional Responsibility	
				Implementation	Supervision
A. Location Issues					
1. Blasting ^a	<ul style="list-style-type: none"> • Highly controlled blasting during lean traffic hours by trained people • Proper safety precautions • Preannouncement of blasting schedule and time • Warning signs • Traffic management and safety 		During design, contract, and tendering stages	During construction (DC) and line agency (LA)	LA
2. Bulldozing, side hill cuts, and excavations ^a	<ul style="list-style-type: none"> • Maximum use in embankments and fill areas • Safe disposal at preselected sites by haulage trucks in waste lands, through consultation with locals • No spoil will be disposed of near houses, farms, forests, water streams, or water bodies 	All project roads, in general, and mountain area roads, in particular	During design, contract, and tendering stages	DC and LA	LA
3. Borrow materials ^a	<ul style="list-style-type: none"> • Borrow areas will be away from habitats and visual distances • Refilling of excavated areas • Areas that cannot be refilled should be cordoned off with barbed wire fence and warning signs should be added 	All project roads, in general, and plain area roads in particular	During design, contract, and tendering stages	DC and LA	LA
4. Ribbon developments ^a	<ul style="list-style-type: none"> • Enforcement of laws • Reduced template widths in built-up areas • Vigilant monitoring for any such developments and timely action 	All project roads, in general, and plain area roads, in particular	During design, contract, and tendering stages	DC and LA	LA
5. Flora and fauna ^a	<ul style="list-style-type: none"> • Detailed tree plantation program • Tree removal to be done in consultation with the Forest Department • Safe storage and reapplication of scarred top earth • Enforcement of wildlife protection laws • Awareness of masses and road users through graphic signboards • Warning signs for presence and crossing places of wildlife 	All project roads, in general, and roads with good vegetative cover and having wildlife in their general vicinity, in particular	During design, contract, and tendering stages	DC and LA	LA

Environmental Issues and Components	Remedial Measures	Approximate Location	Time Frame	Institutional Responsibility	
				Implementation	Supervision
B. Design and/or Preconstruction Stage 1. Alignment a. Reduced templates in settlements ^a b. Loss to land and property ^a 2. Land a. Embankment slopes b. Levelled roads c. Quarries and borrow areas	<ul style="list-style-type: none"> Roadways having significant settlements, where reduced formation width is advised In areas of mosques and graveyards, centerline may require some readjustments Haulage and safe disposal of spoil and undesired materials has been advised Free roll down of spoil in hilly areas must be avoided Maximum waste cut to be used in fill Borrow and quarry areas are advised in waste and uninhibited lands Retaining structures have been proposed for limiting excavations <ul style="list-style-type: none"> For erosion control at critical slopes along all the roadways, bench terracing will be done and vegetative turf will be provided <ul style="list-style-type: none"> In plain canal irrigated areas a 1.0–1.5-meter increase in the vertical elevation, with suitable cross drainage structures <ul style="list-style-type: none"> Maximum use of existing quarries Degraded lands to be used for borrowing materials, and use of productive lands will be prohibited Lands could also be selected through community consultation, and these lands could subsequently be developed into fishponds or other productive purposes 	All roads with linear habitats Entire project corridor, but more specifically in mountainous areas Entire project corridor, but more specifically in plain areas and box-shaped cuts Roads and irrigation channels in plain areas Wherever borrow materials are required	During design, contract, and tendering stages During design, contract, and tendering stages During design, contract, and tendering stages During design, contract, and tendering stages During design, contract, and tendering stages	DC and LA DC and LA DC and LA DC and LA DC and LA	LA LA LA LA

Environmental Issues and Components	Remedial Measures	Approximate Location	Time Frame	Institutional Responsibility	
				Implementation	Supervision
3. Water					
a. Water sources	<ul style="list-style-type: none"> Existing courses will be maintained at all the locations Most of the bridges will be retained Community ponds for cattle will be protected with 1.0-meter high embankments To minimize stress on groundwater, recharging through water harvesting structures along the project corridor will be considered 	All water resources are likely to be impacted along the project corridor	During design and contract stages	DC and LA	LA
b. Drainage	<ul style="list-style-type: none"> No drains will be obstructed Provision for cross drainage structures of adequate size and number will be made Irrigation canals in the area will not be blocked, and, wherever required, suitable alternatives will be provided for smooth flow 	All along the project corridor	During design and contract stages	DC and LA	LA
4. Flora and fauna					
a. Side plantations	<ul style="list-style-type: none"> Widening will be done on one side, having relatively thin trees No trees will be removed without prior approval of the Forest Department Compensatory and additional planting will be done under a planed program Indigenous tree species will be accorded priority over exotic species 	All along the project corridor	During design and contract stages	DC and LA	LA
b. Wildlife	<ul style="list-style-type: none"> Cautionary signs will be erected at suitable places, in consultation with the Wildlife Department Underpasses will be constructed, as per the advice of the Wildlife Department 	All along the project corridor	During design and contract stages	DC and LA	LA
5. Environment quality					
a. Air quality	<ul style="list-style-type: none"> Widening and geometric improvements will ensure smooth traffic flow, thereby reducing toxic emissions Linear and strip trees will be planted on both sides of the road, to act as vegetative screens against air pollutants and attenuate noise 	All along the project corridor	During design and contract stages	DC and LA	LA and EPA
b. Noise levels	<ul style="list-style-type: none"> Design and improvement of junctions and intersections Clear delineations between slow- and fast-moving traffic Roadside plantations will act as sound absorbers 	All along the project corridor	During design and contract stages	DC and LA	LA and EPA

Environmental Issues and Components	Remedial Measures	Approximate Location	Time Frame	Institutional Responsibility	
				Implementation	Supervision
6. Utilities (public)	<ul style="list-style-type: none"> Public utilities are likely to be impacted, and water pipes, power and phone lines, and others must be relocated to suitable places, in consultation with the respective agencies 	At various locations all along the project corridor	During design and contract stages	DC and LA	LA
7. Cultural heritage (cultural properties)	<ul style="list-style-type: none"> Alignments will suitably be rerouted to avoid and/or minimize impacts upon religious and cultural property 	All along the project corridor	During design and contract stages	DC and LA	LA
C. Construction Stage					
1. Soil					
a. Soil erosion	<ul style="list-style-type: none"> Steep embankments will be provided with drains and chutes, to minimize soil erosion; stone pitching; masonry retaining structures (in critical areas); vegetative turfs at embankments and planted grasses and shrubs; borrow pits with regulated depths and sides not steeper than 25%; sediment basins and slope drains; and bench terracing for high cut areas 	At various locations, particularly along the mountainous areas	During construction	Contractor	LA, PMU, and SC
b. Loss of top soil	<ul style="list-style-type: none"> Cultivable lands will not be used for borrow materials, unless requested by the landowner 	At various locations	During construction	Contractor	LA, PMU, and SC
c. Borrow soils	<ul style="list-style-type: none"> No earth will be borrowed from the right-of-way Borrowing may be done from barren land, wasteland, and riverbeds In case of new borrow areas, all measures will be taken to avoid loss of productive soil, and all environmental considerations are to be met Precautionary measures, such as tarpaulin coverings, will be used to avoid spilling borrow materials All borrow areas will be refilled, revegetated, and landscaped, or such areas will be cordoned with barbed wire fence and warning signs will be posted 	At various locations	During construction	Contractor	LA, PMU, and SC
d. Quarry areas	<ul style="list-style-type: none"> Quarry materials are to be obtained from established sites with environmental clearance licenses New quarries will not be opened without prior permission from the respective authorities 	Various quarrying sites	During construction	Contractor	LA, PMU, and SC

Environmental Issues and Components	Remedial Measures	Approximate Location	Time Frame	Institutional Responsibility	
				Implementation	Supervision
e. Contamination of soils	<ul style="list-style-type: none"> Construction equipment will be maintained and refueled with no spillage contaminating the soil Fuel storage and refueling will be kept away from water bodies and/or channels All spoilage and waste will be disposed of as per approved disposal plans in wastelands, in consultation with communities Scarred bituminous wastes will be disposed of at approved sites with impervious linings 	Various construction sites throughout the project corridor	During construction	Contractor	LA, PMU, and SC
2. Water					
a. Water bodies	<ul style="list-style-type: none"> Immediate rehabilitation and compensation of damaged or impacted water sources Advance measures to prevent any damage to water bodies will be avoided at all costs Any community water source, such as wells and springs, will be replaced with alternate sources if lost 	Various construction sites throughout the project corridor	During construction	Contractor	LA, PMU, and SC
b. Drainage and runoff	<ul style="list-style-type: none"> Construction materials at cross drainage structures will be removed in time, so as not to block the water flow 	Various construction sites	During construction	Contractor	LA, PMU, and SC
c. Water contamination	<ul style="list-style-type: none"> Construction work close to streams, especially during the monsoon period Precautions will be taken to construct temporary devices for preventing water pollution resulting from increased siltation and turbidity Suitable measures will be taken to prevent earthworks from impeding rivers, streams, or drainage systems Waste materials must be collected, stored, and disposed of at approved sites To avoid contamination from fuels and lubricants, all equipment will be properly maintained and refueled Traps will be provided at fuelling points, to prevent contamination Embankment slopes leading to water bodies will be modified and screened, so that contaminants do not enter water bodies Side drains in settlement areas will discharge through a primary settling tank 	Various construction sites throughout the project corridor	During construction	Contractor	EPA, LA, PMU, and SC

Environmental Issues and Components	Remedial Measures	Approximate Location	Time Frame	Institutional Responsibility	
				Implementation	Supervision
d. Construction camps and sanitation and waste disposal	<ul style="list-style-type: none"> Waste petroleum products will be collected, stored, and disposed of at the approved sites, as per the Hazardous Waste Management Act Water quality will regularly be monitored at critical locations Construction camps will be located away from built-up areas, in consultation with locals Camps will have sewage systems, so that no water pollution takes place, and, wherever required, temporary effluent treatment plants will be installed, and all workplaces will have medical and recreational facilities 	At construction camp locations		Contractor	LA, PMU, and SC
e. Water use for construction	<ul style="list-style-type: none"> In water scarcity areas, preconstruction arrangements are completed without effecting communities Some areas do not have perennial water bodies, so groundwater will be used for construction, overexploitation must be avoided, and rainwater harvesting must be done 	Various construction sites, Mohmand in particular	During construction	Contractor	LA, PMU, and SC
3. Air a. Emissions from construction vehicles and equipment	<ul style="list-style-type: none"> All static plants will be downwind of human habitats Emission levels of all construction vehicles and equipment will conform to prescribed standards Pollutant parameters will regularly be monitored during construction Asphalt plants, crushers, and batching plants will be at least 1 kilometer downwind from the nearest human settlement 	Various construction sites	During construction	Contractor	EPA, LA, PMU, and SC
b. Dust	<ul style="list-style-type: none"> All precautions are to be taken to reduce dust level emissions from batching and/or hot mix plants, crushers, and others Batching and/or hot mix plants, crushers, and others will be at least 1 kilometer downwind from the nearest habitation, and all will be fitted with dust extraction and suppression devices Regular water spraying will be ensured at all mixing sites and temporary service roads During and/or after compacting works, water spraying on all dirt surfaces will be a regular feature, to prevent dust All delivery vehicles will be covered with tarpaulins, and mixing equipment will be sealed and equipped, as per existing standards 	Various construction sites	During construction	Contractor	EPA, LA, PMU, and SC

Environmental Issues and Components	Remedial Measures	Approximate Location	Time Frame	Institutional Responsibility	
				Implementation	Supervision
4. Noise levels	<ul style="list-style-type: none"> All construction equipment and plants will strictly conform to National Environment Quality Standards noise and emission standards All vehicles and equipment used will be fitted with noise abatement devices Industrial noise standards will be enforced, to protect workers and residents from severe noise impacts Construction workers will be provided with earplugs, and noise levels will be monitored during construction Noise barriers and/or trees will be placed in urban locations Insulation mud walls and live vegetation screens will be installed at critical locations 	Various construction sites	During construction	Contractor	EPA, LA, PMU, and SC
a. Noise from vehicles, asphalt plants, and equipment					
b. Noise barriers		Various construction sites	During construction	Contractor	EPA, LA, PMU, and SC
5. Flora					
a. Vegetation losses	<ul style="list-style-type: none"> All tree removal areas will be replanted according to the plantation program Trees requiring removal will be marked with paint 	Various construction sites	During construction	Contractor	EPA, LA, PMU, and SC
b. Soil compaction	<ul style="list-style-type: none"> All construction machinery and equipment will be stationed in designated areas, to prevent vegetation compaction outside the right-of-way Any incidental damage, such as soil trampling and damage to herbs, shrubs, and grasses, will be kept to the minimum 	Various construction sites	During construction	Contractor	EPA, LA, PMU, and SC
6. Fauna (loss, damage, or disruption)	<ul style="list-style-type: none"> Education for construction workers will reduce disruption of and damage to wildlife Wildlife protection laws will strictly be followed All construction vehicles will ply specified routes, to avoid accidents with cattle and wildlife 	Various construction sites	During construction	Contractor	EPA, LA, PMU, SC, and Wildlife Department

Environmental Issues and Components	Remedial Measures	Approximate Location	Time Frame	Institutional Responsibility	
				Implementation	Supervision
7. Safety and accident risks a. Construction activities and accident risks	<ul style="list-style-type: none"> • Safety signals will be installed on all temporary routes during construction • Strict enforcement of traffic rules and regulations • Blasting sites will have warning and clearance signals and will be inspected prior to and/or after blasting, and blasting will be done during lean hours • Workers will be provided helmets, masks, and safety goggles • Readily available first aid units, dressing materials, ambulances, and nurses will be at critical locations • Road safety education will be imparted to drivers of construction vehicles • Traffic management will be ensured during construction 	Various construction sites	During construction	Contractor	EPA, LA, PMU, SC, and Wildlife Department
b. Health issues	<ul style="list-style-type: none"> • Drainage, sanitation, and waste disposal facilities will be at work sites • Drainage will be maintained to avoid oversaturation • Suitable sanitation and waste disposal facilities are to be provided by means of septic tanks and soakage pits • Sufficient water supply will be maintained at camps, to avoid water-related diseases and secure worker health • Health education and preventive medical care will be provided to workers • Routine medical examinations of workers and avoidance of communicable diseases 	Various construction sites	During construction	Contractor	EPA, LA, PMU, SC, and Health Department
8. Cultural properties (damage to archeological, religious, and cultural properties)	<ul style="list-style-type: none"> • If any valuable articles, coins, artifacts, or archaeological relics are discovered, the excavation will be stopped, and Archaeology Department will be informed • Construction camps, blasting sites, and all allied construction activities will be kept away from cultural properties 	Various construction sites	During construction	Contractor	LA, SC, PMU, and Archeology Department
9. Environmental enhancements a. Landscape development	<ul style="list-style-type: none"> • Avenue plantation of mixed-specie aesthetics trees, shrubs, and aromatic plants will be carried out • In this context, a detailed scheme will be prepared 	Various construction sites	During construction	Contractor	LA, SC, PMU, and Forest Department

Environmental Issues and Components	Remedial Measures	Approximate Location	Time Frame	Institutional Responsibility	
				Implementation	Supervision
b. Roadside amenities	<ul style="list-style-type: none"> Provision of bus shelters, petrol pumps, restaurants, recovery areas, and truck stops, as per site, will be carried out Road furniture, traffic signs, speed zone signs, wildlife warning boards, and others will be erected at suitable places 	Various construction sites	During construction	Contractor	LA, SC, and PMU
D. Operational Stage					
1. Contamination from spills	<ul style="list-style-type: none"> An accident clearance contingency plan will be prepared and sites will be cleared immediately The soiled earth will be scraped into small lined and confined pits nearby, with the right-of-way 		During operation and maintenance	PMU, LA, and Agency Administration	LA
2. Dust generation	<ul style="list-style-type: none"> Maintenance of all plantations that will act as live screens will be ensured New plantations will be created at all blank sites near the road 		During operation and maintenance	PMU, LA, and Agency Administration	LA
3. Air pollution	<ul style="list-style-type: none"> Emissions at critical places of pollutants, such as suspended particulate matter, Respirable Suspended Particulate Matter, carbon monoxide, sulfur dioxide, nitrogen oxide, and plumbum (lead), will be monitored Maintenance of roadside plantations will be ensured 		During operation and maintenance	PMU, LA, and Agency Administration	LA
4. Noise pollution	<ul style="list-style-type: none"> Noise levels will be monitored at critical locations Warning signs will be placed at sensitive zones, such as hospitals and schools Public awareness programs will be launched 		During operation and maintenance	PMU, LA, and Agency Administration	LA
5. Water	<ul style="list-style-type: none"> Regular cleaning of drainage systems will be ensured Water quality will be monitored, as per the monitoring plan 		During operation and maintenance	PMU, LA, and Agency Administration	LA
6. Flora and fauna	<ul style="list-style-type: none"> Roadsides plantations will be strictly monitored and maintained General education and awareness for wildlife conservation 		During operation and maintenance	PMU, LA, and Agency Administration	LA

Environmental Issues and Components	Remedial Measures	Approximate Location	Time Frame	Institutional Responsibility	
				Implementation	Supervision
7. Accidents	<ul style="list-style-type: none"> New roads encourage high speeds and become more prone to accidents, which must be controlled through enforcement of traffic laws, restrictions on speed, safety measures at critical spots; underpasses and/or overpasses and zebra crossings; and contingency plans for accident recovery 		During operation and maintenance	PMU, LA, and Agency Administration	LA
8. Safety measures	<ul style="list-style-type: none"> Development of coordinated traffic management plan along congested and critical locations Traffic control measures, including speed limits, will be enforced strictly Further growth of encroachments, ribbon developments and squatting within the right-of-way will be discouraged No schools, hospitals, mosques, graves, or houses will be allowed within 200 meters of the roadways 		During operation and maintenance	PMU, LA, and Agency Administration	LA

DC = during construction, EPA = Environmental Protection Agency, LA = line agency, PMU = Project Management Unit, SC = supervision consultant.

^a To be added in the relevant parts of contract documents for specific roads.

Source: Asian Development Bank estimates.