PN-ABK-537
75767

DRAFT

Environmental, Economic and Social Soundness Assessment

CHITRAL ACCESS PROJECT

UNITED STATES AGENCY
FOR
INTERNATIONAL DEVELOPMENT

December 1987

TAMS CONSULTANTS, Inc.

PN-ABK-537

DRAFT

Environmental, Economic and Social Soundness Assessment

CHITRAL ACCESS PROJECT

UNITED STATES AGENCY
FOR
INTERNATIONAL DEVELOPMENT

December 1987

TAMS CONSULTANTS, Inc.

ENVIRONMENTAL AND SOCIAL SOUNDNESS ASSESSMENT
CHITRAL ACCESS PROJECT

Table of Contents

EXECUTIVE SUMMARY

1. PROJECT BACKGROUND AND PURPOSE

1.1 Study Area

1.2 Background

1.3 Purpose of Project

1.4 Purpose of Report

1.5 GOP Environmental Policies and Regulations, and Applicable Natural Resource Legislation

1.5.1 Pakistan Environmental Ordinance of 1983

1.5.2 Forest Legislation

1.5.3 NWFP Wildlife Protection, Preservation, Conservation and Management Act of 1975

1.5.4 Antiquities Act of 1975

1.5.5 Environmental Pollution Ordinance

1.5.6 Laws Pertinent to Road Improvement and Land Acquisition

1.6 USAID Environmental Policy and Regulations

1.6.1 22CFR Part 216, A.I.D. Environmental Procedures

1.6.2 Foreign Assistance Act, Section 117, Environment and Natural Resources

1.6.3 Foreign Assistance Act, Section 118, Tropical Forests

1.6.4 Foreign Assistance Act, Section 119, Biological Diversity

1.6.5 Policy Determination (PD-6)

a'

2. DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

2.1 Range of Alternatives

2.1.1 Background to Project Alternatives

2.1.2 Alternative Concepts

2.2 No Action

2.3 Proposed Action: Tunnel Alternatives

2.3.1 Concept

2.3.2 Tunnel Alignment Alternatives

2.3.3 Cross-Section and Ventilation Alternatives

2.3.4 Tunnel Requirements

2.3.5 Tunnel Approach Road Alignments

2.3.6 Construction Scenario

2.3.7 Assumptions for Environmental Assessment

2.4 All-Road Access

2.5 Lowari Rope-Way

3. AFFECTED ENVIRONMENT

3.1 Air Resources

3.1.1 Climatology and Meteorology

3.1.2 Existing Air Pollution Sources

3.1.3 Ambient Air Quality

3.2 Geology, Physiography and Soils

3.2.1 Geology

3.2.2 Physiography

3.2.3 Soils

3.3 Water Resources

3.3.1 Surface Water Resources

3.3.2 Groundwater

3.4 Terrestrial Ecology
3.4.1 Wildlife Habitats
3.4.2 Wildlife
3.4.3 Man-Induced Pressures on Wildlife
3.4.4 Wildlife Management
3.4.5 Protected Areas
3.5 Aquatic Ecology
3.5.1 Habitat Types
3.5.2 Fish Species
3.5.3 Fisheries Development
3.5.4 Regulation of Fishing
3.6 Socioeconomics, Land Use and Infrastructure
3.6.1 Population and Demography
3.6.2 Land Use and Land Tenure
3.6.3 Employment and Economic Activity
3.6.4 Infrastructure
3.7 Agriculture and Livestock
3.7.1 Agriculture
3.7.2 Livestock
3.7.3 Agha Khan Rural Support Program (AKRSP)
3.7.4 IFAD/ADB Chitral Area Development Project
3.8 Forestry
3.8.1 Forest Area and Type
3.8.2 Forest Management
3.8.3 Logging
3.8.4 Future Forestry Plans
3.9 Tourism
3.9.1 Tourism in Pakistan

3.9.2 Tourism in Chitral

3.10 Paleontological, Archaeological and Historical Resources

3.10.1 Paleontological Resources

3.10.2 Archaeological and Historical Resources

3.11 Mineral Resources

3.11.1 Existing Mining

3.11.2 Mineral Prospects

3.12 Aesthetics

3.13 Noise

4. ENVIRONMENTAL IMPACTS OF PROPOSED PROJECT AND ALTERNATIVES

4.1 Construction, Operation and Maintenance Impacts of Tunnel and Other Alternatives

4.1.1 Air Resources

4.1.2 Geology, Physiography and Soils

4.1.3 Water Resources

4.1.4 Terrestrial Ecology

4.1.5 Aquatic Ecology

4.1.6 Socioeconomics, Land Use and Infrastructure

4.1.7 Agriculture and Livestock

4.1.8 Forestry

4.1.9 Tourism

4.1.10 Paleontological, Archaeological and Historical Resources

4.1.11 Mineral Resources

4.1.12 Aesthetics

4.1.13 Noise

4.2 Secondary Impacts of Improved Access

4.2.1 Air Resources

4.2.2 Geology, Physiography, Soils

4.2.3 Water Resources

4.2.4 Terrestrial Ecology

4.2.5 Aquatic Ecology

4.2.6 Socioeconomics, Land Use and Infrastructure

4.2.7 Agriculture and Livestock

4.2.8 Forestry

4.2.9 Tourism

4.2.10 Paleontological, Archaeological and Historical Resources

4.2.11 Mineral Resources

4.2.12 Aesthetics

4.2.13 Noise

5. MITIGATIVE MEASURES AND MONITORING

5.1 Mitigative Measures Associated with Construction of a Tunnel or an All-Road Access Alternative

5.1.1 Advance Site Planning and Infrastructure

5.1.2 Water Supply Development and Protection

5.1.3 Soil Erosion and Sediment Control

5.1.4 Spill Prevention, Clean-up and Control

5.1.5 Forest and Habitat Protection and Enhancement

5.1.6 Paleontology, Archaeology and Historic Resources

5.1.7 Air Quality and Noise

5.1.8 Safety Measures

5.1.9 Compensation

5.1.10 Training Public Education Programs

5.2 Mitigative Measures Associated with Operation and Maintenance of a Tunnel or an All-Road Access Alternative

5.2.1 Safety Design Criteria and Standards

5.2.2 Operations Safety Plan

5.2.3 Spill Prevention, Control and Clean-up

5.2.4 Natural Disaster Emergency Plan

5.2.5 Training and Public Education

5.3 Mitigative Measures Associated with Secondary Impacts

5.3.1 Climate and Air Quality

5.3.2 Geology, Physiography and Soils

5.3.3 Water Resources

5.3.4 Terrestrial Ecology

5.3.5 Aquatic Ecology

5.3.6 Socio-economics, Land Use and Infrastructure

5.3.7 Agricultural and Livestock

5.3.8 Forestry

5.3.9 Tourism

5.3.10 Paleontology, Archaeology and Historic Resources

5.3.11 Mineral Resources

5.3.12 Aesthetics

5.3.13 Noise

5.4 Implementation Priorities for Mitigative Measures

5.5 Environmental Monitoring

5.5.1 Purpose

5.5.2 Training

5.5.3 Short-term Monitoring

5.5.4 Long-term Monitoring

6.0 LIST OF PREPARERS

APPENDICES

A. Bibliography

B. List of Persons Contacted

C. Record of Scoping Sessions

D. Proforma Environmental Assessment

E. Pakistan Laws and Regulations Pertinent to Tunnel and Highway Improvements

F. Economic Feasibility Study

G. Social Soundness Assessment

H. Description of Dir-Ashret Road

I. Report on 1957 Survey Mission - "Dir-Chitral All-Weather Road Connection"

J. "Lowari Rope-way Dir-Chitral"

K. Review of Minerals and Mining

EXECUTIVE SUMMARY

1. Purpose and Scope of Environmental Assessment

The purpose of the Environmental Assessment (EA) is to provide the Government of Pakistan (GOP) and the U.S. Agency for International Development (USAID) with a full discussion of significant environmental consequences of improved access to Chitral District in order to ensure that environmental factors are integrated into the decision-making process. The EA provides a means of evaluating the proposed action to build a tunnel at Lowari Pass as well as project alternatives.

The EA includes a set of mitigative measures to minimize adverse environmental effects and enhance the quality of the environment. Monitoring programs are specified in order to permit identification of the effectiveness of mitigative measures and to serve as a warning device regarding the need for additional mitigative measures. A monitoring program also provides data for subsequent project evaluation.

Training requirements are identified in the EA in order to: (1) help assure effective implementation of mitigative measures and monitoring programs; and (2) develop and strengthen host country capacity to protect and manage the environment.

Two additional components are part of this report: an Economic and Financial Feasibility Analysis and a Preliminary Social Soundness Assessment. The purpose of the former is to determine whether the subject project is a worthwhile investment, i.e., whether benefits are sufficiently valuable to warrant expenditures. The purpose of the Preliminary Social Soundness Assessment is to review the compatibility of the project with the socio-cultural environment into which it is introduced, the spread or diffusion effects of the project on the population and the incidence or distribution of benefits and burdens among special groups.

2. Objectives of Government of Pakistan

The purpose of the project is to provide year-round vehicular access to Chitral District, located in the North West Frontier Province (NWFP) of Pakistan. Presently, the Chitral Valley is isolated from the rest of the country, because of its position within a series of high mountain ranges and lack of all-weather access. The Hindu Kush range lies to the west and north along the boundary with Afghanistan; to the east and south lies the Hindu Raj range, forming to the east the boundary of the Gilgit Agency and China and to the south the boundary of the Dir District. During the winter months (November through May), a poor road link from Chitral to Dir and heavy snow fall on the 10,500 foot Lowari Pass prevent vehicular

access to Chitral District. Steep grades and hairpin curves make the Dir-Chitral road extremely hazardous. In the winter, avalanches and snow slides render it impassable. Repairs of winter damage also result in delays during summer months. Although plane flights to Chitral afford some degree of year-round access, winter weather often curtails and delays flights. This situation imposes hardships on the population and places a financial burden on GOP and the Government of NWFP.

The GOP and the Government of NWFP anticipate that improved access will result in significant economic development of the Chitral District. Currently, the major occupation is agriculture, with the majority of farmland located on small flat terraces in the narrow valley of the Chitral River. Economic advantages expected by GOP include: exploitation of minerals, increased agriculture, development of forestry resources and increased tourism. A desired effect of improved access is reduced prices and government subsidies for many goods, such as fuel, oil, meat, sugar, etc., which must now be brought in and stockpiled in warehouses for winter consumption. With more efficient vehicular transport, the system of foot porters who trek goods over Lowari Pass during winter would no longer be needed. Year-round access is expected to improve the social welfare of Chitral District's 251,000 residents by providing winter access to medical help outside the District, enhancing the ability of government social service and other agencies and businesses to conduct activities, and reducing the psychological effect of isolation.

The geo-political advantage of improved, year-round access to the valley is more effective integration of Chitral District into the country of Pakistan. (At present, the most feasible year-round access to the District is from Afghanistan.)

3. Description of Proposed Project

3.1 Background

The idea of improved year-round access to Chitral is not new. Thirty years ago, a French team investigated road and tunnel improvements. In the early 1970's, the Frontier Works Organization prepared an Engineering Feasibility Report for a tunnel at Lowari Pass and GOP supported construction. The project was abandoned for a variety of technical and economic reasons, after 350 meters were built from the Dir District side. In 1987, the tunnel concept was again investigated by the National Highway Board of Pakistan, with financial assistance from the United States Trade Development Program. PRC Engineering, Inc. in association with Engineering Consultants, Ltd. of Pakistan, carried out a Feasibility Study to verify technical feasibility and develop preliminary cost estimates for the Lowari Tunnel on the Dir-Chitral road.

The definition of improved access for this EA is an all-weather route capable of supporting the design vehicle upon which the PRC Feasibility Report is premised, i.e. a truck-trailer combination capable of transporting a 70-ton military tank (PRC 1987, page 4-1).

3.2 Tunnel

In as much as a tunnel becomes useful only in conjunction with compatible access roads, a broad definition of the tunnel alternative which includes access roads from Dir and from Ashret has been adopted in order to provide a comprehensive EA as requested in the scope of work. Since full access roads were not included in the PRC Draft Feasibility Report, per the scope of work for that report, an estimate of additional project requirements and impacts for these roads has been made (see 3.3).

3.2.1 Tunnel Alignment

The PRC Draft Feasibility Report evaluated six different vehicular alignment alternatives for a tunnel as well as a railway tunnel alternative. The report's comparison of a railway shuttle operation with a road tunnel showed that a railway alternative was more costly and did not offer the flexibility of a road tunnel. Three locations for a south portal and four locations for a north portal were examined. The Draft Feasibility Report (PRC 1987) recommended that the AO alignment be selected for implementation. This alignment is described in the Draft Feasibility Report as follows.

> Alternative AO was conceived in order to minimize the length of the northern approach road and the amount of associated earthworks and structures.
>
> North Portal O is situated on the south bank of the Trangar Gol at elevation 2268 m, i.e. 146 m below south portal A (location of abandoned tunnel built in 1976). From the south side, the tunnel will have to be driven almost entirely downward, because of the resulting assymetrical gradients of 470 m at 0.5 percent south and 8109 m at 1.83 percent slope in the north. With 8579 m length, it is the longest tunnel alternative. The central ventilation system requires a 320 m long gallery and a 631 m high shaft. The approach road to the north portal is 613 m long with a maximum slope of 9.1 percent and necessitates a 120 m long open cut tunnel across the Trangar Gol and a 10 m bridge across the Gatus Gol. The approach road from the south portal to the existing road crosses Nirga Khwar with a gently curving alignment at a slope of one percent.

The choice among six vehicular alternatives studied essentially came down to the AO alignment described above and the AM alignment, which was shorter (8282 m), but two major

bridges were required at the northern approach. The AO alignment was selected because:

- It was cheaper by 15 percent.
- The logistic problems and associated risks were considerably reduced as a result of smaller quantities of road works and structures on the north side.
- Operation of the road link was considered more reliable.

Anticipated construction time for AO is also slightly less; the difference, however, was small.

Even though the project completion period might be extended by about 9 months and project costs would be 4 percent more, the Draft Feasibility Report also recommended allowing for installation of a pilot tunnel, driven from the north side, in order to reduce logistic problems and associated risks.

Geology was considered important to project feasibility, but was not significant to comparison of alignments, since there are no major differences in conditions. In the design stage, the alignment will be reconsidered in light of results of geological drilling, according to the Feasibility Report. A site-specific seismicity analysis was being carried out and is intended to be presented in the Design Report.

3.2.2 Cross-Section and Ventilation Alternatives

Four tunnel cross-sections including two ventilation options were analyzed in the Draft Feasibility Report. The recommended tunnel cross-section (PRC 1987) was a double-lane tunnel with longitudinal ventilation and no safety gallery. On the basis of the costs to construct and install a central ventilation station and shaft, these items were deferred. The Feasibility Report recommended an initial longitudinal ventilation system with jet fans, although this system could not handle eventual predicted traffic. Completing the longitudinal ventilation system would require future consideration of actual traffic volume, vehicular emissions and experience in operation of tunnel ventilation, as well as possible installation of a ventilation shaft.

3.2.3 Tunnel Requirements

Traffic clearances for the preferred double-lane tunnel are two lanes of 3.65 m and a vertical dimension of 5.50m. Water mains, pipes for high voltage transmission lines for other authorities, pipes for tunnel high voltage lines, and cable ducts for electrical power supply and distribution are also specified. SOS niches every 250 m and emergency lay-by areas every kilometer are provided. Concrete lining over the length of the tunnel is recommended for ease of maintenance.

Other requirements include: lighting fixtures located in the middle (under the vault) of the preferred double-lane tunnel; stand-by, battery-powered lighting and fluorescent, battery-powered, fire-emergency lighting.

Drainage is designed to: collect seepage water to avoid icing on walls, vault and road; prevent water pressure build-up behind the concrete lining; prevent water from stagnating under the pavement; and collect oil, petroleum or other spilled liquids. An oil and petrol separator is recommended on the wastewater collector at both ends of the tunnel.

The main electrical power supply is anticipated to be a 66kv overhead line to the south portal with cable feeders to the north portal. The high tension line is expected to be run from the grid station at Chokiatan, 8 km south of Dir, scheduled for completion by the end of 1989. (The incoming overhead feeder line is to be designed and installed by GOP and as such was considered outside the PRC scope of work for the tunnel project.)

An automatic fire and smoke detection system is recommended. Although a transversal or reversible semi-transversal ventilation would provide greater safety, the larger tunnel section and additional roof slab made these solutions uneconomical. Emergency exits to an escape gallery would increase costs by nearly twenty percent. It is planned that accidents be avoided by operational rather than design measures, e.g., combination of vehicles carrying flammable or dangerous materials into convoys.

Water supply for fire-fighting, drinking and sanitary needs is anticipated to be derived from streams at the north and south portals.

3.3 Access Roads

3.3.1 Approach Roads (Feasibility Report)

Design criteria utilized in the PRC Draft Feasibility Report are based on a truck-trailer with a minimum turning radius of 14.60 m.

A two-lane paved highway (7.30 m wide) with shoulders (2.50 m wide, but narrower in mountainous terrain) is planned. Horizontal alignments of tunnel approach roads avoid hairpin bends where possible. Vertical alignment is based on a maximum slope of 10 percent. Final design will include interruptions of sustained steep grades by intervals of more gentle grades, specifically at hairpin bends. Long climbing sections of the road will include a third auxiliary lane (3.65 m wide) for slower-moving traffic.

A flexible type pavement has been selected: 30 cm aggregate subbase, 15 cm graded crushed aggregate base and 10cm bituminous surface in two courses. A drainage system that prevents erosion of alluvial soils is planned.

Depending upon alignment, tunnel approach roads require a variety of different structures, such as hillside bridges and bridges across streams. Snow rakes, snow fences, avalanche galleries, and rock fall galleries are considered necessary.

Approach roads varied in length at the north approach from 613 m (recommended portal O) to 4,470 m. At the south approach, length varied from 200 m (recommended portal A) to 1000 m. Among the considerations in recommending AO as the preferred alignment was the more reliable operation of the road link and its cheaper cost.

3.3.2 Full Access Roads

The road from Dir to a south tunnel portal is inadequate for 70-ton loads as is the road from a north portal to Ashret. The paved road from Ashret to Chitral appears to be adequate for 70-ton loads. A technical review of road conditions south of Dir, particularly bridges and culvert capacities to ensure adequacy for heavy loads, is recommended.

3.4 EA Definition of Tunnel Alternative

The tunnel alternative, based on consideration of full access roads, is defined to include the following segments:

a.	Reconstruct road from Dir to south portal	21 km
b.	Tunnel alternative AM or AO	8.3 - 8.6 km
c.	Reconstruct road from north portal to Ashret	7 km
Total length of tunnel and reconstructed road		36.3 - 36.6 km

Tunnel access roads would be closed four to five times per season for one to five days, depending on snow removal efforts.

3.5 Construction and Operation Infrastructure

An important consideration is the construction of a pilot gallery at the north portal. A pilot gallery would provide: better information on exact geological and hydrogeologic conditions prior to full excavation; reduced ventilation requirements; and fewer access problems at the north portal.

The estimated costs of AO as the recommended alternative are 2,971 million Rs without a pilot gallery. For AO alignment, construction is expected to last 4.5 years (without pilot gallery) or 5 years (with pilot gallery) and require an average manpower of level of 307 persons (without pilot gallery) or 269 (with pilot gallery), not including the full length of access roads.

The construction schedule is predicated upon installation of permanent electrical power by Government authorities. If the start of construction at the Lowari Tunnel is scheduled before permanent electrical power is available from the Government Authorities, the contractor will have to install power generating stations at the north and south portal to cover all construction power supply requirements. In this connection, it is important to notice that the north portal fuel requirements for the winter months must be delivered before the Lowari Pass is closed by snow.

Excavation material at the south side is planned to be used to create a platform for a crushing and screening plant and material stockpiles. On the north side, excavation material is planned to be utilized in various ways, depending upon the tunnel alignment, but generally to create platforms or elevated areas, or for aggregate preparation and access road improvement. There does not appear to be, particularly for AO alignment, detailed consideration of any excess spoil disposal.

Maintenance manpower needs are estimated to require a staff of 50: nine each for control room and police, 13 for rescue/vehicle repairs/fire-fighting staff, 13 for road maintenance and snow removal, and six additional staff for management and electro-mechanical equipment maintenance.

An independent analysis of manpower requirements for construction made during EA site reconnaissance and prior to availability of the PRC Feasibility Report indicated that more construction personnel (500 to 800) might be needed than estimated in the Feasibility Report. In this instance, the higher number has been assumed as a worst-case assumption for projecting most environmental impacts. Similarly, preliminary higher estimates of tunnel maintenance personnel (100 rather than 50) have been assumed.

For the EA, high and low estimates of area needed for construction camps have been made; the low estimate is derived from PRC drawings of site installations, while the high estimate allows for workers and a large population of camp followers. As a worst case assumption for the north portal, camp size is not considered to be reduced by the pilot gallery construction technique. It is further assumed that temporary camps will become permanent settlements, based on experience with such camps and the continuing need for tunnel maintenance.

The camp population is estimated in the EA at 3,000 to 4,000 persons per camp. Once a tunnel is in operation, portal locations would become small centers of activity, particularly if tolls are charged, loads are inspected, or the like. The construction camp at the north portal would very probably become a permanent village, perhaps at a reduced size, to provide tunnel maintenance and services for vehicles and their occupants. For the same reasons, the existing small village (population estimated at 500) near the south portal would probably have a larger population after construction.

Areas needed for construction are estimated as follows:

Tunnel (Camp and Spoil Disposal Area):	Hectares
North Portal	7*-10
South Portal	9*-12
Total	16 -22

* Based on PRC Feasibility Study. Larger number represents potentially greater area due to larger estimate for construction camp population.

Mobile camps would also need to be established along access roads (Dir to south portal and Ashret to north portal) in order to rebuild road access in a manner compatible with tunnel design criteria.

The EA recommends as infrastructure in the camps: a food storage facility at the north portal camp, a sewage treatment facility and an emergency medical center/infirmary. In particular, site planning should address needs for compact infrastructure, efficient internal access within the camp and the construction of multi-story buildings at portal sites in light of the limited level land in the area. Schools might also be needed for workers' children.

4. Environmental Policy, Regulations and Procedures of the Government of Pakistan and USAID

4.1 Pakistan Environmental Policy and Regulations

The report complies with Pakistan Environmental Ordinance of 1983 and provides a full discussion of environmental policies, regulations, and natural resource legislation applicable to improving access to Chitral, thus offering a framework for subsequent decisions. With respect to the 1983 ordinance, a standardized Pro-Forma Questionaire has been answered with cross-references to the EA text. This Pro-Forma is being used by GOP until such time as formal procedures for an EA are developed.

Other pertinent environmental legislation includes the Forest Act, NWFP rules for Management of Protected Forest, NWFP Wildlife Protection, Preservation, Conservation and Management Act of 1975, and the Antiquities Act of 1975.

The West Pakistan Highways Ordinance of 1959 authorizes acquisition of land for highway improvement. Specific land acquisition procedures for a public purpose are detailed in the Land Acquisition Act of 1894. Blasting would be regulated under the Explosives Act (IV) of 1884 which controls transport and use of explosives. Stream and drainage control is regulated by the NWFP Canal and Drainage Act (VIII) of 1948.

The EA recommends additional analysis of state property versus tribal area and the applicability of various laws which do not in all cases extend to Provincially Administered Tribal Area.

4.2 USAID Environmental Policy and Regulations

The report in its entirety is designed to satisfy the requirements of USAID environmental regulations, including 22 CFR Part 216, A.I.D. Environmental Procedures; Foreign Assistant Act, Section 117, Environment and Natural Resources; Foreign Assistance Act, Section 118, Tropical Forests; Foreign Assistance Act, Section 119, Biological Diversity; and Policy Determination-6 (PD-6).

Environmental procedures at 22 CFR Part 216 specify that USAID identify the environmental consequences of USAID-financed activities prior to a final decision to implement a project. In accordance with the regulation, the EA has been prepared using the recommended EA format and contents, has considered alternatives, has incorporated the results of scoping sessions and has given attention to endangered species and their critical habitats.

With respect to Section 117, the EA has given special attention to the maintenance and restoration of resources, in this case, forest, wildlife and mineral resources, and has developed mitigative measures to protect these as well as other resources.

In accordance with Section 118, which stresses the importance of forest and tree cover, the EA addresses forestry management and conservation.

In compliance with Section 119 regarding biological diversity, the EA includes an analysis of wildlife protection and protected habitats; EA preparers drew upon the expertise of GOP wildlife personnel and international wildlife agencies.

The EA satisfies PD-6 by addressing the environmental sustainability and soundness of improved access and pays particular attention to examining the potential range of secondary impacts. Resource management programs are included in the

recommendations for mitigative measures. Assistance in building host-country capacity to deal with resource problems is achieved by preparation of the Pro-Forma, inclusion of Pakistan counterparts in the EA team, and environmental training programs as part of the recommended set of mitigative measures.

5. Alternatives Evaluated

5.1 No-Action

The no-action alternative is defined as maintaining the present road as has been done in the past, but not investing large sums to improve it. Such maintenance would include clearing the road each spring, re-building retaining walls and drainage structures and re-grading the road during the months of use.

The no-action alternative would not permit transport of 70-ton tractor-trailers to the Chitral Valley. Thus, it is not an alternative which conforms with the project goal of providing all-season transport to Chitral for heavy loads.

If no-action as defined above is selected, the road can be expected to deteriorate in 5 to 7 years to the point where it becomes usable only by jeeps, and in 7 to 10 years would revert to a foot path.

5.2 All-Road Access

In order to satisfy the desired goals for access, an all-road access would need to permit year-round operation of 70-ton tractor-trailer combinations. A highway capable of carrying such loads would require construction to certain geometric standards, e.g., minimum centerlines, curve radii and maximum permissible grades. Design criteria would be similar to those adopted for tunnel approach roads (see 3.3.1, above). Extensive retaining walls, avalanche protection devices, and drainage structures are required in addition to complex, engineered structures to prevent rock slides during snow melt. An improved highway would need a substantial pavement to support large loads during freezing and thawing and would have to be equipped with delineators in such a way that snow removal equipment could operate around the clock, during the snow season.

Portions of the existing "road" do not lend themselves to upgrading to the standards described above. Extensive topographical survey work would be required to determine a new alignment. Engineering structures along this new alignment would be required and result, in effect, in a new highway for approximately 25 percent of the present route.

Improvement of the existing road consists of building or rebuilding approximately 50 kilometers of highway. For purposes of comparison with the tunnel alternative, four seg-

ments are defined of which two ("a" and "d") are also required for tunnel access:

a.	Reconstruct existing road from Dir to south portal location	21 km
b.	Reconstruct existing road from south portal location to Lowari Pass	10 km
c.	Construct new road from Lowari Pass to north portal location	12 km
d.	Reconstruct existing road from north portal location to Ashret	7 km
	Total new/reconstructed road	50 km

This alternative has considerable merit and warrants preliminary engineering studies, since costs are estimated to be an order of magnitude less than the costs of a tunnel.

The infrastructure for roadway construction will require two mobile camps, one operating on the road on the Dir side and the other on the Chitral side. It is likely that permanent camps would be established at strategic locations. Water, shelter, sanitation facilities and fuel supplies would be needed. Construction of an improved road is estimated to take four years (up to seven years, depending on phasing) and utilize the services of 600 men. Road maintenance would require about 50 men.

Depending on the snow removal effort, an all-weather road over the pass would be closed four to five one-to-two week periods.

5.3 Lowari Rope-Way

The Lowari Rope-Way alternative attracted local interest for several years. The Superintending Engineer of the Development Circle of Peshawar wrote a paper concerning this subject in 1974. The report suggests a cable car system for the transport of goods and people as a temporary solution to the annual supply problem in Chitral until a tunnel can be built. The paper outlines a cable car system (27,200 feet long) from the Gujar Post on the Dir side to the Ziaret Post in Chitral District. An engineering study of this system would be necessary to answer questions regarding capacity, loading/unloading method, power requirements, utility in winter and the like.

The Rope-Way alternative, like the tunnel alternative, would require improved access to the facility itself, if heavier loads than currently cross the pass are to be transported. This alternative would therefore consist of these components:

Cable car system (27,200 feet)	8.3 km
Reconstruction of existing road from southern terminus to Dir	21 km
Reconstruction of existing road from northern terminus to Ashret	7 km
Approximate Total Length	36 km

Construction of the Rope-Way would entail the building of a series of concrete foundations for the erection of towers. This would probably be accomplished from "flying" tent camps. Permanent settlements, however, could well be expected at the termini which would become break-in-bulk points.

Construction of a rope-way is estimated to require 50 men. Maintenance and operation would require 20 men (10 at each end). Construction time is estimated at between 2 and 3 years for the cable car system and 1-2 years for the generating station. These estimates do not include improved access to the cable termini.

The Rope-Way alternative has estimated costs similar to those of an improved roadway, but does not serve the goal of access for vehicles capable of carrying 70-ton loads. It also requires reorganization of the transport system institutions. Such a system is much less flexible with respect to transporting mixed loads, heavy equipment, vehicles and anything larger than a gondola's capacity, unless the item could be disassembled. Since insufficient information is available to evaluate this alternative and it does not fulfill the project purpose and need, no detailed evaluation of environmental impacts is made.

5.4 Other Alternatives

A thorough analysis of all available alternatives for all-weather access should take into consideration various routes requiring a combination of road, bridges and one or more tunnels. The fact that a Dir-Chitral road exists presently need not pre-determine a tunnel location, since much of the road cannot meet access specifications without substantial up-grading.

If one were to assume that the existing road between Dir and Ashret on either side of a proposed tunnel portal could support the specified design loads, such a choice would be appropriate. Since this assumption is not correct, another alternative could be presumed to exist, i.e., a different route, with a tunnel not located under Lowari Pass, might be equally or more attractive. For example, the cost to upgrade existing road access to the north and south of the tunnel could be comparable or greater than the cost of an entirely new road from Dir to an undetermined south portal tunnel location and from an undetermined north portal location to Ashret. It is

possible that a tunnel of less or equal length could connect such undetermined portal locations. An engineering determination would be needed to rule out the possibility of a different tunnel and road combination. It is also possible that an improved all-road access following a different alignment than the existing road is advantageous.

Thus, the presumption that a tunnel at the Lowari Pass location, a tunnel at an undetermined location, or an improved road is better from an engineering viewpoint alone, despite cost or environmental considerations, has not yet been evaluated.

Because of the historical emphasis on a tunnel, the little attention given to improved all-road access, and the substantial difference in costs, candid examination of the alternatives to a tunnel is recommended.

6. Proposed Action and Impacts

As a preamble to the discussion of impacts, some pertinent facts about the Chitral District and the vicinity of the proposed tunnel project are relevant.

The immediate vicinity of the Lowari Pass is remote, mountainous and sparsely populated with few sensitive receptors and no important agriculture or grazing. Deposits of sand, gravel, marble and granite are readily available for use in road or tunnel construction. Existing forest is comparatively better than many areas of Chitral District. Wildlife populations (particularly Chukar partridge) are present, but in the proximate vicinity of the present road, disturbances to wildlife already exist.

The Chitral District (14,850 square km) has a population density of approximately 17 persons per square km. Development is limited. Because of steep terrain, rock outcrops and snow cover, cultivated area of approximately 18,000 hectares could probably not be expanded to much beyond the amount (less than 25,000 hectares) contemplated as part of the International Fund for Agriculture Development (IFAD) and Asian Development Bank (ADB) Chitral Area Development Project. Most agriculture requires irrigation which has historically been possible as a result of indigenous techniques of tapping perrenial streams. Deforestation is a serious problem and in some areas is probably irreverisble, although logs are a principal export. Forested lands represent four percent or less of total area.

Industry and manufacturing are of marginal importance. Tourism is an established sector of the economy with 15 hotels providing approximately 4,000 room nights during a tourist season (principally May to October), but with an occupancy rate of only slightly over 20 percent. Current mineral production is very low; mines operate on an intermittent basis, except for one antimony mine that has been in continuous

production. Many mineral prospects exist, but none have been proved to be economically exploitable. The internal transportation system is extremely limited. Roads suitable for truck transport include only the Chitral-Ashret access to the Lowari Pass, which is inaccessible from October through May. (There is air service from Peshawar.) Travel on other roads requires jeeps or other four-wheel drive vehicles. Most of the Chitral Valley is accessible only by foot and most villages have no or inadequate road access.

Per capita income levels are low (around $102 per annum). Cash income comes principally from wage labor, frequently located outside the district. Farm production does not typically meet consumption needs. Imports of grain are required to make up deficits. In addition to subsidies on grain, GOP supports imports of sugar and petroleum.

Rugged mountain resources, sparse population, and limited levels of exploitation in any economic sector have probably contributed to the continued presence of wildlife, including endangered species such as snow leopard, musk deer, leopard, leopard cat and urial, among others. Increased pressures on wildlife populations are occurring as a result of deforestation, competition with domestic livestock, hunting, poaching and agricultural practices. The rivers and lakes of Chitral District support a variety of fish. Trout for sport fishing have been introduced into three stream networks as part of a fisheries development program and two trout hatcheries are in operation.

In summary, the Chitral District is not well-endowed with natural resources, except for minerals prospects. Economically feasible development of minerals must be proved by further exploration, barring major mineral market changes. Opportunities for expansion of other sectors of the economy are constrained.

Nevertheless, continued lack of access for the long winter inhibits the district's political integration into the rest of Pakistan, results in difficulties for the delivery of government services and the posting of government officials, and contributes to a psychology of isolation.

6.1 Impacts of Construction

6.1.1 Physical Impacts

Air Quality. Quantities of exhaust fumes would increase during construction due to operation of construction-related machinery. More dust would be added to the air. Nevertheless, no air quality problems are anticipated. Within the tunnel itself, construction ventilation has been examined (PRC 1987) and protective measures are assumed to be included as part of final feasibility and design studies. With a lesser need for heavy machinery and construction equipment for road access, no significant air quality problems are anticipated.

Geology, Physiography and Soils. No impacts of significance to geological formations are anticipated. Localized modification of physiography and soils would occur. The principal issue is to ensure that soil erosion is minimized. The more important impacts of geology and physiography in the Lowari Pass area are on the project rather than of the project on the environment. Identification of landslide prone areas and analysis of active faults in the proposed tunnel vicinity are recommended.

Attention to rock (spoil) disposal requirements is important. Use of excavated material in camp construction and approach roads does not appear to account for the volume of excavation. Further studies are needed to determine appropriate disposal locations for excavated materials.

Water Resources. Temporary impacts on water quality due to sediment releases during construction are expected, but no permanent impacts are anticipated.

6.1.2 Biological Impacts

Terrestrial Ecology. Approximately 160 hectares (tunnel) to 250 hectares (all-road access) of terrestrial habitat would be impacted, but could be offset by enhancement of proximate habitats.

Aquatic Ecology. Increases in suspended matter, increased turbidity, and alterations of erosion and sedimentation patterns would have temporary impacts on aquatic communities.

6.1.3 Social, Economic and Other Impacts

Socio-economics, Land Use and Infrastructure. The establishment of construction camps (3,000-4,000 population) would cause significant localized increases in population and require advance site planning and infrastructure. Direct land use impacts are relatively small, ranging from land use changes of 150-160 ha (tunnel) minus about 15 acres of abandoned roadway to 250 ha (all-road access) minus 48 acres of abandoned roadway. Approximately 300-800 jobs would become available in construction work with some multiplier effects creating additional jobs. Infrastructure is recommended for the construction camp, as indicated at 3.5 above. Increased risk of vehicular accidents is likely, with more use of roads for delivery of construction equipment. Road-construction work and, especially, tunneling activities would be probable causes of accidents.

Agriculture and Livestock. Minor losses of agricultural or grazing land would occur, but no significant impacts as a result of construction activities are predicted.

Forestry. There is increased likelihood that timber resources in the construction camp areas would be cut for use as firewood and, possibly, for construction activities. The latter could be minimized by appropriate restrictions on the contractor and timber could be bought at legal auction. Limitations on tree-cutting for the camps' domestic fuel supply, however, would be harder to achieve. This impact is considered serious in light of deforestation and consequent erosion and should be avoided and/or mitigated.

Tourism. Construction activities would create temporary inconveniences for the 40 percent of tourists who gain access to Chitral by vehicle.

Paleontological, Archaeological and Historic Resources. There is no evidence of such resources in the vicinity of proposed construction.

Mineral Resources. Minerals such as calcium carbonate for cement or marble and granite for crushed stone would be mined for use as road metal. Sand and gravel deposits near the proposed tunnel would likely be used in concrete production. Since resources are large, use in construction would not lead to depletion or any serious impacts.

Aesthetics. Alteration of the landscape would occur, but no major visual impacts are associated with construction, assuming sensitivity in the matter of spoil material disposal.

Noise. Construction-related noise from blasting and excavation would occur. Because the surrounding area is sparsely populated, no major impacts are predicted. Workers would require ear protection. Some mitigative measures might be needed for camp populations.

6.2 Direct Impacts of Operation and Maintenance

6.2.1 Physical Impacts

Air Quality. The principal concern is the impact of vehicular emissions within the tunnel. The longitudinal ventilation system selected is sufficient up to the year 2005, but at that point modifications would be needed in order to handle projected traffic volumes. Further analysis of the ventilation system is suggested, because a longitudinal ventilation system must be reduced or stopped in case of fire, and intervention is not as easy as with semi-transversal or transversal systems.

Geology, Physiography and Soils. No significant impacts during operation are expected. Monitoring of faults and risk assessment for landslides or other natural disasters are recommended to identify and help avoid potential impacts of the natural environment on the proper operation of a tunnel and road access.

Water Resources. Other than minor impacts of sediments or contaminants to nearby streams, no significant impacts are predicted, assuming that spill prevention, control and clean-up plans are implemented.

6.2.2 Biological Impacts

Terrestrial Ecology. No significant adverse impacts are predicted. The tunnel portion of improved access would eliminate regular traffic over the Lowari Pass and thus reduce disruption to wildlife in that area.

Aquatic Ecology. No significant impacts are predicted, since no changes in flow volume or water quality are anticipated.

6.2.3 Social, Economic and Other Impacts

Socio-economics, Land Use and Infrastructure. Operation of a tunnel and/or roadway is likely to result in permanent villages at portal locations and some land use development at strategic locations along a roadway, e.g. services for travelers. Operation and maintenance of a roadway or tunnel would create 50 to 100 additional jobs and, perhaps, some other long-term employment in service-sector jobs oriented to travelers. No impacts on infrastructure are anticipated. With increased traffic, however, additional accidents are likely. Improved road design would permit vehicles to achieve greater speed; more serious accidents, particularly collisions, are likely than is currently the case.

Agriculture and Livestock. No direct impacts as a result of operation and maintenance are anticipated.

Forestry. With more traffic, the risk of forest destruction as as result of fires or illicit wood-cutting increases.

Tourism. For a small proportion of tourists attracted to the rigors of traveling a high mountain pass, a tunnel or improved road would not represent the same attraction. Better road access, however, would probably induce more tourists to chose vehicles rather than airplanes as a mode of travel into Chitral. An 8 km long tunnel would in itself be a modest tourist attraction.

Mineral Resources. Although maintenance requirements would generate some mining of road-metal, operation of a road or tunnel would have no impact on mineral resources.

Aesthetics. No significant impacts due to operation and maintenance are likely.

Noise. Additional roadway noise would be of little consequence. The volume of traffic is not high and population is sparse.

6.3 Secondary Impacts

Secondary impacts as a consequence of improved access in and of itself are limited. Improved access is a precondition for various kinds of development, but better access does not alter the endowment of exploitable resources nor funding levels for government services.

Air Quality. No significant impacts are anticipated, assuming no large-scale mining, smelting or refining operations are initiated in the near future (see Mineral Resources, below).

Geology, Physiography and Soils. Increased exploration for minerals would occur. Localized disturbance of soils and, if exploration roads were built, modification to slopes would result. If increased timber cutting were permitted or controls not exercised, further erosion would occur as a consequence of deforestation.

Terrestrial Ecology. Improved access for hunters outside Chitral District could increase hunting pressures (legal hunting and poaching), particularly in winter when wildlife move to lower elevations where they are closer to human populations. To the extent hunters from outside are attracted to the district, there will be increased burdens on the Chitral Wildlife Division to enforce hunting regulations. Increased exploitation of forests (see Forestry below) and any stepped-up mineral exploration or mining activities would subject wildlife habitat to increased disturbance.

Aquatic Ecology. Scattered sources of pollutants (petroleum and oil) from increased vehicles on roadways, filling stations or automobile repair shops are not expected to result in serious consequences to aquatic ecosystems. Any increase in forest exploitation, however, would have deleterious consequences on streams which already suffer from effects of erosion and sedimentation.

Socio-economics, Land Use and Infrastructure

No adverse environmental impacts are predicted; little change is expected due to the limited amount of development projected as a result of improved access. Unless a major mineral resource were found to be exploitable, opportunities for substantial economic development as a result of improved access are small. In this context, it is critical to note that anticipated benefits of the IFAD/ADB Chitral Area Development Project would probably not be fully realized without improved access into Chitral District. The Chitral Access Project would complement the development project in important ways, especially efforts to improve the internal road network of the district, achieve production of a marketable fruit surplus and boost cereal production to levels capable of sustaining the population.

Delivery of social services and other government assistance would be facilitated. Government posts in Chitral would be more attractive than is currently the case.

Reduced transport costs and alleviation of winter shortages would benefit the population by reducing prices, especially during winter. The reduced transport cost component of government subsidies on staple items would benefit government agencies.

Improved access would enhance political security and help achieve greater political integration of the Chitral District into the county of Pakistan.

Agriculture and Livestock. Improved access would reduce transport cost components of agricultural inputs, reduce transport costs to import grain into the district and facilitate export of a fruit surplus anticipated by the IFAD/ADB Chitral Area Development Project. No increases in area under cultivation are expected as a result of improved access in and of itself. Improved access would facilitate achievement of that project's livestock program, but no livestock exports are projected.

Forestry. With lowered transport costs for logs, illicit tree-cutting or pressures to increase the allowable cut could be anticipated. If increased exploitation of forestry resources were to occur, the effects would be devastating but short-term; deforestation is already a severe problem, and the forest would soon disappear.

Tourism. A modest increase (10 to 15 percent) in tourism, particularly by tourists from other parts of Pakistan, is anticipated. Since facilities for tourists are already available but underutilized, additional infrastructure would not be needed.

Paleontological, Archaeological and Historic Resources. No adverse impacts are anticipated, assuming controls on minerals exploration and any subsequent exploitation of these resources.

Mineral Resources. While many mineral prospects exist, none are known to be sufficiently large, sufficiently rich or well-enough defined to conclude that major mining, smelting or refining activities would occur. (Some exploitation of minerals for use in tunnel and road construction and limited marble export are assumed.) Nevertheless, improved access would stimulate increased exploration activities and these activities could result in proving feasible and profitable avenues of exploitation. Since the results of the EA analysis cannot predict location and timing of mining activities, mitigative measures specific to such activities must be relied upon to avoid environmental effects. In the meantime,

mitigative measures to reduce or avoid effects of exploratory programs have been included in the EA.

Aesthetics. Aside from the potential for greater deforestation (illicit or a result of an increased allowable cut), minerals exploration and any subsequent mining, no adverse effects are predicted.

Noise. No adverse effects, except localized effects due to potential minerals exploration and subsequent mining, are anticipated.

7. Mitigative Measures

Mitigative measures included in the EA respond to the need for such measures in conjunction with construction of the project, operation and maintenance of the project and secondary development in the Chitral District.

7.1.1 Construction Phase Mitigative Measures

These measures are designed to minimize or, where possible, avoid adverse environmental consequences of construction activities. Although some of these recommendations may well be included in final design and thus not needed as mitigative measures, they are listed here as precautions.

- Advance site planning to permit efficient and environmentally appropriate use of very scarce areas of level land;

- Provision for an emergency medical center/infirmary; sewage treatment facility to protect public health; and food storage facilities (especially at the north portal);

- Water supply development and protection plans to assess adequacy of planned surface water withdrawals, development of additional water supplies if needed, and protection of both ground and surface water from contamination due to spills, accidents and human waste products;

- Soil erosion and sediment control;

- Spill prevention, clean-up and control;

- Forest and habitat protection and enhancement, including sanctions against tree-cutting and compensation for taking of wildlife habitat by habitat enhancement of proximate areas;

- Briefings of construction managers and periodic inspections concerning paleontological, archaeological and historic resources;

- Protective measures for tunnel construction ventilation, protective respiration gear for workers, sound-attenuating devices and ear-protecting equipment;

- Safety training for construction workers and special driver-safety training for construction crew drivers;

- Provision for emergency transport of accident victims;

- Control of explosives in accordance with GOP legislation and specific worker-safety procedures;

- Compensation for land acquisition in accordance with GOP legislation;

- Public safety awareness program to reduce accident risk during road and tunnel construction;

- Advance training in construction specialties for Chitral and Dir residents to allow them to benefit from new employment opportunities.

7.1.2 Operation and Maintenance Phase Mitigative Measures

Suggestions for safety-related design criteria to permit safer operation of a tunnel and access roads require consideration during final design. Mitigative measures during the operation and maintenance phase also entail continuation of programs begun during construction.

- Safety-related design criteria and standards, including tunnel safety gallery, median barrier and further analysis of ventilation alternatives;

- Operations safety plan incorporating vehicle inspection, towing service, paramedic/ambulance services, enforcement of speed limits and other traffic regulations and specialized considerations for snow removal and de-icing;

- Spill prevention, clean-up and control;

- Natural disaster emergency plan, including assessment of risk-prone areas for avalanches, landslides, floods and earthquakes;

- Training in safety operations; spill prevention, clean-up and control; paramedics; vehicle inspection; traffic regulation enforcement; and handling of natural disaster situations. Such a

program could include preferential training for residents of Chitral and/or Dir Districts.

- Public education, particularly in driver safety awareness and in forest/brush fire prevention.

7.1.3 Mitigative Measures for Secondary Impacts

Mitigative measures for secondary impacts respond in part to existing conditions in Chitral District and are not necessarily remedies for adverse environmental impacts of improved access in and of itself.

- Regulations regarding storage of petroleum products, disposal of vehicle maintenance products and spill prevention, control and containment to protect surface water resources;

- Wildlife field studies, wildlife protection plan and formulation of wildlife programs to counteract infringment on wildlife populations (particularly endangered species) and the consequences of deforestation;

- Control of wildlife poaching through use of a wildlife inspection and control station;

- Training for Chitral Wildlife Division personnel and wildlife extension program;

- Establishment of protected area or park at Lowari Pass;

- Investigation of additional farm-to-market roads, beyond those planned as part of the Chitral Area Development Project;

- Support to the training and extension programs of the Chitral Area Development Project, specifically regarding use of fertilizer and agricultural chemicals;

- Revised forestry management plan based on field studies to scientifically determine an allowable cut supporting a sustainable yield;

- Establishment and enforcement of sanctions against illict tree-cutting;

- Terrain analysis to guide reforestation of mountain slopes;

- Provision of fuelwood by woodlot plantings, in addition to those planned by the Chitral Area Development Project, or encouraged use of alternate fuel sources;

- Establishment of environmental procedures and regulations for Mineral Exploration Plans to be developed by companies or proponents on a site-specific basis;

- Establishment of procedures and regulations for Environmental Assessment and Mitigation Plan for mining, smelting or refining activities to be developed by proponents on a site-specific basis.

In the case of secondary impacts, mitigation actions are most important to assist in: (1) forest resource management to reduce or limit deforestation, which will have beneficial effects on wildlife populations; (2) establishment of safeguards to protect the environment during minerals exploration and, if exploitable resources are found, measures to ensure continued protection. Additional investigation and study of wildlife populations and habitat are recommended, because of the presence of endangered species and the existing man-induced pressures on wildlife and critical habitat.

8. Monitoring and Evaluation

8.1 Monitoring

The EA addresses the need for short-term monitoring during the construction period and a limited time thereafter. Following are recommended components of this short-term monitoring program:

- Records of construction accidents;

- Inspections of spoil disposal;

- Documentation of any paleontological or archaeological finds;

- Identification and enforcement of sanctions on logging activities;

- Streamflow gauging in Nirga Khwar and Trangar Gol to determine adequacy of water supply and subsequent effects on aquatic communities;

- Determination of adequacy of erosion and sediment control techniques.

The EA recommends initiation of long-term monitoring during or prior to construction and continued monitoring throughout project life, assuming other events or programs do not obviate the need. Following are suggested components of a long-term monitoring program:

- Records of avalanches and landslides in the vicinity of tunnel and along access roads;

- Mapping and monitoring of faults in the tunnel corridor;

- Collection of surface and groundwater quality data in the vicinity of tunnel, approach roads and strategic locations in Chitral and Dir Districts;

- Traffic counts;

- Records of traffic accidents, fires and spills;

- Periodic surveys of tourist use;

- Surveys of wildlife populations in conjunction with World Wildlife Fund and other conservation organizations;

- Surveys of land use change, utilizing remote sensing techniques;

- Inspection and review of mining exploration activities;

- Analysis of forest composition and changes, utilizing remote sensing and field investigations, and surveys of consumption and export of forest products;

- Geomorphological terrain analysis, based on remote sensing techniques, to determine geomorphological constraints to development and changes in geomorphologically dynamic features.

8.2 Project Evaluation

8.2.1 Primary Impacts

The purpose of the project is to provide year-round vehicular access to the Chitral Valley. Evaluating the project's effectiveness in terms of meeting this objective would be feasible as well as quantifiable. Measuring the successful implementation of year-round access is simple and inexpensive, requiring analysis of traffic, tolls, volumes of goods, accidents, closings, spills and the like. More informative studies, although still inexpensive, could analyze the project's impact on the region's transport system and might involve an origin-destination survey of vehicles traversing Lowari Pass and interviews of travelers. Utilization of similar rapid, low-cost data gathering could yield timely roadway maintenance information from drivers, concerning snow conditions, rock slides, etc., as well as an analysis of types of vehicles using the access route and types of goods being transported.

8.2.2 Secondary Impacts

Assessing the project's performance within the context of more complex objectives such as those defined by GOP (economic development in Chitral District, improved social welfare of the population, and geo-political security of Pakistan) would be a more difficult task. Firstly, data collection and evaluation plans must be sufficiently defined so as to identify the users of such information, the institutional locus for data collection and analysis, the project's specific goals, key performance indicators and data collection methodologies. (See Program Design and Evaluation Methodology Report No. 9, Guidelines for Data Collection, Monitoring and Evaluation Plans for A.I.D. Assisted Projects. April 1987, Washington D.C.). Secondly, as findings of the EA and Economic Feasibility Analysis indicate, major economic development or changes in social welfare can not be an assumed consequence of the Chitral Access Project. Year-round access to Chitral is a necessary, but not sufficient, precondition for dramatic changes in economic or social development. Meaningful project evaluation with respect to impacts on agriculture, livestock, village infrastructure, water supply, power, land use and population must, therefore, take into account and be coordinated with an assessment of other projects currently planned for Chitral. Since increased exploration for minerals and a greater likelihood of major finds are predicted in a sector where other development projects are not planned, tracking the success of mineral exploration efforts is recommended. Tourism is expected to increase modestly. Records of tourist arrival, modes of arrival, counts of hotel rooms and occupancy rates as well as interviews with suppliers of tourist services would provide useful data to evaluate effects of improved vehicular access.

Because a major objective of improved access is reduced prices and/or reduced transport subsidies for various goods, baseline data on market prices and amount of government transport subsidies need to be collected and tracked in the construction period and subsequently. Seasonal updating of a record of selected prices for major commodities, but including all those with government subsidy and periodic updates of government subsidies for commodities could accomplish this goal. Attention to exogenous factors which can cause price fluctuations will be needed. Decreased transport subsidies, for example, may not be reflected in lower consumer prices or it is possible that transport subsidies may not decrease for reasons unrelated to improved access. The evaluation, therefore, will need to incorporate a historical perspective, including qualitative information and results of interviews with government officials.

Evaluation of secondary impacts on forest and terrestrial ecology (especially wildlife) requires a different persepctive. In these situations, adverse impacts are likely to occur as a result of pre-existing conditions which improved access may or may not exacerbate. Because of the serious na-

ture of adverse effects, whatever their cause, monitoring and mitigative measures have been proposed. The minimum desired outcome of the evaluation would be to show that wildlife populations had not decreased and that deforestation had not increased. Adequate baseline data (see monitoring), however, will be needed in order to make valid evaluations.

8.2.3 Mitigative Measures and Monitoring

Examining the success of mitigative measures, monitoring programs and associated training forms another component of the evaluation. Safety-related programs can be evaluated through use of accident records, interviews with drivers or accident victims and other straightforward measures. Assuming collection of baseline data on workers' health and subsequent record keeping, health of wokers (and to some extent camp population) can be documented. Evaluaters can: observe spoil disposal, soil erosion and sediment control, and conditions of construction camps; compare these with the objectives and design of mitigation measures and review the success of monitoring. With regard to other mitigative measures recommended during constrution or operation of a tunnel, documentation of a mitigative measure's implementation and end results would be needed. Most of this aspect of the evaluation can be achieved within the context of documenting and evaluating primary effects.

Evaluation of mitigative measures and monitoring for secondary impacts related to ecology and forestry, has been addressed above (8.2.2) as a suggested means to evaluate project success, whether the project helps to remedy an environmental problem or simply does not contribute to further environmental degradation.

Chapter 1

Project Background: Purpose, Pertinent Policies and Regulations

1.1 Study Area

The Chitral District, located in the northwest corner of Pakistan, lies in the North West Frontier Province (NWFP). (See Figure 1, Location Map.) The population is estimated at about 251,000. The District is comprised of a series of high mountain valleys. The Hindu Kush range lies to the west and north along the boundary with Afghanistan; to the east and south lies the Hindu Raj range, forming to the east the boundary of the Gilgit Agency and China and to the south the boundary of the Dir District.

The Chitral Valley lacks year-round, vehicular access to the rest of Pakistan. During the winter months (November through May), the poor road link from Chitral to Dir and heavy snow fall on the 10,500 foot Lowari Pass (some sources cite 10,200) prevent vehicular access. (See Figure 2.) Steep grades and many hairpin bends make the road hazardous at all seasons, but, in winter, avalanches and snow slides make it impassable for vehicles. Repairs of winter damage also result in delays during summer months. Plane flights afford some degree of year-round access, but inclement winter weather and fog at other seasons often curtail and delay flights. Good vehicular access to the District is technically feasible year-round through Afghanistan, along the Chitral River which flows out of the valley at Arandu and back into Pakistan at Warsak, about 115 kilometers to the south.

The 220-mile long and 3-mile wide Chitral Valley is the focus of the study area, but investigations have also included Dir and the road to Dir (see Figure 2). The Chitral valley has two-thirds of all agricultural and economic activity located in its southern half, roughly from Mastuj south to Arandu. The major occupation is agriculture, with the majority of the farmland located on small flat areas or terraces along the Chitral river; all but a small area is irrigated. Rainfall averages about 650 mm per year in the south grading to about 200 mm to the north (northern figure is an estimate based on the appearance of the barren hills).

1.2 Background

Studies of improved, year-round access have a 30-year history. In 1957, a French team investigated road and tunnel improvements (see Appendix I). In 1973, an Engineering Feasibility Report for a tunnel was prepared by the Frontier Works Organization, NWFP. In 1976, the Government of Pakistan (GOP) supported the construction of a tunnel at an elevation of

8,000 feet. The Frontier Works Organization abandoned the project for a variety of technical, economic and political reasons, after 350 meters were built from the Dir District side.

Tunnel concepts were subsequently pursued about a decade later. In 1987, the National Highway Board of Pakistan, with financial assistance from the United States Trade Development Program, contracted PRC Engineering, Inc. in association with Engineering Consultants, Ltd. of Pakistan to conduct a review and analysis of available data, perform field surveys and investigations and prepare an updated feasibility study. The Draft Feasibility Report (PRC 1987) is the basis for this Environmental Assessment of tunnel access into the Chitral District.

1.3 Purpose of Project

The purpose of the project is to provide year-round, vehicular access to the Chitral Valley. The Governments of Pakistan and the NWFP anticipate that improved access will result in significant economic development of the Chitral District. Desired effects include reducing prices and government subsidies for many goods such as fuel, oil, meat, sugar, etc., which must now be brought in and stock-piled in warehouses to be consumed in the winter months. With more efficient vehicular transport, the use of foot porters to bring goods over the Lowari Pass during winter would no longer be needed.

Year-round access is expected to improve the social welfare of the population in winter, e.g. better access in case of medical emergencies, ability of government agencies and business to conduct activities. Expected economic advantages include the possible exploitation of mineral, agricultural, and forestry resources along with increasing tourism and consequent economic benefits for these sectors.

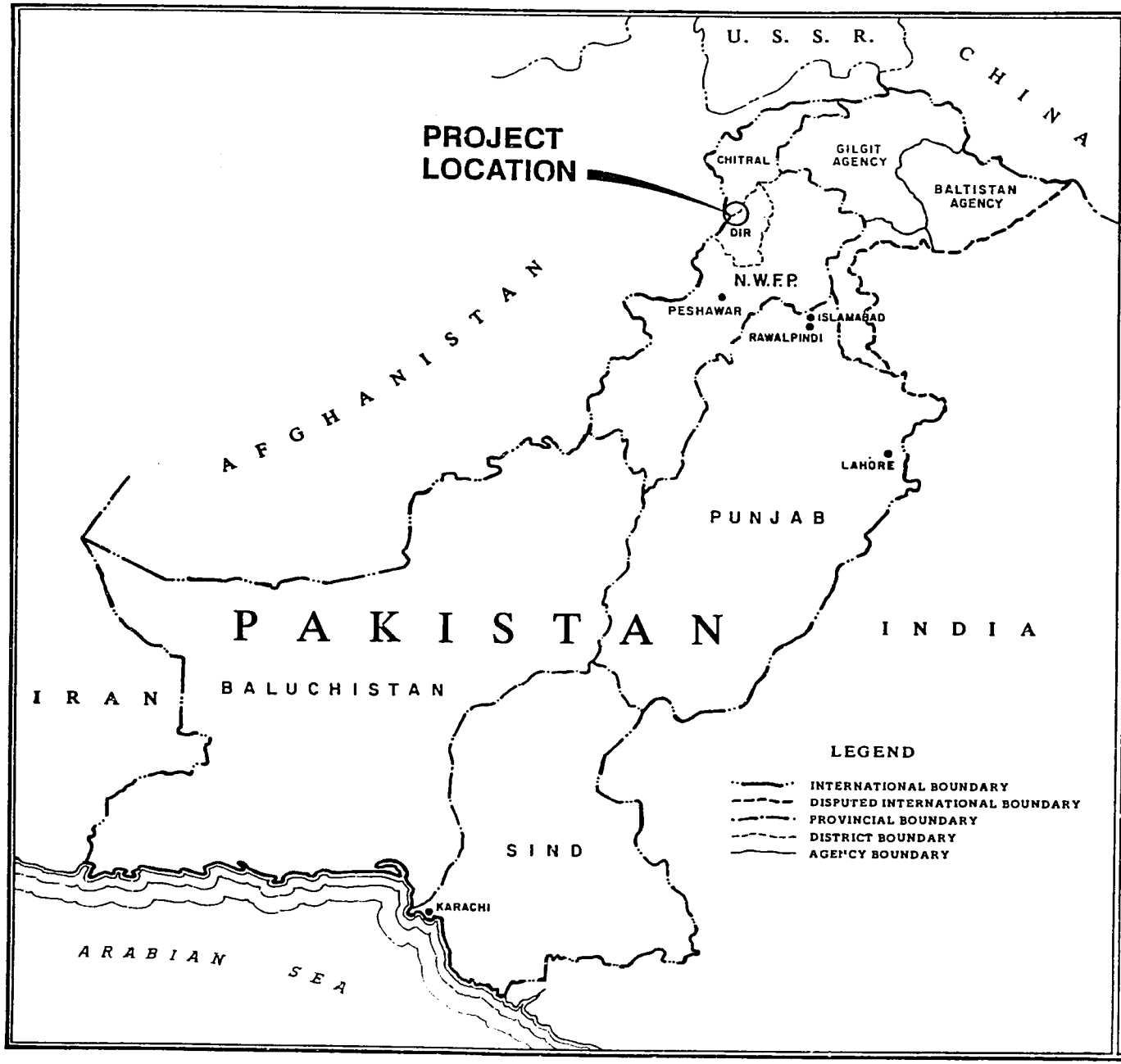
The geo-political advantage of improved, year-round access to the valley is more effective integration of Chitral District into the country of Pakistan. Since access to and from Chitral is easier from Afghanistan than from Pakistan itself, it must be recognized that the district not only suffers from lack of access to the rest of Pakistan, but is subject to the increased possibility of influence from outside.

Improved access has been defined as access sufficient for large tractor-trailer combinations. The design vehicle upon which the PRC Feasibility Report is premised is a truck-trailer combination, capable of transporting a 70-ton military tank (PRC 1987, page 4-1).

1.4 Purpose of Report

This report includes an Environmental Assessment (EA), an Economic and Financial Feasibility Analysis and a Social Soundness Assessment.

28



Environmental, Economic and Social Soundness Assessment

CHITRAL ACCESS PROJECT

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

North

200 100 0 100 200 Km

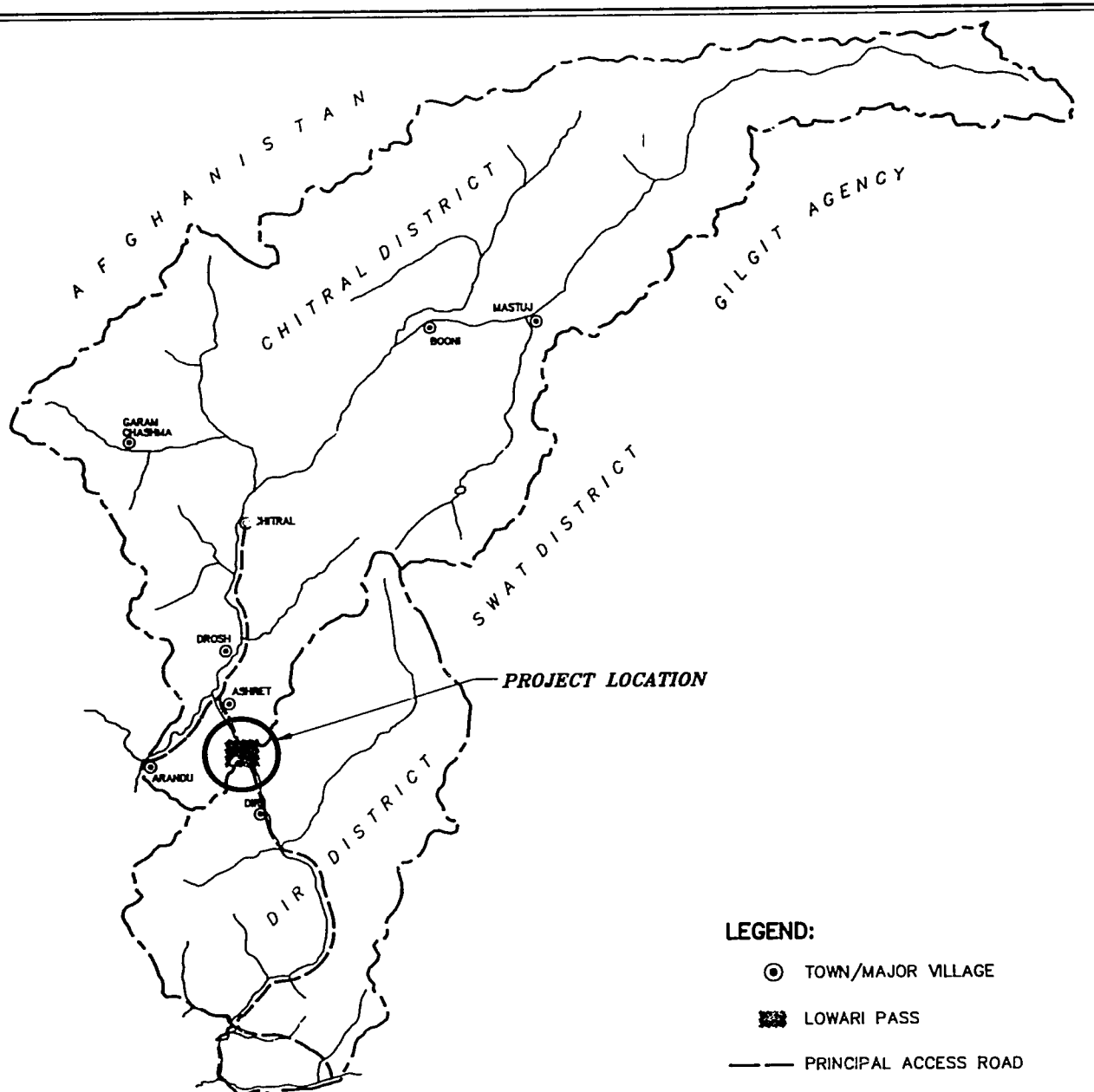
Approximate Scale: 1 : 6 600 000

TAMS CONSULTANTS, Inc.

December 1987

Location Map

Figure 1



Environmental, Economic and Social Soundness Assessment

CHITRAL ACCESS PROJECT

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

North

30 10 0 10 20 30 40 50 km

Approximate Scale: 1 : 1 000 000

TAMS CONSULTANTS, Inc.

December 1987

PROJECT LOCATION

Figure 2

The purpose of the EA is to provide the GOP and USAID with a full discussion of the significant environmental effects of improved access alternatives in order to ensure that environmental factors are integrated into the decision-making process. The EA, which provides a means to weigh expected benefits of development objectives against adverse impacts, will satisfy the requirements of 22 CFR 216, AID Environmental Procedures, and GOP Ordinance XXXVII, Control of Pollution and Protection of Living Environment. The EA also includes suggested mitigation measures to minimize adverse effects and enhance the quality of the environment. In accordance with 22 CFR 216, scoping sessions were conducted during September 1987 in Chitral District and in Peshawar (provincial capital of the NWFP). The objective of the scoping sessions was to identify significant issues and assist in determining the scope of issues to be addressed in the EA. These scoping sessions included representatives of the provincial governments, USAID and EA preparers. A record of the scoping sessions is presented in Appendix C.

The Economic and Financial Feasibility Analysis is presented in Appendix F. The purpose of the economic analysis is to determine whether the subject project is a worthwhile investment, i.e., whether benefits are sufficiently valuable to warrant the expenditures. The financial analysis is a tool to provide guidance on the financial viability of the project, in this case, with particular attention to the use of tolls.

The purpose of the Social Soundness Assessment is to review the compatibility of project with the socio-cultural environment into which it is introduced, the spread or diffusion effects of the project on the population and the incidence or distribution of benefits and burdens among different groups. A report of findings relevant to social soundness assessment of the project was carried out by USAID and has been incorporated into the report as Appendix G.

1.5 Government of Pakistan Environmental Policies and Regulations, and Applicable Natural Resource Legislation

Pakistan's federal government is a form of parliamentary government. At the federal level, GOP is responsible for national policy. The major administrative division is the province headed by a governor and each has a provincial parliamentary system. Provinces are divided into districts. Chitral, formerly administered as an agency, became a district of Pakistan in 1969. Its status remains Provincially Administered Tribal area which implies that land tenure is "unsettled" (unregistered) and national legislation is only partially applicable. There are two forms of elected council -- the District Council and the Union Council. The Union is the smallest unit of elected government; Chitral District has 11 union councils. Chitral also has two elected members of the Provincial Assembly.

1.5.1 Pakistan Environmental Ordinance of 1983

With the promulgation of Pakistan Ordinance No. XXXVII of 1983: Control of Pollution and Preservation of Living Environment, the GOP initiated mechanisms to formulate national environmental quality standards. Policy and standards approval is the purview of the Pakistan Environmental Council. Section 8 of the ordinance calls for preparation of an Environmental Impact Statement. Until such time as the Pakistan Environmental Protection Agency is established and formal procedures are developed, the Environment and Urban Affairs Division of the Ministry of Housing and Works is employing a standardized Pro Forma Questionnaire. This pro forma, which cross-references the main EA document, is contained in Appendix D.

1.5.2 Forestry Legislation

The Forest Act of 1927 established the right to designate Reserved Forests, Village Forests and Protected Forests. The government can take control of forest and lands belonging to private persons to protect the forest for special purposes and it has the power to assume management. The government may manage forests at the request of the owners. The government may also levy duty on timber and other forest products and control such in transit. If cattle trespass in a reserved forest or parts of a protected forest closed to grazing, the Cattle Trespass Act of 1871 applies and cattle may be seized or impounded. Amendments to the Forestry Act in 1959 and 1961 empowered the government to limit the number of goats and regulate their movement, in recognition of the damage caused by goats to rangelands.

Legislation of the NWFP, Protection of Trees and Brushwood Act of 1949, prohibits cutting or girdling of trees and brushwood without permission.

Rules of the NWFP regarding Management of Protected Forest (1975) state that no trees shall be felled or removed from protected forest without permission in writing. A free grant of trees for domestic purposes can be applied for.

NWFP rules regarding Establishment of Sale Depots and Sawing Units (1975) prohibit establishing a timber depot or sawmill without first obtaining a permit and being registered. No timber can be removed from a registered depot until it has been marked with the registered sale hammer.

1.5.3 NWFP Wildlife Protection, Preservation, Conservation and Management Act of 1975

Designed to consolidate laws relating to wildlife, this Act establishes a NWFP Wildlife Management Board to make policy decisions about conservation and the development of wildlife and game management; approve wildlife and game management development schemes; supervise progress of development

(32)

activities; and supervise a Fund administered by the Board. The Act applies to the entire province except tribal area. While Dir and Chitral are Provincially Administered Tribal Area (IFAD 1986), the Act is not inapplicable to these districts in their entirety; various categories of land have been declared to be owned by the provincial government as noted at 1.5.6 and Appendix E.

The Act establishes a set of hunting restrictions. Hunting of wild animals by certain methods (set gun, trap, automatic weapon and others) is prohibited. Specially protected animals can not be hunted at all and game animals can be hunted only if a permit is obtained. Other limitations are set by the Act such as: no hunting from a vehicle; requirements for certificates of possession for animals, trophy or meat; and restrictions on transfer, export, import or dealing in animals, trophies or meat. The Act defines the number of individual animals by species that may be killed, specifies protected and game species, and indicates the procedure for adding or excluding a species from the schedules of protected and game animals.

In addition, the Act allows GOP to set aside a wildlife sanctuary as an undisturbed breeding ground for the protection of wildlife, if the area is the property of the government or if the government has proprietory rights. Access to the public is limited by regulation and the cutting of trees, damage to vegetation, and grazing are prohibited.

The Government may in like manner develop any area under its jurisdiction to be a National Park. Parks are open to the enjoyment of the public with the restriction that no hunting, trapping, killing or capturing of animals in the park or within a three-mile radius is permitted. The felling, burning, collecting or removal of any plant or tree is not permitted. Also prohibited is the breaking-up of land for cultivation, mining or other purposes.

The government may declare an area to be a game reserve where hunting or shooting of wild animals is not allowed without a permit. It may also declare private land to be a private game reserve upon application of the owner.

1.5.4 Antiquities Act of 1975

With this legislation, the GOP instituted an Advisory Committee to designate and protect antiquities or national monuments. An antiquity is defined as an ancient product of human activity, any ancient object or site of historical, ethnographical, anthropological, military or scientific interest, any national monument or any other object declared by GOP to be an antiquity. The Director of the Advisory Committee is authorized to take steps necessary for the custody, preservation and protection of antiquities. GOP may direct the Provincial Government to acquire land containing antiquities under the Land Acquisition Act of 1894 as a public purpose. An antiquity may be declared to be protected. If a protected, immov-

able antiquity is in danger of destruction, injury or falling into decay, the GOP may direct the provincial government to acquire it. The GOP may also acquire movable antiquities in order to preserve them. The owner of an immovable or protected antiquity can enter into an agreement with the Director for maintenance, custody, terms of public access and payment of expenses. It is prohibited to destroy, break, deface, damage, alter, injure, or mutilate any antiquity. Restrictions on dealing in antiquities, exporting and trafficking and on archaeological excavation or exploration are also established.

The Act protects antiquities from various forms of development. For example, no development plan or scheme or new construction can be undertaken within 200 feet of a protected immovable antiquity feet, except with the approval of the Director of the Advisory Committee. The GOP may prohibit or restrict mining, quarrying, excavating, blasting, heavy vehicle movement, or similar operations in order to protect an immovable antiquity.

1.5.5 Environmental Pollution Ordinance

Local Government Ordinance of 1979, Section 93 pertains to Environmental Pollution. An urban local council may prepare and implement schemes for the prevention of pollution of air by gases, dust or other substances exhausted or emitted by automobile engines, factories, brick or lime kilns, crushing machines for grain, stone, salt or other materials and such other sources of air pollution as the by-laws may provide. An urban council may prepare and implement schemes for the prevention of the pollution of water or land from such sources and in such manner as by-laws may provide. (See Appendix E for additional information.)

1.5.6 Laws Pertinent to Tunnel/Road Improvement and Land Acquisition

The West Pakistan Highways Ordinance of 1959 (summarized more fully in Appendix E) authorizes the Highway Authority to acquire land for highway improvement. If purchase cannot be acquired by agreement, the acquisition can be accomplished as a public purpose under the Land Acquisition Act of 1894.

With regard to any blasting needed to construct improved access, the Explosives Act (IV) of 1884 controls use and transport of explosives.

Stream and drainage control is regulated by the NWFP Canal and Drainage Act VIII of 1948 (see Appendix E).

Laws pertinent to Dir and Chitral with regard to state ownership of land and land acquisition for public purposes are reviewed in Appendix E, prepared by a legal expert from ACE, which provided Pakistani team members for the EA. Because Dir and Chitral are provincially administered tribal

area, the legal nature of the situation with respect to applicable laws is complex. Due to the potentially sensitive nature of land tenure issues, additional analysis is recommended regarding:

- NWFP and Tribal Affairs and Local Government Department Order of September 15, 1972 declaring all roads and forests in Dir to be treated as state property;

- NWFP Home and Tribal Affairs and Local Order of July 31, 1975 specifying that NWFP can own state property of the former state of Chitral, including forests, wastelands, mines and minerals subject to government concessions to the public, all rivers and riverbeds, all mountains and all public roads, paths, tracks, bridges and culverts;

- Land Acquisition Act I of 1894 regarding acquisition of land for public purposes and covering public notice, entry for survey purposes, taking of land, hearing of objections, declaration of public need and award of compensation;

- West Pakistan Land Revenue Act XVII of 1967 regarding mines and minerals as government property;

- Local Government Ordinance of 1979 regarding burial or burning places;

- Extent of applicability of NWFP Wildlife Act.

1.6 USAID Environmental and Policy Regulations

1.6.1 22 CFR Part 216, A.I.D. Environmental Procedures

These regulations specify procedures by which environmental consequences of AID-financed activities are to be identified and considered by AID and the host country, prior to a final decision to proceed with implementation. Appropriate environmental safeguards are to be adopted. The procedures were developed to ensure that environmental factors were integrated into the AID decision-making process and are consistent with Executive Order 12114 of 1979 and the U.S. National Environmental Policy Act of 1970.

Pertinent to this document are those aspects of the regulations regarding an EA. As required, scoping sessions have been conducted (see Appendix C). This document follows the specified content and form for an EA and includes an analysis of alternatives to assist in the decision-making process. In accordance with AID policy to conduct assistance programs in a manner sensitive to the protection of endangered or threatened species and their critical habitats, the EA discusses potential impacts and means to avoid or mitigate such impacts.

As specified by the regulations, the EA is to be reviewed as an integral part of the Project Paper for Chitral Access.

1.6.2 Foreign Assistance Act, Section 117, Environment and Natural Resources

This amendment to the Foreign Assistance Act addresses the problem of degradation of natural resources in developing countries. The amendment authorizes the President to furnish assistance to develop and strengthen the capacity of developing countries to protect and manage their environment and natural resources. Special effort is to be given to maintenance and restoration of resources upon which economic growth and well-being, especially of the poor, depend. An environmental assessment or impact statement is to be prepared and taken fully into account.

This EA report fulfills the overall objectives of Section 117 by taking into account comprehensively the relationship of the project to the environment and by developing mitigative measures to avoid or minimize environmental degradation.

1.6.3 Foreign Assistance Act, Section 118 Tropical Forests

In passing this 1986 amendment, Congress recognized the importance of forests and tree cover in development activities, since properly managed forests provide a sustained flow of resources to developed and developing countries alike. Of particular concern is accelerating alteration, destruction or loss of tropical forests. Recommendations of the United States Inter-agency Task Force on Tropical Forests is to be given a high priority in formulating programs and carrying out policies with respect to developing countries.

This EA document, while not concerned with tropical forest, does address forestry conservation and management.

1.6.4 Foreign Assistance Act, Section 119, Biological Diversity

Each country development strategy statement or other country plan proposed by AID is to include an analysis of the actions necessary to conserve biological diversity and the extent to which actions proposed for support by the Agency meet the identified needs. USAID is tasked to perform the following: cooperate with appropriate international organizations, both governmental and non-governmental; look to the World Conservation Strategy as an overall guide; and perform other activities to conserve biological diversity. In particular, USAID must deny direct or indirect assistance for actions which degrade national parks or similar areas or introduce exotic plants or animals.

This EA report addresses protection of wildlife and their habitats, national parks, and other reserves and protected areas. Document preparers have drawn upon the expertise of pertinent GOP agencies and appropriate international organizations involved in wildlife preservation.

1.6.5 PD-6 Policy Determination

Policy Determination (PD-6) regarding Environmental and Natural Resource Aspects of Development Assistance (April 1983) declares that USAID policy is to help less developed countries build institutional and scientific capacity regarding critical environmental and resource problems; establish resource management programs; ensure environmental and long term sustainability of projects; and promote environmentally sound development.

This EA satisfies PD-6 by addressing the environmental sustainability and soundness of improved access, with particular attention to induced secondary development that may occur as a result. This EA makes recommendations regarding resource management programs through its list of mitigative measures (Chapter 5) intended to reduce or avoid impacts. Assistance in building host-country capacity to deal with environmental and resource problems has been achieved, in part, by inclusion of Pakistan counterparts on the EA team, by preparation of the Pro-Forma environmental questionaire of the GOP, and by recommendations for environmental training as appropriate to mitigative measures.

37

Chapter 2

Description of Proposed Action and Alternatives

2.1 Range of Alternatives

2.1.1 Background to Project Alternatives

The four alternatives for the proposed project listed in the Scope of Work issued by USAID are:

- No action
- Tunnel (alternative elevations)
- Improvement of present road over the Lowari Pass
- Lowari Rope-Way

A tunnel at Lowari Pass has long been the presumed means to improve access to and from Chitral. This alternative has historically received more detailed attention than other possible alternatives and has become the designated proposed action in the scope of work for the EA.

The 1957 report by a French team (Baudet Report) addressed tunnel construction as well as the problem of the road. (Pertinent portions of the Baudet Report are presented in Appendix I). The study evaluated a tunnel at a high elevation, a low elevation and at a medium elevation. The medium length/medium elevation tunnel was favored. The greatest difficulties were expected at the north portal. The report also examined various lay-outs including the existing one. It stressed that the advantages of a completely relocated road outweighed the benefits of upgrading the existing lay-out. In addition, the report stated that a "decent amendment" of the existing lay-out would cost only 7 percent less than a completely new road and was not warranted in light of maintenance costs (Appendix I, page 16). The report further recommended that the existing road be quickly, but sufficiently, upgraded to become a service road during tunnel construction and for use during new road construction.

The medium elevation tunnel recommended by the French team appears to be where 350 meters of tunnel, out of an approximate total of more than 8 kilometers, were built in the mid-1970's by the Frontier Works Organization. The presence of a partial tunnel, albeit abandoned, has continued to influence concepts for improved access.

38

In January 1987, PRC Engineering, under contract to the Pakistan National Highway Board, initiated work to verify the technical feasibility of a Lowari tunnel located on the Dir-Chitral Road and to develop preliminary cost estimates. The PRC Draft Feasibility Report of tunnel alternatives and short approach roads is the basis for evaluation of the proposed action. Support or access roads from Dir to Ashret have been included in the EA in order to provide a comprehensive environmental assessment. The scope of work for the PRC Feasibility Report did not include studies for full access roads which will be the responsibility of the Government of Pakistan (USAID Scope of Work, PIO/T No. 391-0470-3-20546, page 5).

Since access needs are defined as the ability for tractor-trailer units ("semis") with 70-ton loads to move between Dir and Chitral, observations of access roads were made in order to determine the potential extent of upgrading and/or new construction (see Appendix H). The road between Dir and a south tunnel portal is inadequate for 70-ton loads as is the road leading from a north portal to Ashret. The paved road from Ashret to Chitral appears to be adequate for 70-ton loads, although it is unlikely that trucks capable of carrying loads of that size have ever reached the Chitral Valley. The paved road south of Dir appears to be capable of handling traffic of this order of magnitude. Bridge and culvert capacities, however, must be determined to assure adequacy for heavy loads. A technical review of road conditions south of Dir is also highly recommended prior to selection of any alternative for improved access north of Dir.

In light of the above, improved access can be described as the following transportation access system:

> All-weather route from Dir to Ashret capable of supporting tractor-trailers carrying 70-ton loads.

2.1.2 Alternative Concepts

A thorough analysis of all available alternatives for all-weather access should take into consideration various routes requiring a combination of road, bridges and one or more tunnels. The fact that a Dir-Chitral road exists presently need not pre-determine a tunnel location, since much of the road cannot meet access specifications without substantial up-grading. Route studies may have been made before the tunneling attempt of the mid-70's on the south side of the Lowari Pass was begun, but no information with regard to alternate routes was located.

It appears that the feasibility study was tasked with verifying the Lowari tunnel location on the Dir-Chitral road, because 350 meters of tunnel and the road over the Lowari Pass existed. If one were to assume that the existing road between Dir and Ashret on either side of a proposed tunnel

portal could support the specified design loads, such a choice would be appropriate. Since this assumption is not correct, another alternative could be presumed to exist, i.e., a different route, with a tunnel not located under Lowari Pass, might be equally or more attractive. For example, the cost to upgrade existing road access to the north and south of the tunnel could be comparable or greater than the cost of an entirely new road from Dir to an undetermined south portal tunnel location and from an undetermined north portal location to Ashret. It is possible that a tunnel of less or equal length could connect such undetermined portal locations. An engineering determination would be needed to rule out the possibility of a different tunnel and road combination. It is also possible that an improved all-road access following a different alignment than the existing road is advantageous.

Thus, the presumption that a tunnel at the Lowari Pass location, a tunnel at an undetermined location, or an improved road is better from an engineering viewpoint alone, despite cost or environmental considerations, has not yet been evaluated.

Because of the historical emphasis on a tunnel and the little attention given to improved all-road access, a candid examination of the alternative to a tunnel is needed.

2.2 No-Action

The no-action alternative is defined as maintaining the present road as has been done in the past, but not investing large sums to improve it. Such maintenance would include clearing the road each spring, re-building retaining walls and drainage structures and re-grading the road during the months of use.

The no-action alternative would not permit transport of 70-ton tractor-trailers to the Chitral Valley. Thus, it is not an alternative which conforms with the project goal of providing all-season transport to Chitral for heavy loads.

If no-action as defined above is selected, the road can be expected to deteriorate in 5 to 7 years to the point where it becomes usable only by jeeps and, in 7 to 10 years, would revert to a foot path. (See also Appendix F.)

2.3 Proposed Action: Tunnel and Access Roads

2.3.1 Concept

In as much as a tunnel becomes useful only in conjunction with compatible access roads, a broad definition of the tunnel alternative which includes access roads from Dir and from Ashret has been adopted in order to provide a comprehensive EA, as requested in the scope of work. Since full access

-40

roads were not included in the PRC Draft Feasibility Report, per the scope of work for that report, an estimate of additional project requirements for these roads has been made (see 2.3.7).

Environmental, economic and social impact analyses (Chapter 4, Appendix F and Appendix G, respectively) have all assumed that full access roads were integral to the project in order to ensure comprehensive treatment of impacts for the Chitral Access Project.

2.3.2 Tunnel Alignment Alternatives

The PRC Draft Feasibility Report evaluated six different vehicular alignment alternatives for a tunnel as well as a railway tunnel alternative. The report's comparison of a railway shuttle operation with a road tunnel showed that a rail alternative was more costly and did not offer the flexibility of a road tunnel.

Based on previous studies and site visits, only a medium elevation tunnel was investigated. Three locations for the south portal were examined. In the descriptions which follow, location A is the tunnel portal already built in 1976 at elevation 2414 m. South portal location B is located downstream from A on the Nirga Khwar at elevation 2365 m; C is located at elevation 2294 m. on the Lowari Khwar. Four possible locations of a north portal in the Ziarat area (see Figure 3) were investigated. These are designed M at elevation 2375 m; N at elevation 2323 m; O at elevation 2268 m; and P at elevation 2405 m. Combination of the north and south portal sites resulted in the alignment alternatives described below as taken from the PRC Feasibility Report, Executive Summary.

- "Alternative AM:

  The total length of the tunnel is 8282 m, the maximum slope is 1.38 percent. At the south side, use is made of the existing portal and tunnel section; the approach from the existing road is relatively easy. Access to the north portal is difficult, which will influence the construction of the tunnel and of the approach road. Two major large span bridges will be required to cross the deep valleys of the Trangar and Gatus Gols. In view of the elevation of the portal and the steep gradient of the existing road between the Ziarat area and Baradam, a new approach road of 4.5 km containing numerous side hill bridges, and further support and protection structures will be required. Maintenance requirements of the northern approach road are extensive.

- Alternative AN:

  The total length of the tunnel is 8435 m, the maximum slope is 1.30 percent. Although the north portal is at a lower elevation, access to the existing road is still difficult and a 1.35 km long steep road with major bridges over the Trangar and Gatus Gols are required. The southern approach is the same as in Alternative AM.

- Alternative AO:

  The total length of the tunnel is 8579 m, the maximum slope is 1.83 percent. Since the elevation of the north portal is the lowest of all alternatives, the access is short and tunnel construction at this end will be easier in comparison with the other alternatives. The southern approach is again the same as in the previous alternatives.

- Alternative AP:

  The total length of the tunnel is 8280 m, the maximum slope is 0.70 percent. Access to the north portal is easy in this alternative, but construction space at the portal site is restricted. Installation of the approach road is difficult because of slope stability conditions. Maintenance is also difficult.

- Alternative South Portal Locations:

  Alternative locations for the south portal, identified as B and C have also been reviewed. The existing portal and tunnel section is not used in these cases; construction costs are, therefore, more than for the alternatives using location A."

The findings of the PRC analysis show that while tunnel alignment AM is somewhat more attractive, the northern portal location M has a difficult access and requires construction of two major bridges and several other road structures, resulting in an overall construction cost that is considerably higher than for alignment AO. Alignment AO is recommended.

Regarding concerns about faults with respect to tunnel alignment, the Draft Feasibility Report states:

> "All alignments avoid the area where a local geological fault zone may exist. If the results of a further deep drilling program confirm that such a zone does not occur, the alignments will be opti-

42

mized with regard to overburden and shaft location. This optimization will not influence the portal locations."

Geology is considered important to project feasibility, but was not significant to comparison of alignments, since there are no major differences in conditions. In the design stage, the alignment will be reconsidered in light of the results of the geological drilling, according to the Feasibility Report.

A site-specific seismic analysis was being carried out and is intended to be presented in the Design Report.

2.3.3 Cross-Section and Ventilation Alternatives

Different tunnel cross-sections in combination with alternative ventilation options were investigated:

- A double lane road tunnel with semi-transversal ventilation.
- A double lane road tunnel with longitudinal ventilation.
- A double lane road tunnel and safety gallery with longitudinal ventilation.
- Twin single lane tunnels with longitudinal ventilation.
- A railway tunnel.

A longitudinal ventilation system is preferred because of its lower cost. Initial installation of 28 jet fans with no central ventilation and shaft is recommended. Although additional fans, in response to traffic growth, can subsequently be installed, the report recommends keeping options open on how to complete the ventilation system. Factors to be considered include traffic, vehicular emissions and experience in operation of tunnel ventilation, and allowing for possible future installation of a ventilation shaft at three possible locations (Lowari Village, Daro Khwar and Chitrali Gol).

The preferred tunnel cross-section is a double lane tunnel with longitudinal ventilation and no safety gallery. Twin single lane tunnels were not preferred due to high cost and the psychological factor of confinement in a single lane tube which provided only minor safety and maintenance advantages. The double-lane option with a safety gallery, which provides improved safety in case of fire and better accessibility for maintenance and rescue teams, was not recommended in view of the high additional investment that would be required.

In summary, the PRC Draft Feasibility Report recommended that a road tunnel along Alignment AO with a double-lane cross-section and longitudinal ventilation system be selected for further development. Alternative AM, however, was also carried through in detailed analysis.

2.3.4 Tunnel Requirements

Traffic clearances for the preferred double-lane tunnel are two lanes of 3.65 m and a vertical dimension of 5.50 m. Water mains with hydrants every 250 m, 150 mm diameter pipes for high voltage transmission lines for other authorities, 150 mm diameter pipes for tunnel high voltage lines, and cable ducts for electrical power supply and distribution are also specified in the design criteria. SOS niches every 250 m and emergency lay-by areas every kilometer are provided. Concrete lining over the length of the tunnel is recommended for ease of maintenance.

Lighting fixtures (sodium lamps every 9 m) would be located in the middle (under the vault) in the preferred double-lane tunnel with longitudinal ventilation. Stand-by, battery-powered lighting is to be provided in every tenth luminaire. Fluorescent, battery-powered, fire-emergency lighting is to be installed every 50 m.

Drainage is designed to: collect seepage water to avoid icing on walls, vault and road; prevent water pressure build-up behind the concrete lining; prevent water from stagnating under the pavement; and collect oil, petroleum or other spilled liquids. A continuous gutter on one side of the tunnel would be connected to a main collector through siphon chambers in order to prevent propagation of fuel and gas explosions. A single collector is anticipated for seepage and waste water. An oil and petrol separation is recommended on the waste water collector at both ends of the tunnel.

The main electrical power supply is anticipated to be a 66 kV overhead line to the south portal with cable feeders to the north portal. The high tension line is expected to be run from the grid station at Chokiatan, 8 km south of Dir, scheduled for completion by the end of 1989. (The incoming overhead feeder line is to be designed and installed by GOP and as such was considered outside of the PRC scope of work for the tunnel project.)

Water supply for fire-lighting, drinking and sanitary needs is anticipated to be derived from streams at the north and south portals.

An automatic fire and smoke detection system is recommended. Although a transversal or reversible semi-transversal ventilation would provide greater safety, the larger tunnel section and additional roof slab made these solutions uneconom-

ical. Emergency exits to an escape gallery would increase costs by nearly twenty percent. Fire escape niches were studied, but ruled out, since it was not expected that tunnel users would employ them. It is planned that accidents be avoided by operational rather than design measures, e.g. combination of vehicles carrying flammable or dangerous materials into convoys.

Avalanche galleries and flood protection structures are provided as protection against natural hazards. Icing problems are least with the lowest elevation alignment (AO).

Maintenance manpower needs are estimated to require a staff of 50: nine each for control room and police, 13 for rescue/vehicle repairs/firefighting staff, 13 for road maintenance and snow removal, and six additional staff for management and electro-mechanical equipment maintenance.

2.3.5 Tunnel Approach Road Alignments

Design criteria utilized in the PRC Draft Feasibility report are based on a design vehicle that is a truck trailer capable of carrying a 70 ton military tank. The minimum turning radius is 14.60 m.

A two-lane paved highway (7.30 m wide) with shoulders (2.50 m wide, except narrower in mountainous terrain) is planned. Horizontal alignments of tunnel approach roads avoid hairpin bends where possible. In the vicinity of the north portal, some hairpin bends can not be avoided, but a minimum radius of 15 m is maintained. Vertical alignment is based on a maximum slope of 10 percent. Final design will include interruptions of sustained steep grades by intervals of more gentle grades, specifically at hairpin bends. Along long climbing sections of the road, a third auxiliary lane (3.65 m wide) for slower moving traffic is included in the design.

A flexible type pavement has been selected: 30 cm aggregate subbase, 15 cm graded crushed aggregate base and 10 cm bituminous surface in two courses. A drainage system to prevent erosion of alluvial soils will incorporate: intercepting ditches at the top of hillside cuts; side ditches along the road to collect water; and culverts to carry water beneath the road to natural drainage or to surface protected berms down slope from cut-and-fill sections.

Depending upon alignment, the tunnel approach roads require a variety of different structures such as hillside bridges, bridges across streams (two major bridges for alignment AM, a long span and a short span for AN and AP and a small bridge for AO). Depending on location, snow rakes, snow fences, avalanche galleries, and rock fall galleries are needed. For northern approach roads of alternatives AN, AO and AP, re-alignment of Trangar, Gatus and Ashret Gols will be neces-

45

sary. In the case of AO, water of Trangar Gol can be carried over the road section near the portal by construction of an open-cut tunnel section.

Approach roads investigated varied in length at the north approach from 613 m (portal O) to 4,470 m (portal M). At the south approach, road length varied from 200 m (portal A) to 1000 m (portal C). Among the considerations in recommending AO as the preferred alignment were the more reliable operation of the road link and its cheaper cost. Approach A from the south crosses the Nirga Khwar with a gently curving alignment and a slope of one percent. Approach O has maximum slope of just over nine percent.

2.3.6 Construction Scenario

Pilot Gallery

For recommended tunnel alternative AO or next preferred alternative AM, the PRC report includes an analysis of various construction scenarios. An important consideration is the construction of a pilot gallery at the north portal. A pilot gallery would provide better information on exact geological and hydrogeologic conditions prior to full excavation. Ventilation requirements are reduced and energy savings can be achieved. Construction drainage is facilitated and access problems could be much reduced, a major difficulty at the north portal. Site installation, equipment, labor and power requirements are reduced to about 30 percent compared to a full tunnel approach. Material supplies can be minimized until the north portal is accessible through the tunnel and pilot gallery. This approach also eliminates the expensive option of mobilizing heavy equipment to the north portal, requiring road work. Although the project completion period is longer and costs are four percent higher, the Feasibility Report recommends a pilot installation from the north side to reduce logistical problems and construction risks.

Construction Manpower

The following tentative estimate for manpower of alternatives AM and AO with and without pilot galleries was derived from the PRC Draft Feasibility Report (page 6-23):

	Average Manpower Level	Estimated Manpower Level
Alternative AM (without pilot gallery)	342	507
Alternative AM (with pilot gallery)	297	588
Alternative AO (without pilot gallery)	307	414
Alternative AO (with pilot gallery)	269	507

26

The above estimates provide average levels for construction labor, field management and construction staff. The second column, based upon reading of text, indicates levels of peak construction manpower.

Construction Schedule

Construction schedules were developed for alternatives AM and AO with and without a pilot gallery. The estimated duration of construction for each, as derived from the Feasibility Report (page 6-30), is:

AM (without pilot gallery)	4.5 years
AM (with pilot gallery)	5.5 years
AO (without pilot gallery)	4.5 years
AO (with pilot gallery)	5.0 years

The construction schedule is predicated upon installation of permanent electrical power by Government authorities. If the start of construction at the Lowari Tunnel is scheduled before permanent electrical power is available from the Government Authorities, the contractor will have to install power generating stations at the north and south portal to cover all construction power supply requirements. In this connection it is important to notice that the north portal fuel consumption for the winter months must be delivered before the Lowari Pass is closed by snow. In that case fuel storage requirements are estimated to be 500 m^3 at the south side and 1000 m^3 at the north side.

Equipment and Site Installations

Construction equipment needs, including use of wheel loaders to remove excavated materials, are detailed. More costly rail haulage is envisaged only if needed, because of ventilation requirements.

The PRC report also provides information on portal site installations. Excavation material at the south side is planned to be used to create a platform for a crushing and screening plant and material stockpiles. On the north side, excavation material is planned to be utilized in various ways, depending upon the tunnel alignment, but generally to create platforms or elevated areas, or for aggregate preparation, and access road improvement. There does not appear to be, particularly for AO alignment, detailed consideration of any excess spoil disposal. (See 4.1.2 for more detailed discussion in the context of impact evaluation.)

41

2.3.7 Assumptions for Environmental Assessment

Definition of Tunnel Alternative

In order to provide a comprehensive assessment of the tunnel and approach roads from Dir and from Ashret, the tunnel alternative is defined to include the following segments (see Figure 3):

a.	Reconstruct road from Dir to south portal	21 km
b.	Tunnel alternative AM or AO	8.3 - 8.6 km
c.	Reconstruct road from north portal to Ashret	7 km
Total length of tunnel and reconstructed road		36.3 - 36.6 km

Figure 4 illustrates the relationship of the northern part of an approximate tunnel corridor to the existing road and the existing fault zone. The fault may lie closer to the southern portal than is shown here.

Approach roads would potentially be closed in winter four to five times for a period of one to five days, depending upon snow removal efforts.

Costs

The recommended PRC alternative (AO with double lane cross section and longitudinal ventilation system) is the least cost alternative, assuming no pilot gallery construction. The economic analysis (Appendix F) has been based upon the least cost tunnel alternative plus estimated costs for reconstruction of access roads from the north portal to Ashret and from the south portal to Dir. (PRC scope and cost estimates include only short approach sections to the tunnel.)

Manpower and Construction

An independent analysis of manpower requirements for construction made during EA site reconnaissance and prior to availability of the PRC Feasibility Report indicated that more construction personnel (500 to 800) might be needed than estimated by PRC. In this instance the higher number has been assumed as a worst-case assumption for projecting most environmental impacts. Similarly, preliminary, higher estimates of tunnel maintenance personnel (100 rather than 50) have been assumed.

Construction duration is potentially longer than 4.5 to 5.5 years, since longer access roads are part of the alternative defined for the EA.

46

Alignment and Design Criteria

In evaluating specific environmental impacts (Chapter 4), alternatives AM and AO are distinguished, when appropriate. Various design criteria are also considered, as appropriate, to evaluate such topics as tunnel air quality, spoil disposal and accident risk.

Site Installations

A high and low estimate of area needed for construction camps have been made; the low estimate is derived from PRC drawings of site installations, while the high estimate allows for a population of camp followers. As a worst case assumption, for the north portal, camp size is not considered to be reduced by the pilot gallery construction technique. It is further assumed that temorary camps will become permanent settlements, based on experience with such camps and the continuing need for tunnel maintenance.

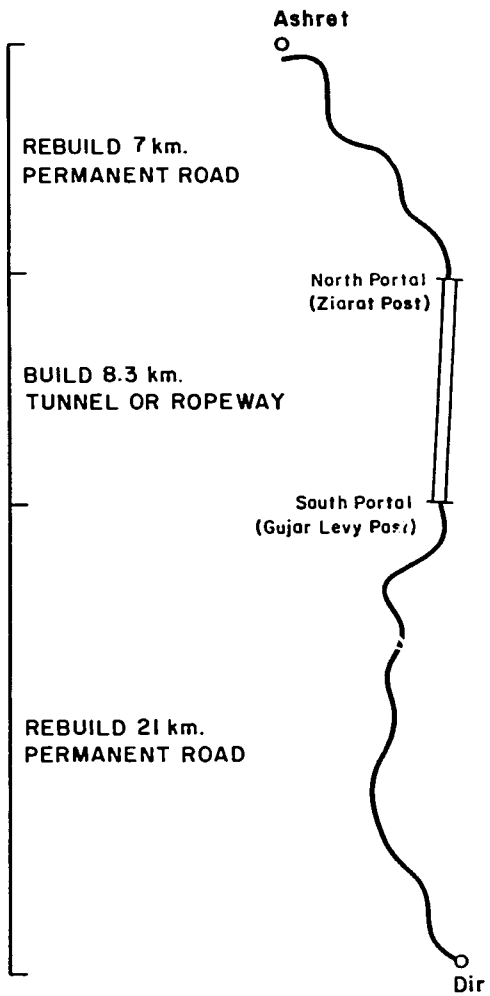
2.4 All-Road Access

In order to satisfy the desired goals for access, an all-road access would need to permit year-round operation of 70-ton tractor-trailer combinations. A highway capable of carrying such loads would require construction to certain geometric standards, e.g., minimum centerlines, curve radii and maximum permissible grades. Design criteria would be similar to those adopted for tunnel approach roads (see 2.3.5). Extensive retaining walls, avalanche protection devices and drainage structures are required in addition to complex, engineered structures to prevent rock slides during snow melt. An improved highway would need a substantial pavement to support large loads during freezing and thawing and would have to be equipped with delineators in such a way that snow removal equipment could operate around the clock, during the snow season.

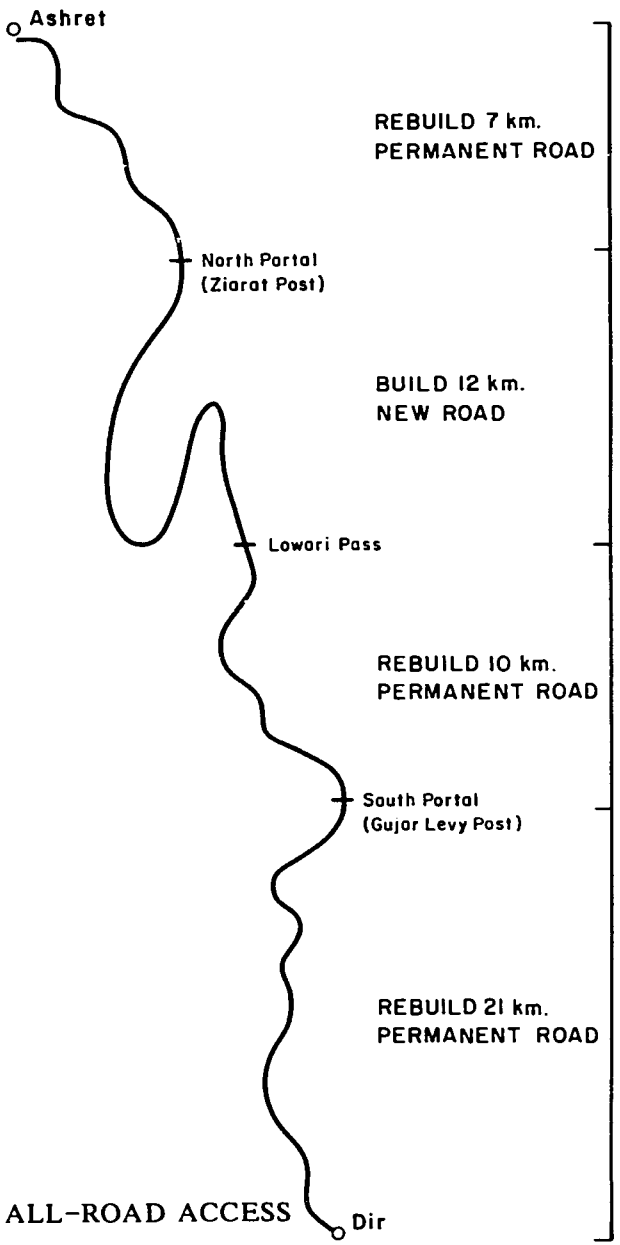
Portions of the existing "road" do not lend themselves to upgrading to the standards described above. (Refer to Appendix H for detailed description.) Figure 4 shows approximate existing road alignment between the proposed north portal location and Lowari Pass. Extensive topographical survey work would be required to determine a new alignment. Engineering structures along this new alignment would be required and result, in effect, in a new highway for approximately 25 percent of the present route.

Improvement of the existing road consists of building or rebuilding approximately 50 kilometers of highway. For purposes of comparison with the tunnel alternative, four segments are defined (see Figure 3) of which two ("a" and "d") are also required for tunnel access:

49



TUNNEL OR ROPEWAY ALTERNATIVE



ALL-ROAD ACCESS

Environmental, Economic and Social Soundness Assessment

CHITRAL ACCESS PROJECT

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

△

North

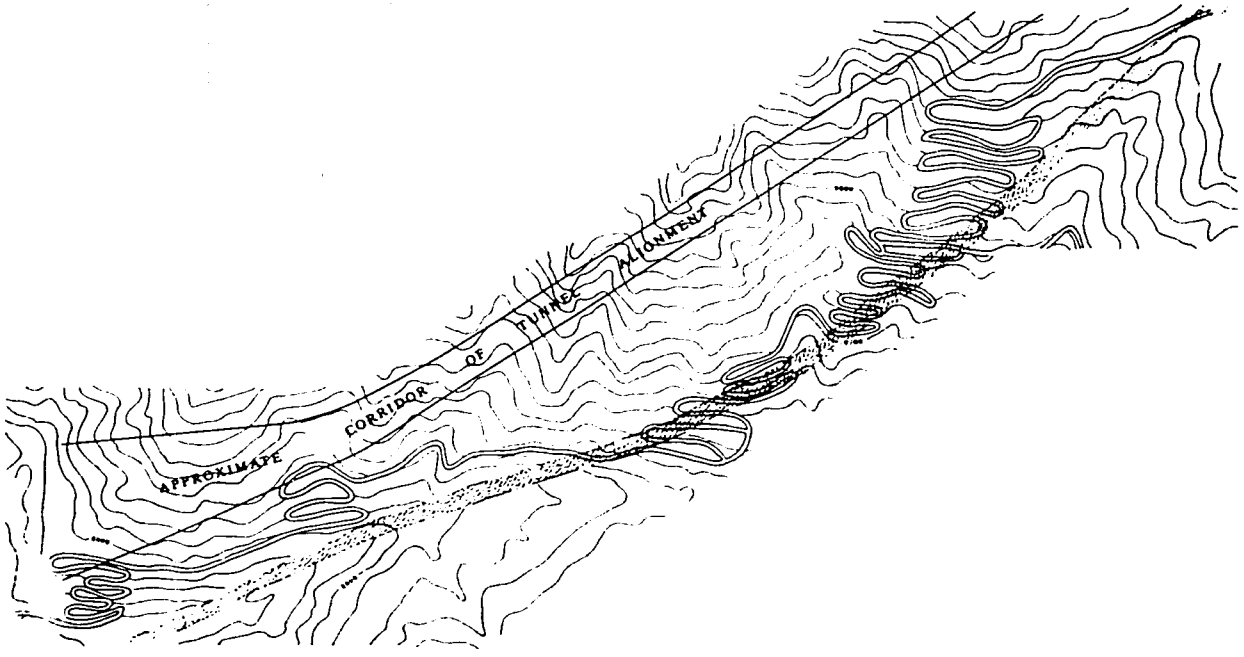
NOT TO SCALE

TAMS CONSULTANTS, Inc.

December 1987

SCHEMATIC OF PROJECT ALTERNATIVES

Figure 3



Environmental, Economic and Social Soundness Assessment

CHITRAL ACCESS PROJECT

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

North

5 2 0 2 4 6 10 10 km

Approximate Scale: 1 : 1 000 000

TAMS CONSULTANTS, Inc.

December 1987

PORTION OF CHITRAL ACCESS ROAD: LOWARI PASS TO NORTH PORTAL

Figure 4

a.	Reconstruct existing road from Dir to south portal location	21 km
b.	Reconstruct existing road from south portal location to Lowari Pass	10 km
c.	Construct new road from Lowari Pass to north portal location	12 km
d.	Reconstruct existing road from north portal location to Ashret	7 km
	Total new/reconstructed road	50 km

This alternative has considerable merit and warrants preliminary engineering studies, since costs are estimated to be an order of magnitude less than the costs of a tunnel (see Appendix F, Economic Feasibility).

The infrastructure for roadway construction will require two mobile camps, one operating on the road on the Dir side and the other on the Chitral side. Construction of an improved road is estimated to take four (up to seven years, depending on phasing) years and utilize the services of 600 men. Road maintenance would require about 50 men.

Depending upon the snow removal effort, an all-weather road over the pass would be closed four to five one- to two-week periods.

2.5 Lowari Rope-Way

The Lowari Rope-Way alternative attracted local interest for several years. The Superintending Engineer of the Development Circle of Peshawar wrote a paper (reproduced in Appendix J) concerning this subject in 1974. The report suggests a cable car system for the transport of goods and people as a temporary solution to the annual supply problem in Chitral until a tunnel can be built. The paper outlines a cable car system (27,200 feet long) from the Gujar Post on the Dir side to the Ziaret Post in Chitral District. An engineering study of this system would be necessary to answer questions regarding capacity, loading/unloading method, power requirements, utility in winter and many others.

The rope-way alternative, like the tunnel alternative, would require improved access to the facility itself, if heavier loads than currently cross the pass are to be transported. This alternative would therefore consist of these components:

Cable car system (27,200 feet)	8.3 km

Reconstruction of existing road from southern terminus to Dir	21 km
Reconstruction of existing road from northern terminus to Ashret	7 km
Approximate Total Length	36 km

Construction of the rope-way would entail the building of a series of concrete foundations for the erection of towers. This would probably be accomplished from "flying" tent camps. Permanent settlements, however, could well be expected at the termini which become break-in-bulk points.

Construction of a rope-way is estimated to require 50 men. Maintenance and operation would require 20 men (10 at each end). Construction time is estimated at between 2 and 3 years for the cable car system itself and 1-2 years for the generating station. These estimates do not include improved access to the cable termini.

The rope-way alternative has estimated costs similar to those of an improved roadway (see Appendix F), but does not serve the goal of access for vehicles capable of carrying 70-ton loads. It also requires reorganization of the transport system institutions (see Appendix G). Such a system is much less flexible with respect to transporting mixed loads, heavy equipment, vehicles and anything larger than a gondola's capacity, unless the item could be disassembled. Since insufficient information is available to evaluate this alternative and it does not fulfill the project purpose and need, no detailed evaluation of environmental impacts is made.

Chapter 3
Affected Environment

3.1 Air Resources

3.1.1 Climatology and Meteorology

The climate of the Chitral Valley is continental in nature with warm to hot, dry summers and cold winters. The data available are limited in scope as there are only two meteorological stations, both in the south end of the valley, at Drosh and Chitral.

Precipitation varies from mean annual levels of 650mm at Drosh in the south to about an estimated 200mm in the north, judging from the lack of vegetation. Precipitation in the winter from November to March 15 is in the form of snow, which accumulates to a depth of three feet on the valley bottom and more at higher altitudes.

Precipitation varies to some extent with topography and altitude and factors such as width of valleys and nearness to mountains. Monthly precipitation is greatest in March and April at Chitral and Drosh. The average precipitation in Chitral during March was 138mm and at Drosh about 136mm (see Table 3-1). Precipitation from June through November averaged less than 30mm per month. In general, from south to north, the valley ranges from dry to extremely dry for agriculture.

Temperatures in the valley vary from south to north and according to altitude. Mean daily maximum and minimum temperatures for Drosh are highest in July at 36.0o and 23.2o Centigrade (C), respectively, as shown in Table 3-2. Comparable figures are 7.1o and 0.2oC for January, the coldest month. Temperatures in the north abutting the Hindu Kush are much colder both in winter and summer, although no quantitative data are available. Relative humidity does not vary significantly from the mean annual ratio of 61 percent throughout the year.

In Dir District, the rainfall pattern is similar to that of Chitral, but there is more monsoon rain during the summer months. Mean annual precipitation at Dir on a five-year average was 1,227mm of which 513mm fell between February and May. Rainfall is well distributed throughout the year, allowing for better growth conditions compared to dry summer months in Chitral. In Dir, the mean temperature in July is 32.4oC and in January the minimum is -2.0oC.

54

Table 3-1

MEAN MONTHLY PRECIPITATION AT DROSH AND CHITRAL

Months	Drosh 30yr Average (mm)	Chitral 10yr Average (mm)
January	87.1	27.6
February	74.7	66.7
March	135.9	138.0
April	109.7	140.3
May	61.0	41.4
June	21.8	4.6
July	20.3	6.9
August	23.9	6.9
September	26.4	13.8
October	34.8	16.1
November	22.4	13.8
December	39.9	43.7
Total	657.9	519.8

Source: GOP Meteorological Dept, Regional Meteorological Centre Lahore, derived from Malakand Area Development Project: Agro-Socioeconomic Study of Chitral District by Institute of Development Studies, NWFP Agricultural University for IFAD, 1986.

Table 3-2

TEMPERATURE CONDITIONS AT DROSH AND CHITRAL

	Drosh				Chitral			
	Mean Daily		Extremes		Mean Daily		Extremes	
Month	Max.oC	Min.oC	MaxoC	Min.oC	Max.oC	Min.oC	Max.oC	Min.oC
January	7.1	0.2	12.1	-3.8	8.7	-1.3	17	-9
February	10.2	1.4	16.4	-2.2	10.6	0.3	19	-12
March	15.1	4.9	22.3	0.1	16.1	5.1	25	-1
April	21.3	9.8	29.1	3.7	21.7	8.4	32	0
May	28.1	15.3	34.9	9.3	27.3	12.0	38	6
June	33.8	20.3	38.9	13.8	34.8	18.7	41	11
July	36.0	23.2	40.2	18.1	36.7	20.9	44	13
August	35.1	22.7	38.8	16.9	35.7	20.3	43	11
September	32.1	18.6	37.2	12.8	31.7	13.6	38	4
October	25.6	11.9	32.7	6.8	24.7	8.2	35	3
November	17.8	6.4	24.2	3.1	17.9	3.4	27	-4
December	11.1	2.4	17.0	-0.8	11.5	0.1	19	-4

Source: GOP Meteorological Dept, Regional Meteorological Center Lahore, derived from Malakand Area Development Project: Agro-Socioeconomic Study of Chitral District by Institute of Development Studies, NWFP Agricultural University for IFAD, 1986.

3.1.2 Existing Air Pollution Sources

The two major air pollution sources in the Chitral Valley are burning wood for fuel by householders and exhaust fumes from diesel and gasoline engines. Other sources include a small antimony smelter emitting sulfurous smoke at Krinj, located approximately ten miles north of Chitral town; this source is comparatively small, since output is only 5 tons per year. Two intermittently active lime kilns, located approximately 13 miles south of Chitral town, produce small quantities of carbon monoxide and carbon dioxide gases. The remaining source is dust from the roads.

3.1.3 Ambient Air Quality

While there are no air monitoring stations that record pollutant levels, it is reasonable to assume that the quality of the air in the Chitral Valley is good. Furthermore, pollutants are readily dispersed due to the large size of the valley and the fact that there are continual light winds throughout the year. No data is available regarding the possible periodic presence or absence of inversions during the winter months.

3.2 Geology, Physiography and Soils

In preparing this section, literature and data available from Princeton University, the U.S. Geological Survey (USGS), and the Pakistan Geological Survey in Islamabad, Peshawar, and Quetta were reviewed and visits were made to the Universities at Peshawar and Quetta. Several geologists provided assistance, including a USGS geologist in Islamabad, a former head of the Pakistan Geological Survey and now USAID geologist, geologists with the Pakistan Geological Survey in Peshawar and Islamabad, Sarhad Development Authority (SDA) geologists and ACE. Site reconnaissance was performed in the District, specifically along most jeepable roads south of Garam Chasma, and a few foot trips were made to mineral prospect sites.

3.2.1 Geology

Stratigraphy

The Chitral District is underlain by structurally deformed rocks which range in age from Devonian to Cretaceous (Calkins et al. 1981). They consist mainly of regionally metamorphosed rocks of low to medium grade and granite intrusions. Slate and phyllite underlie most of the Chitral Valley and marble and other metamorphic rocks flank the Chitral Slate formation in bolts trending north-northeastward. Granite is on the western and southern edges of the District.

The metamorphic rocks are mainly of low temperature grade; associated with granite are some high grade metamorphic rocks. Beginning at Partsan, approximately 13 miles north of

156

Chitral town, regional metamorphism decreases rapidly toward the northeast. Rocks at Partsan are of low enough metamorphic grade to contain well-preserved fossils.

Low-grade metamorphic rocks include slate, phyllite, volcanic greenstone, marble, and other types. Medium to high-grade metamorphic rocks include garnetiferous schist, staurolite-bearing schist, amphiholite, hornblende schist, granite gneiss and other metamorphic rock types.

Quaternary deposits consist of sand, gravel, and boulders in the stream beds, terrace deposits, slope talus, and glacial deposits, mostly in high topographic basins. The main alluvial deposits are along the Chitral River, Shishi River, and in the Hot Springs (Garam Chashma) area.

Structure

Structure is dominated by four major reverse faults which dip steeply to the northwest. The faults likely become asymtotic downward and form a deep near-horizontal decollement zone (Seeber and Armbruster 1979). The fault of greatest displacement is the Naz Bar Fault, which shows prominently on Landsat and Spot imagery which were obtained for project use.

Bedding generally dips very steeply to the west so folds are isoclinal and overturned to the east. The major fold of the area is the Chitral Syncline which is cored by the Chitral Slate and bound on the east and west by thick carbonite formations. These carbonite units show well on Landsat and Spot images.

Lineaments on Spot imagery strongly suggest a steeply dipping northwest striking fault system in Chitral District. One of these faults passes subparallel along the tunnel alignment. Also a major, steep northeast-striking fault is suggested by a lineament cutting across the tunnel alignment.

Seismicity and Neotectonics

Chitral District in the Hindu Kush range lies within the Himalayan tectonic province which is tectonically active. The Chitral District is currently experiencing extensive seismic activity. Within the last year, the town of Chitral experienced structural damage to buildings due to earthquakes. A list of Chitral District epicenters and magnitudes are shown in Table 3-3.

Table 3-3

CHART OF SEISMOLOGICAL DATA FOR DIR, CHITRAL AND SURROUNDING AREAS

Date	Latitude N	Longitude E	Depth	Magnitude G. Ritchter Scale
19-7-57	36.0	71.0		5.5
18-9-58	36.5	71.0		6.1
10-7-63	36.5	71.8	33	4.9
14-11-28	35.0	72.5	110	6.0
16-12-62	36.2	71.3	145	4.3
4-2-63	36.3	71.7	200	4.8
28-4-63	36.1	71.3	150	4.8
3-1-64	36.1	71.3	123	4.5
4-1-64	36.3	71.3	200	4.3
31-1-64	36.3	71.4	127	4.2
9-3-64	36.2	71.5	132	4.8
16-5-64	36.3	71.5	122	5.3
28-9-64	36.3	71.6	118	5.5
28-10-64	36.1	71.3	130	5.5

Note: Reproduced from Record of Earthquakes in Pakistan by Geophysical Institute, Quetta.

Epicenters have occurred in the Lowari Pass vicinity (near the proposed tunnel alignment); Landsat and Spot imagery suggest a northwest-striking major fault zone. There are associated active faults of a lesser displacement striking in other directions.

3.2.2 Physiography

The Chitral District is on the eastern flanks of the Hindu Kush mountain range, which forms the western segment of the broad mountain arc of the greater Himalayan tectonic system. The main valleys and ridges trend north-south, but tributary valleys and irregular ridges have many trends. The highest elevations are greater than 6,000 meters (20,000 feet), and valleys are as low as 1,200 meters (4,000 feet). Local relief between a valley and an adjacent mountain may be as much as 10,000 feet.

Valleys are generally "V"-shaped. There are rare narrow flood plains, as near Chitral. Small "U"-shaped glacial valleys occur at high elevations. Ridge elevations are irregular and do not suggest peneplanes.

3.2.3 Soils

Soils of Chitral District are extremely thin to absent over a large percentage of the area due to very steep slopes and deforestation. Very deep soils occur in floodplains, alluvial fans, terraces, glacial drift, and on ridge

58

tops. Some glaciated valleys contain organic soils, and locally bogs.

Where trees cover most of an area, soil has accumulated, even on steep slopes; where the timber has been cut extensively, the soil has been highly eroded, as on slopes surrounding the town of Chitral. On ridges, however, soil as deep as 15 feet has been observed. For example, at the Summer Palace, immediately northwest of Chitral town, soil derived from weathered calcareous slate was mined to make bricks.

3.3 Water Resources

3.3.1 Surface Water Resources

Hydrology

The streams of the Chitral Valley are valuable resources. They are a major source of potable water and are used extensively for irrigation. They are also the means to transport most of the timber out of areas without roads, which are extensive. Streams provide hydroelectric generating capacity, the source of electricity for Chitral town and some other locations in the District (See Section 3.6.4 Infrastructure).

The major stream is the Chitral River which flows southward through the southern part of the District; the river bifurcates in about the center of the district with a northwestern branch, the Lutkho River, and a northeastern branch, the Mastuj River. The drainage basin of this stream system defines the Chitral District. The stream flows out of Pakistan at Arandu into Afghanistan and re-enters Pakistan through the Khyber Pass as the Kabul River.

Streams are generally very fast flowing though "V" shaped valleys. The streams are slowed in the upper reaches of valleys which have been altered by glacial erosion and there are a few cirque lakes and bogs. In a few places, such as in and around the town of Chitral, alluvial floodplains have developed and the stream meanders. In winter, much water is retained in glaciers and stream flow is much less than in summer, despite typically higher average precipitation.

Total catchment area of the Chitral River is estimated at 11,500 sq. km. Annual discharge at Chitral is estimated to be 3,240 cubic meters per second (cumsec); monthly discharge is as low as 85 cumsec in winter and as high as 640 cumsec during summer (ADB 1987).

Water Quality

Most streams (often referred to by the term "gol", which can also mean stream valley) are fed by glaciers and, thus, contain suspended rock flour which colors the streams gray. According to studies made for the Asian Development Bank (ADB 1987), suspended sediment loads in the Chitral River vary

49

from 2,000-3,000 parts per million during high flow. At least three stream systems are clear in late summer: Lutkho River; Rumboor Gol and Bomburet Gol; and Shishi River. These streams are apparently not fed by glaciers and are periodically stocked with hatchery-reared trout. Indigenous fish species inhabit both the clear streams and those laden with silt and clay.

There are no sewage treatment facilities in the district, except a few septic tanks, and most human fecal matter is deposited in fields where it can contaminate surface water. There appears to be insufficient control of kerosene, diesel fuel and gasoline which can pollute surface and groundwater. The extent to which chemical fertilizer, insecticides and pesticides are significant pollutants was not determined; use of agro-chemicals appears to have decreased in recent years as suppies to the area have dwindled (ADB 1987).

Most rural homes have a water source at a nearby irrigation ditch situated along a mountainside. These ditches are also used for washing and personal hygiene; however, some irrigation ditches are located down slope from areas of human habitation and become contaminated.

3.3.2 Groundwater

The only wells observed in the area during site reconnaissance are three in the floodplain south of the town of Chitral and one in the floodplain north of town and just south of the airport. The three wells south of Chitral, installed in an Afghan refugee camp, are presumably used by the refugees as a domestic water supply. All four wells in the Chitral River floodplain are located very close to the river and, unless the well tips were established at sufficient depth, may be contaminated with bacteria and viruses, as well as petrochemicals, pesticides or other chemicals.

Only sections of Chitral town and about five percent of the villages are provided a safe and assured supply of drinking water (ADB 1987, page 23). From 1982-1984, portions of Chitral town were served by piped water, supplied from open wells along a tributary of the Chitral River in a flood-prone location. Wells were abandoned in 1984 and new headworks are being constructed. (The ADB development project includes plans to overcome the problems of water supply and water quality in this system by connecting the town distribution system with springs 22km north which can supply not only the town, but villages in between.)

Most rocks in the district have little permeability due to original sedimentation. Permeability is primarily related to rock fractures. In such rock, useful, household wells in the future will be no greater than a few hundred feet deep. Water for a town may, however, require quantities of water found along major fault zones in wells several hundred feet deep. Future exploration for groundwater in the Chitral District, can benefit from structural geological studies emphasiz-

ing fault and photographic lineament studies. It should be noted that ADB (1987) studies state that the District does not appear to have exploitable groundwater resources, except in isolated areas on terraces near larger rivers.

3.4 Terrestrial Ecology

3.4.1 Wildlife Habitats

Eight terrestrial wildlife habitat types can be identified in Chitral and Dir Districts, based on vegetation studies reported by Champion et al. (1965), Beg (1975), Khan (1975) and Roberts (1977). The applicability of this classification system was substantiated by field reconnaissance and by interviews with officials of the NWFP Forest Department and representatives of the World Wildlife Fund - Pakistan in August and September 1987. The habitat types are as follows:

1. Permanent snowfields and cold desert
2. Alpine meadow
3. Sub-alpine scrub and birch forest
4. Dry temperate coniferous forest
5. Dry evergreen oak forest
6. Alpine dry steppe
7. Open scrub
8. Riverine scrub and *Populus-Salix* forest
9. Agricultural field and orchard

Vegetation and wildlife associated with each habitat type are indicated in Table 3-4.

Permanent Snowfields and Cold Desert

This habitat type is found in the northern regions and highest altitudes of Chitral, generally above 4500 meters. The vegetation is more xerophytic than that of the alpine zone. The accessible parts of this habitat are under heavy pressure of grazing and fuel wood collection.

Alpine Meadows

Alpine meadows are found throughout Chitral and northern Dir at elevations greater than 3,750 meters, above the coniferous forest treeline. This habitat receives the heaviest grazing pressure of livestock during summer throughout the district. Scanty rains render lower altitudes unsuitable or only partially suitable to summer grazing. Availability of moisture results in lush growth of herbaceous vegetation in the alpine meadows, attracting thousands of sheep, goats, cattle and horses to these areas. All this livestock has heavy impact on native flora and fauna.

Sub-Alpine Scrub and Birch Forest

This habitat is confined to a narrow zone between 3,450 and 3,750 meters elevation, below the alpine meadows and

61

Table 3-4

FLORA AND FAUNA OF TERRESTRIAL HABITAT TYPES IN CHITRAL AND DIR DISTRICTS

Common Name	Scientific Name
PERMANENT SNOWFIELDS AND COLD DESERT - CHITRAL	
Flora	
Juniper	Juniperus communis
Lungwort	Mertensia tibetica
	Potentilla desertorum
	Salix denticulata
Fauna	
Royle's high mountain vole	Alticola roylei
Himalayan ibex	Capra ibex sibirica
Snow pigeon	Columba leuconata
Himalayan lynx	Felis lynx isabellina
Long-tailed Marmot	Marmota caudata
Snow leopard	Panthera uncia
Himalayan snow cock	Tetragallus himalayensis
ALPINE MEADOWS - CHITRAL AND DIR	
Flora	
	Astragalus spp.
	Draba trinervia
	Euphorbia kanaorica
	Oxytropis spp.
Meadow-grass	Poa spp.
	Polygonum affine
	Potentilla spp.
	Potentillia spp.
	Primula spp.
	Saxifraga sibirica
Fauna	
Royle's high mountain vole	Alticola roylei
Asiatic jackal	Canis aureus
Wolf	Canis lupus
Himalayan ibex	Capra ibex sibirica
Himalayan lynx	Felis lynx isabella
Snow partridge	Lerwa lerwa
Long-tailed marmot	Marmota caudata
Ermine	Mustela erminea
Snow leopard	Panthera uncia
Chinese birch mouse	Sicista concolor
Lesser shrew	Sorex minutus
Himalayan snow cock	Tetragallus himalayansis
Red Bear/Brown bear	Ursus arctos
Common red fox	Vulpes vulpes

'62'

SUB-ALPINE SCRUB AND BIRCH FOREST - CHITRAL AND DIR

Flora

	Alopecurus spp.
	Anemone spp.
	Berberis vulgaris
Birch	Betula utilis
	Ephedra gerardiana
	Heracleum thomsoni
Juniper	Juniperus communis
	Juniperus recurva
	Lonicera spp.
Meadow-grass	Poa spp.
	Primula spp.
	Prunus jacquemontii
	Ranunculaceae spp.
	Rhamnus minuta
	Rhododendron anthopogon
	Ribes villosum
Willow	Salix spp.
	Sorbus aucuparia

Fauna

Royle's high mountain vole	Alticola roylei
Asiatic jackal	Canis aureus
Wolf	Canis lupus
Pir Panjal/Kashmir Markhor	Capra falconeri cashmiriensis
Himalayan ibex	Capra ibex sibirica
Musk deer	Moschus moschiferus
Leopard	Panthera parva
Snow leopard	Panthera uncia
Common red fox	Vulpes vulpes

DRY TEMPERATE CONIFEROUS FOREST - CHITRAL AND DIR

Flora

Silver fir	Abies pindrow
Maple	Acer caesium
Horse chesnut	Aesculus indica
Deodar	Cedrus deodara
	Indigofera sp.
Walnut	Juglans regia
	Lonicera sp.
Spruce	Picea smithiana
Chalghoza pine	Pinus gerardiana
Kail	Pinus wallichiana
Bird cherry	Prunus cornauta
Holly oak	Quercus dilatata
Bani oak	Quercus ilex
Elm	Ulmus wallichiana
	Vibernum sp.

Fauna

Chukar partridge	Alectoris chukar chukar
Pir Panjal/Kashmir Markhor	Capra falconeri cashmiriensis
Small kashmir flying squirrel	Hylopetes fimbriatus
Monal pheasant	Lophophorus impejanus
Rhesus macaque	Macaca mulatta
Yellow-throated marten	Martes flavigula
Urial	Ovis orientalis
Leopard	Panthera pardus
Koklass pheasant	Pucrasia macrolopha
Himalayan black bear	Selenarctos thibetanus
Brown bear	Ursos arctos

DRY EVERGREEN OAK FOREST - CHITRAL AND DIR

Flora

	Artemisia martima
	Astragalus sp.
	Berberis sp.
	Carragana decorticans
Deodar	Cedrus deodara
	Cotoneaster nummularia
	Daphne oleoides
	Ephreda intermedia
	Geltis sp.
	Heteropogan contartus
Juniper	Juniperus polycarpos
	Lonicera spp.
	Lonicera sp.
Kao	Olea cuspidata
	Parrotia jacquemontiana
	Periploca phylla
Chalghoza pine	Pinus gerardiana
Kail	Pinus wallichiana
Pista	Pistacia khinjuk
	Plactranthus rugosus
	Plectranthus rugosus
	Prunus euberna
Jangli anar	Punica granatum
Banj oak	Quercus ilex
	Rumux histatus
	Salix spp.
	Sophora mollis
	Sophora mollis
	Spiraea lindleyana
	Symbopogan jawarancusa

Fauna

Chukar partridge	Alectoris chukar chukar
Pir Panjal/Kashmir Markhor	Capra falconeri cashmiriensis
Yellow-throated marten	Martes flavigula
Urial	Ovis orientalis
Leopard	Panthera pardus
Himalayan black bear	Selenarctos thibetanus
Rufous turtle dove	Streptopelia orientalis

ALPINE DRY STEPPE - CHITRAL AND DIR

Flora

	Artemesia maritima
	Berberis sp.
	Ephedra intermedia
	Hippophae rhamnoides
	Juniperus macropoda
	Juniperus polycarpus
	Pistacia integerrima
	Plectranthus rugosus
Oak	Quercus ilex
	Saphora mollis

Fauna

Chukar partridge	Alectoris chukar chukar
Pir Panjal/Kashmir Markhor	Capra falconeri cashmiriensis
Himalayan ibex	Capra ibex sibirica
Cape hare	Lepus capensis
Urial	Ovis orientalis
Snow leopard	Panthera uncia

OPEN SCRUB - CHITRAL

Flora

	Artemisia maritima
	Capparis spinosa
	Delphinium saniculaefolium
	Fraxinus xanthoxyloides
	Haxoxylon spp.
	Hyoscyamus pusillus
	Papaver spp.
	Pennisetum spp.
	Reheum tibeticum
	Tamarix gallica

Fauna

Markor	Capra falconeri cashmiriensis
Himalayan ibex	Capra ibex sibirica
Leopard cat	Felis bengalensis
Black bear	Selenarctos thibetanus
Brown bear	Ursus arctos

RIVERINE SCRUB AND POPULUS-SALIX FOREST-CHITRAL

Flora

Birch	Alnus nitida
	Betula utilis
	Hippophae rhamnoides
	Myricaria spp.
	Populus ciliata
	Salix hastata
	Salix oxyearpa
	Salix viminalis
	Salix wallichiana
	Tamarix troupii

Fauna

Himalayan lynx	Felis lynx isabellina
Cape hare	Lepus capensis
Common otter	Lutra lutra

AGRICULTURAL FIELD AND ORCHARD - CHITRAL AND DIR

Fauna

Common myna	Acridotheres fuscus
Pir Panjal/Kashmir Markhor	Capra falconeri cashmiriensis
Himalayan ibex	Capra ibex sibirica
Blue rock pigeon	Columba livia
Golden oriole	Oriolus oriolus
Bulbul	Pycnonotus
Turtle dove	Streptopelia orientalis
Hoopoe	Upupa epops
Waterfowl	

66

above the treeline of the coniferous forest in Chitral and Dir. This habitat type is also found in the dry valleys of upper Chitral where moisture is available from the nearby glaciers. Like the alpine meadows, this habitat type is typically subject to heavy livestock grazing.

Dry Temperate Coniferous Forest

Dry temperate coniferous forest occurs throughout lower Chitral and can be subdivided as predominantly fir forests and predominantly deodar forests. Generally confined to the lower reaches of this habitat type, between 1,800 and 3,000 meters, deodar forest occupies about 75 percent of the area of the dry tempeate coniferous forest, generally occupying the side valleys of lower Chitral. Between 2,850 and 3,500 meters, the silver fir forests form a belt above the deodar forests. Associated wildlife depend on these forests for forage and cover from hunting, predators and the weather. The habitat also constitutes all the managed, commercial forest of the District and is the only source of timber for local construction.

Dry Evergreen Oak Forest

Throughout lower Chitral, between altitudes of 1,200 and 2,000 meters, occurs the dry temperate evergreen oak forest habitat type. Regeneration is poor and the condition of the vegetation has deteriorated due to unrestricted grazing/browsing and lopping/topping for fodder and fuel.

Alpine Dry Steppe

This steppic habitat is located in tributary valleys of Chitral and parts of Dir between 2,500 and 3,500 meters. This habitat is under heavy pressure from firewood collection. Sparsely growing, stunted trees are cut for firewood, exposing the bare soil to water and wind erosion. This alpine habitat can not endure continuous exploitation.

Open Scrub

Open scrub habitat is steppic and occurs north of Chitral town. Hill slopes are bare and, except in crevices, almost devoid of soil. In the more northern portions of Chitral, the open scrub habitat type merges with the alpine zone.

Riverine Scrub and Populus-Salix Forest

Riverine scrub and forest are present along rivers and streams where seasonal deposition of silt and other requisite growth conditions occur. This habitat type occurs throughout Chitral at elevations up to approximately 3,500 meters. Vegetation generally flourishes due to favorable growth conditions, despite heavy utilization for firewood by local populations, especially in upper Chitral.

67

Agricultural Field and Orchard

This habitat occurs throughout Chitral District, almost exclusively along the major rivers and streams. Typical cultivated crops include wheat, maize, rice, barley, potatoes, pulses and various vegetables. Walnuts, grapes, apricots, apples and peaches are grown in orchards and along the edges of fields.

This habitat type provides food and cover to migratory turtle doves, which are hunted by the local population for meat. Waterfowl, migrating through the district, also use this habitat for feeding. Common myna, blue rock pigeon, golden oriole, hoopoe and bulbul also occur. Occasional winter use of agricultural fields and orchards by markhor and ibex is reported.

3.4.2 Wildlife

The wild fauna of Chitral District are diverse and have an affinity to the paleartic zoogeographic region. Several researchers, Aleem (1976), Aleem and Malik (1977), Khan (1974,1975), Malik (1985,1986), Roberts (1967,1969,1977), Schaller (1977,1980), Schaller and Khan (1975) and Schaller and Mirza (1971), have studied the wildlife in Chitral. No specific records of bird fauna are available for Chitral. Detailed studies on the wildlife of Dir District have not been conducted, although some information is available on the species present. Table 3-5 provides a listing of wildlife known to inhabit Chitral and Dir Districts.

Status and Distribution

Past attempts to assess the size and distribution of various wildlife populations in Chitral have been limited, due to shortages of staff and the inaccessibility of habitats. These factors, in addition to the lack of training of local NWFP Forest Department personnel, have constrained the number of studies conducted within a rigid scientific framework and commensurate with sound scientific technique. Based on the reports of the Forest Department field staff, population estimates of wildlife in Chitral, as shown in Table 3-6, have been made (NWFP Forest Department). Previous estimates abstracted by A. A. Khan (1975) are also indicated.

Table 3-5

WILDLIFE OF CHITRAL AND DIR DISTRICTS

Common Name	Scientific Name
WILDLIFE OF CHITRAL AND DIR	
Pir Panjal/Kashmir markhor	Capra falconeri cashmiriensis
Rhesus macaque	Macaca mulatta
Musk deer	Moschus moschiferus
Leopard	Panthera pardus
Himalayan black bear	Selenarctos thibetanus
Chinese birch mouse	Sicista concolor
Lesser shrew	Sorex minutus
Avifauna	
Chukar partridge	Alectoris chukar chukar
Monal pheasant	Lophophorus impejanus
Rufous turtle dove	Streptopelia orientalis
WILDLIFE OF CHITRAL	
Royle's high mountain vole	Alticola roylei
Wood/Field mouse	Apodemus sylvatia
Asiatic jackal	Canis aureus
Wolf	Canis lupus
Himalayan ibex	Capra ibex sibirica
Woolly flying squirrel	Eupetaurus cinereus
Leopard cat	Felis bengalensis
Himalayan Lynx	Felis lynx isabellina
Hyaena	Hyaena hyaena
Small kashmir flying squirrel	Hylopetes fimbriatus
Indian crested porcupine	Hystrix indica
Cape hare	Lepus capensis
Common otter	Lutra lutra
Long-tailed marmot	Marmota caudata
Yellow-throated marten	Martes flavigula
Stone marten	Martes foina
Ermine	Mustela erminea
Short-tailed bandicoot rat	Nesokia indica
Royle's pika	Ochotona roylei
Urial	Ovis orientalis
Snow leopard	Panthera uncia
Giant red flying squirrel	Petaurista petaurista
Carruthers vole	Pitymys carruthersi
Wild boar	Sus scrofa
Brown bear	Ursus arctos
Hill fox	Vulpes vulpes griffithi
Tibetan red fox	Vulpes vulpes monatana

Avifauna

Golden eagle	Aquila chryseatos
Snow pigeon	Columba leuconata
Blue rock pigeon	Columba livia
Saker falcon	Falco cherrug
Snow partridge	Lerwa lerwa
Collared doe	Streptopelia decaocto
Himalayan snow cock	Tetragallus himalayansis
Green pigeon	Treron phoenicoptera
Saker falcon	

WILDLIFE OF DIR

Goral

Avifauna

Black partridge	Francolinus francolinus
Grey partridge	Francolinus pondicerianus
Koklass pheasant	Pucrasia macrolopha

10

Table 3-6

ESTIMATED POPULATION OF WILDLIFE SPECIES
IN CHITRAL DISTRICT

Species	Estimated Population	
	1987	1975
Markhor	600-800	700-1000
Ibex	1600-4000	1000-1200
Musk deer	Less than 30	20-30
Urial	25-100	50-100
Snow leopard	30-60	30-40
Wolf	140-700	100-150
Black bear	20-30	30-40
Brown bear	Less than 10	5-10
Monal pheasant	30-50	Poor
Himalayan snow cock	1140-4000	Poor
Chukar partzidge	3950	Abundant

No specific study has been performed to determine the minimum viable population size of these species. The populations of musk deer, black bear and brown beer appear to be inadequate for satisfactory recruitment. Individuals of these species in Chitral may, however, be members of larger populations in Afghanistan and the adjoining Districts of Dir, Swat and Gilgit. Adequate recruitment population of markhor, ibex, urial, snow leopard, wolf, monal pheasant, Himalayan snow cock, ram chikoor and chikoor seem to exist. Few major barriers exist within Chitral, and the free movement of individuals of each species is probable. It is therefore assumed that the estimated populations given above represent existing recruitment populations or parts of larger populations, individuals of which seasonally migrate into Chitral.

Since these animal species have large home ranges and may migrate from one valley to another, exact location of recruitment populations cannot be specified. Nevertheless, some population centers have been generally located and often tend to coincide with particular stream valleys or gols. The known population centers for markhor, ibex and urial are as follows:

Species	Location of Recruitment Population
Markhor	Chitral Gol, Drosh Gol, Puret Gol, Gehrait Gol,Tooshi and Goleen Gol.
Ibex	Agram Basti, Booni Gol, Zewar Gol, Shajnali, Bishkar Gol, Goleen Gol and Chumarkan Gol.
Urial	Chitral Gol, Rambor Gol and Uchalgah.

71

The estimated ranges in Chitral of markhor and ibex and locations where some other species are known to occur are indicated in Figure 5, provided by the Chitral Wildlife Division.

There is no significant diurnal migration of any of the species of principal concern. Most of these target species do, however, migrate vertically on a seasonal basis. As the alpine pastures become free of snow cover and water is available in the late spring, the herbivores move up the hillslopes to the higher elevations. Markhor, ibex, urial and musk deer, in addition to domestic livestock, migrate to the alpine pastures to feed on the luxuriant growth of palatable vegetation. In response to the movement of prey species, many predator species also migrate to the higher elevations.

By autumn, the pastures become meager due to the demands of overgrazing. With the onset of winter, the high-altitude pastures become covered by snow and food for the herbivores becomes scarce. Accompanied by the predators, the grazing wildlife migrate to lower elevations. Monal pheasant, Himalayan snow cock and golden eagle follow a similar, although less accentuated seasonal migration.

Endangered Species

Of the existing wildlife species in Chitral, eleven have been declared endangered by the Pakistan Wildlife Enquiry Committee (GOP 1970) and have been designated "protected animals" under the NWFP Wildlife Act of 1975 (NWFP 1975). These species are as follows:

Snow leopard	*Panthera uncia*
Himalayan lynx	*Felis lynx*
Brown bear	*Ursus arctos*
Musk deer	*Moschus moschiferus*
Yellow-throated marten	*Martes flavigula*
Leopard	*Panthera pardus*
Leopard cat	*Felis bengalensis*
Rhesus monkey	*Macaca mulatta*
Common otter	*Lutra lutra*
Urial	*Ovis orientalis*
Monal pheasant	*Lophophorus impejanus*

The snow leopard, musk deer, leopard, leopard cat and urial have been designated endangered species by the U.S. Fish and Wildlife Service (1987). Only the snow leopard has been designated in the IUCN Red Data Book as an endangered species. The general habitat and distribution of each animal is outlined below (Ali *et al*. 1969; Khan 1975; Roberts 1977).

Snow leopard. The snow leopard generally inhabits arid alpine regions where it is well camouflaged with the grey rocks of its background. It descends in winter about 1,500 meters elevation. In Pakistan, it exists in the inner Himalayan ranges where there is very little precipitation. Snow

leopards are considered to be very thinly distributed in Pakistan in general, and occur very sparsely in northern Chitral. The snow leopard is hunted for its pelt and to protect domestic livestock.

Himalayan lynx. In Pakistan, the lynx is associated with alpine slopes above the tree line in mountains areas as well as upland valleys in the extreme northern regions. These areas are characteristically low in precipitation. The lynx generally avoids very steep rocky areas, seeming to prefer regions where there is some scrub vegetation. It is comparatively uncommon and very thinly distributed throughout the northern regions of Chitral.

Brown bear. The brown bear is generally restricted to alpine meadow and sub-alpine scrub zones above the tree-line. It will however, descend to remoter side valleys or ravines with stunted junipers and birch forest in search of succulent food plants. It occurs very sparsely in all the higher mountain ranges and is rare in the northern parts of Chitral. The brown bear is captured for taming and killed for its fat, purportedly used for massages and in medicines.

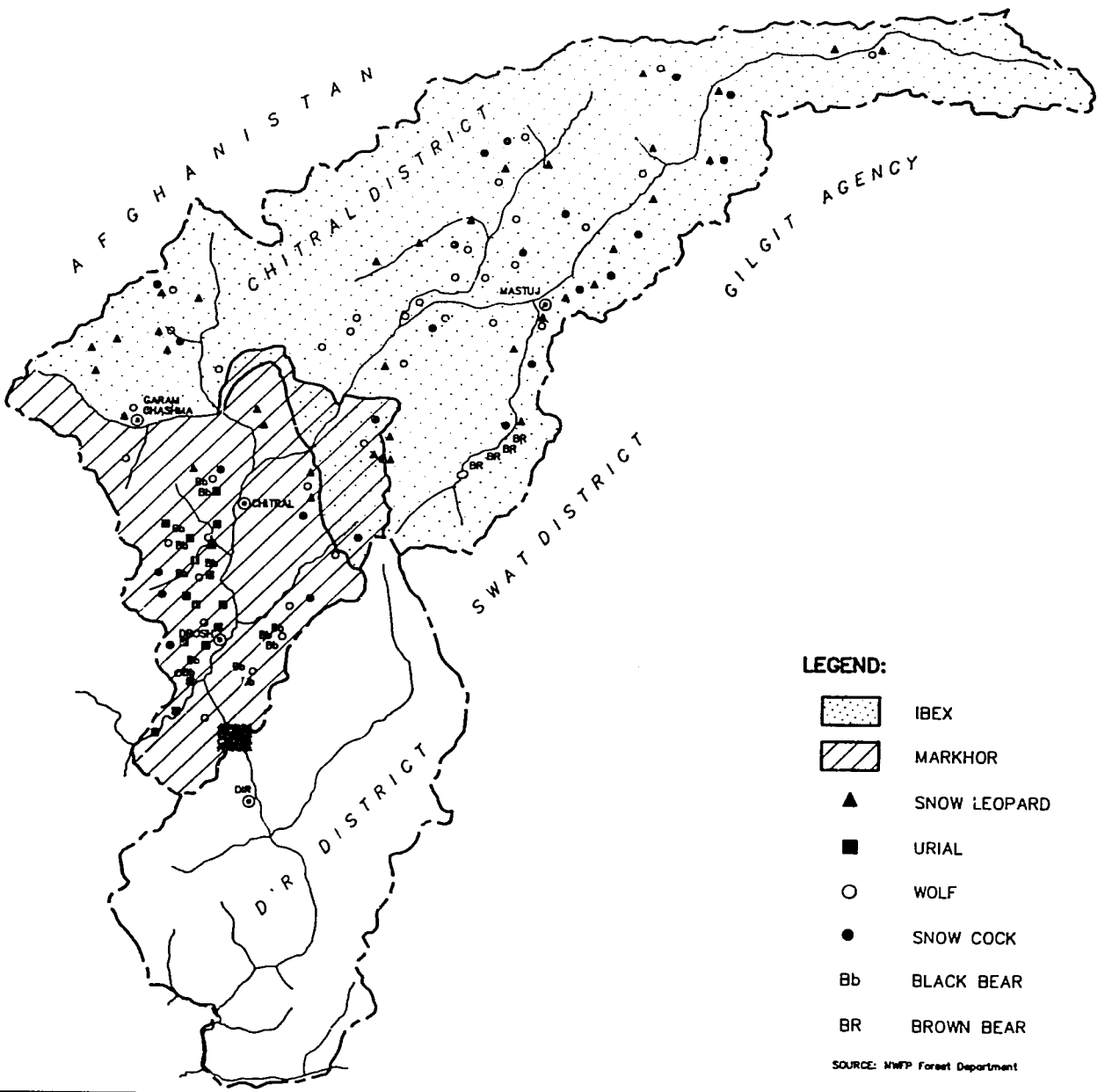
Musk deer. In the north west Himalayas, the musk deer is associated with the sub-alpine scrub zone, above coniferous forest. It seems to prefer steep slopes and narrow gullies near nountain crests where winter snows provide sufficient moisture in the spring for growth of stunted bushes such as the wild currant (Ribena sp.) or wild celery (Ferula sp.). It is known in Chitral, but has become exceedingly rare due to constant persecution by hunters. The musk pod is used in medicines and perfumes.

Yellow-throated marten. Although considered a forest-dwelling species, the yellow-throated marten is widely adaptable. Typically associated in the outer Himalayan ranges with silver fir (Abies pindrow) and blue pine (Pinus excelsa), it also occurs in the tropical deciduous forest and wild olive scrub forest in the outer foothills. Additionally, it exists in the dry Himalayan forest. It has been known to occur in the lower part of Chitral and Dir. Although its fur is not highly valued, it is still constantly shot and trapped and is thus disappearing in places where it once prospered.

Leopard. In Pakistan, the leopard is confined to Himalayan forest regions up to the limit of the tree line or the lower altitude valleys in the more arid, mountainous regions further north. The leopard occurs sparsely in southern Chitral around Rondu. Leopard populations in Chitral are declining due to indiscriminate killing and loss of suitable habitat.

Leopard cat. The leopard cat is normally associated with the Himalayan moist temperate forest in Pakistan but, it has penetrated into Himalayan dry coniferous forest in regions further north. Because of its valuable pelage, it is heavily

-73



LEGEND:

- IBEX
- MARKHOR
- ▲ SNOW LEOPARD
- ■ URIAL
- ○ WOLF
- ● SNOW COCK
- Bb BLACK BEAR
- BR BROWN BEAR

SOURCE: NWFP Forest Department

Environmental, Economic and Social Soundness Assessment

CHITRAL ACCESS PROJECT

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

North

30 10 0 10 20 30 40 50 km

Approximate Scale: 1 : 1 000 000

TAMS CONSULTANTS, Inc.

December 1987

WILDLIFE RANGES AND LOCATIONS OF OCCURENCE

Figure 5

hunted and has consequently become quite rare in Pakistan, although it has a wide distribution in other parts of the world. It is known to occur in northern Dir and in the forests of Chitral, although local hunters allege that it is very rare. The fur of the leopard cat is in high demand.

Rhesus monkey. The Rhesus monkey inhabits mountainous regions having forest cover and is typically associated with Himalayan moist temperate forest. It has become quite rare in Chitral due to persecution by local villagers and the fact that young monkeys are saleable as pets to visitors.

Common otter. The common otter formerly occurred throughout all the Himalayan river systems. Because of its great commercial value, it has been greatly persecuted. Additionally, the otter has been hunted and destroyed, because of its devastation to trout fisheries. Consequently, it has become rare in all the more accessible regions, such as the Chitral River Valleys. It still, however, occurs in the northern valleys of Chitral.

Urial. In Chitral, the urial is associated with holly oak (*Quercus balout*). In the extreme northern and inner Himalayan ranges, it inhabits barren, treeless regions occurring in stony valleys and lower foothills. This species generally tends to avoid steep precipitous regions and is usually found in regions with deep erosion gulleys interspersed with relatively smooth boulder-strewn slopes. While once plentiful in Chitral, the urial has become quite rare due to severe hunting pressure. It appears that the urial population in Chitral will shortly become extinct.

Monal pheasant. The monal pheasant inhabits high oak, rhododendron and deodar forests in the Himalayas. In these forests, the pheasant appears to prefer areas which are interspersed with open glades and pastures. Additionally, the monal pheasant is associated with precipitous hillsides which have grass and weeds growing on narrow ledges.

Ecology

Predator species found in Chitral include snow leopard, leopard, brown bear, black bear, wolf, lynx, leopard cat, red fox, golden eagle and saker falcon. The population of brown bear and black bear are significant. Although they are known to occasionally attack and kill domestic livestock, no specific research has been conducted on them within Chitral or Dir Districts and their relationship with wild prey is unknown. Snow leopard, leopard, lynx and wolves prey upon the wild herbivores including markhor, ibex, urial, musk deer, marmot and Himalayan snow cock. When the wild prey is not available, these predators switch over to domestic livestock. The seasonal movement pattern of these predators follows the seasonal migration of livestock to the subalpine and alpine pastures and back. Raptors prey upon small mammals and birds. Golden eagle

75

particularly has been reported to kill the young of markhor and ibex, as well as marmot and Himalayan snow cock.

The size of the indigenous predator populations can only be approximated. The relative abundance of wolf is the highest and of brown bear the lowest. The relationships between fluctuations in the populations of predators and prey and other aspects of predator-prey ecology have not been studied.

There is no significant impact of wildlife populations on agriculture or domestic livestock in Chitral or Dir. During particularly severe winters, markhor and ibex do occasionally enter agricultural fields and feed on crops, but the extent of damage is insignificant. Nowhere in either district is the impact of wildlife on crops or livestock so great as to warrant the removal of wild animals.

Nowhere in Chitral or Dir Districts are the populations of wild herbivores so high as to impact grazing of livestock. In areas such as Chitral Gol and Agram-Basti where the populations of markhor and ibex, respectively, are high, competition for food exists between wildlife and livestock. Under such conditions, livestock almost always out-compete wildlife due to the following factors:

- Livestock greatly outnumber wildlife;
- Wildlife avoid the shepherds who herd and guard the livestock flocks;
- Livestock actively graze during most of the day, whereas wild herbivores generally are active only during the early and late daytime hours.

The principal natural causes of losses to wildlife populations in Chitral and Dir are predation and migration. No significant losses have been recorded due to disease or malnutrition. (Loss of habitat, competition with livestock, hunting and poaching are discussed in Section 3.4.3.)

No estimates of the rate of depredation on wild herbivores by carnivores in Chitral or Dir Districts are available. Due to the low carnivore populations, it can be assumed that predation does not occur at rates unsustainable by herbivore populations. It is more likely that in lower Chitral and Dir, where human influence is greatest, the populations of large predators are insufficient to regulate properly the size and characteristics of markhor and other large herbivore populations.

During summer, a significant portion of the markhor and ibex populations migrate to adjoining territories of Afghanistan, and return with the onset of winter. Occasionally, early snowfalls in the high mountains along the Pakistan-Afghanistan border forestall the return journey and result in a

temporary loss sustained by the wildlife populations in Chitral and Dir.

3.4.3 Man-Induced Pressures on Wildlife

Wildlife in Chitral and Dir Districts are confronted with several man-induced pressures, including deforestation, competition with domestic livestock, hunting and poaching, and prevailing agricultural practices. These factors, among others, regulate wildlife populations and will determine the response of those populations to increased access and resulting secondary development.

Deforestation

As discussed in Section 3.8, the forests in Chitral and Dir are meager, as a result of decades of mismanagement. Due to the clear-cutting and subsequent grazing of livestock, particularly goats, on large tracts of hillside forest, the fragile mountain slopes lack vegetative cover and soil erosion is extensive and in most locations irreversible. This situation has caused serious watershed management problems and stresses to the ecological system.

In some areas where the trees have already been felled, people in need of fuel and forage uproot the shrubs and grasses of the fragile mountain slopes, starting an erosion process that may never be remedied. In the northern parts of Chitral this uprooting of vegetation is common, because there is no other fuel source.

Existing forest exploitation is concentrated on the dry temperate coniferous and dry evergreen oak forests. The forest management plan in force provides for the annual harvesting of 0.5 million cubic feet of timber, of which 0.1 million is for the domestic use of permit holders and the remaining 0.4 million cubic feet is commercially harvested by the Forest Development Corporation. According to the Divisional Forest Officer of Chitral (Shabir Hussain, NWFP Forest Department, September 17, 1987), the low soil productivity, poor timber crop condition and highly erodible hill slopes warrant that commercial exploitation be terminated and timber be extracted only to meet the needs of local populations for house and other small construction.

Forests also have to provide firewood for daily cooking needs as well as to keep houses warm in winter. People have the rights and privileges to collect the dry fallen wood, but they often resort to the cutting of green trees. The forests not only have to meet the firewood requirements of the local, rural population, but must also sustain the burden of commercial exploitation to meet the energy requirements of urban population, as well as requirements of areas where no fuelwood is available.

The dry evergreen oak forest is under great pressure for firewood collection and lopping of trees for fodder. Oak is the dominant tree species of this habitat type and provides most of the winter fodder to domestic livestock and resident wildlife. Throughout the year, it is also the most important source of firewood.

Oak stands are being cleared rapidly. Due to the slow growth rate of holly oak, low rainfall and other climatic factors, lopping for fodder and heavy browsing by goats, regeneration is poor. No significant steps have been taken toward afforestation.

The importance of the remaining forests to many wildlife species in Chitral and Dir is great. Forests provide protective and thermal cover and vital forage. Oak, olive, juniper, willow, birch, ash and Prunus are the preferred plant species for firewood. These are also the species of greatest importance for food and cover to wild herbivores. The animals using these plant species as food include markhor, ibex, urial, and musk deer. Cutting of oak is seriously depleting the winter food source of markhor. Removal of juniper, birch and willows is adversely affecting ibex and musk deer. Removal of trees from several areas has created a shortage of suitable perches for some species of raptors.

Competition

The rural economy in Chitral is dependent upon agriculture and livestock rearing. People rear cattle for dairy products and farm power. Horses and donkeys are kept for transport and as beasts of burden. Sheep and goats are reared for milk, wool and meat. The livestock depends upon forest and rangelands, which are shared by wildlife.

Livestock cause heavy damage to vegetation by overgrazing, compaction of soil and soil erosion. They also trample seedlings which results in poor regeneration. Sheep and goats also adversely affect vegetation by overgrazing.

The lack of mechanized farming has required the rearing of cattle for plowing fields and threshing crops. On the average, each family has its own pair of oxen or cows. The cattle are actually used for about one month during the entire year. During the remainder of the year, they are either stall-fed or driven into the forest and rangelands for grazing. Excessive number of cattle is a burden on poor ranges. This not only causes deterioration in range condition but also hampers germination of seedlings and induces soil erosion through trampling and compacting of soil. The extent and quality of habitat available to grazing wildlife is therefore generally inadequate.

Studies conducted in Chitral Gol (Aleem 1977) have revealed that overgrazing by sheep and goats resulted in retrogression of the herbaceous vegetation. Markhor were forced

18

to use only secluded corners of the habitat. It was found that the percent cover of forbs was higher in the grazed area then in the ungrazed area. Similarly the presence of unpalatable forbs and shrubs was relatively higher in grazed areas and palatable perennial grasses were more common in ungrazed areas.

According to the District Forest Officer of Chitral (Shabir Hussain, NWFP Forest Department, September 9, 1987) and representatives of the World Wildlife Fund-Pakistan (Dr. Abdul Aleen Chaudhry and Zaheer Ahmad, September 1, 1987), the productivity of rangelands in Chitral is low and the livestock number is higher than the carrying capacity of the range. Although specific surveys of carrying capacities have not been conducted, poor condition of plants, inadequate plant cover, heavy soil erosion and extremely poor health and productivity of the livestock are indications of poor range condition. Excessive grazing pressure on wildlands has resulted in poor wildlife habitat and adversely affected the plant succession. Dr. George B. Schaller of the New York Zoological Society (October 21, 1987) indicated that overgrazing and competition with livestock is a major problem facing wildlife and wildlife habitat in Chitral.

Hunting and Poaching

Two to four permits are issued annually in Chitral District for hunting markhor. The remainder of permitted hunting is confined to chukor partridge, waterfowl and doves, for which 2,000 permits are issued annually. Of these the greatest hunting pressure is sustained by ducks and doves, which are migratory. Although some shooting and trapping of chukar partridge occurs, this hunting pressure is insignificant. There is no serious threat to the survival of chukar, being a bird of open country, by livestock grazing or deforestation.

Hunting pressure is essentially evenly distributed throughout Chitral District. Hunting of waterfowl and doves occurs primarily in spring and fall, whereas chukar partridge is hunted in winter. Most hunting of markhor and ibex is also in winter, when the animals are confined to lower, more accessible terrain. Heavy snow cover and scarcity of food drive the animals to lower altitudes nearer to human habitation. At this time predator activity is also high. In other parts of the country, some hunters trap falcons under a valid license during winter. Falcon trapping in Chitral is limited, due to its inaccessibility in winter.

In Chitral, prior to 1969, the wildlife was protected by the ruling family and other influential families to whom resorts were allotted by the ruler. Thus, the general public did not have access to hunting. After merger of the state to Pakistan in 1969, stringent state rules no longer existed. It is thought that long suppression of the public in the past and the sudden realization of personal freedom led to excessive poaching, particularly when protective staff was non-existent

(Malik 1987). Gradually the wildlife organization in the province developed and some control over poaching was achieved. However, due to shortage of staff, lack of awareness among the people and poor economic condition in the far-flung areas, poaching has not been checked completely.

Poaching of wild animals for subsistence meat consumption and to obtain hides and trophies for sale remains a major problem throughout Chitral and Dir Districts. Although less than 10 cases of big game poaching are reported annually, the NWFP Forest Department estimates that 100 to 150 animals, mostly ibex and markhor, are poached each year.

Poaching is perpetuated as a threat to wildlife populations, because hunting of most wild animals is either legally prohibited or the hunting permit fee is too expensive for the local people. The reasons for poaching include: checking predator damage to livestock; obtaining meat for subsistence; achieving economic gains through the sale of hides or trophies; and giving of gifts of meat or hides to influential people. The brunt of most poaching is sustained by ibex, markhor, snow leopard, red fox, lynx, wolf, monal pheasant and Himalayan snow cock.

A considerable degree of protection to wildlife populations in Chitral is afforded by the remoteness and inaccessibility of wildlife habitats to poachers from outside the district. Although poaching does take place locally, in winter, the snowbound Lowari Pass and uncertain flights save the wildlife from other potential poachers living in down-districts.

Agriculture Practices

The rural economy in Chitral and Dir is dependent upon agriculture. Limited flat land is available along the rivers and streams and is tilled for cultivation of crops. Two aspects of prevailing agricultural practices which are detrimented to wildlife and habitat conservation are low farm income and small farm parcels. As in many other parts of Pakistan, land holdings in Chitral and Dir Districts are small, averaging less than one hectare, and the purchasing power of farm families is very low. To fulfill their daily needs, farm families must resort to relatively laborious and marginally productive practices, such as the collection of firewood from mountain slopes and the rearing of poor quality, small livestock. Already stressed natural resources are thereby additionally burdened and the rural poor are trapped in a self-defeating activity cycle.

3.4.4 Wildlife Management

Wildlife management in NWFP can be traced to the late nineteenth century when rules were formulated to regulate

80

the hunting of markhor, ibex, musk deer, and urial in the District of Chitral. Chitral was a semi-autonomous state governed by a ruler (Khan 1975). Not only were rules formulated for the protection and hunting of big game, the concept of game reserves was introduced when the ruler and other influential leaders set aside areas as their personal game preserves. Chitral Gol, the present national park was one such reserve. No written laws were adopted in the adjoining states, Swat and Dir.

Some degree of wildlife protection was achieved through the Indian Forest Act of 1927 and the Hazard Forest Act of 1936 (Rao 1984) which regulated grazing by cattle. The rules set forth under the Indian Forest Act of 1927 empowered forest officials to exercise control over grazing, cultivation, cutting of trees and hunting within reserved or protected forests, but did not affect other areas (U.S. Fish and Wildlife Service 1978).

After independence in 1947, the West Pakistan Game Department was entrusted with the responsibility of game management and the Department performed its job with a skeleton staff. Emphasis was placed upon small game protection and the artiodactyls and carnivores remained largely neglected. Increased interest in wildlife conservation was shown by the Government during the late 1950s, and as a result an ordinance known as the "West Pakistan Wildlife Protection Ordinance of 1959" was issued. The provisions of this ordinance were inadequate and ineffective (Khan 1975; Malik 1987).

Subsequently, the West Pakistan Game Department was abolished and its functions and staff were transferred to the Provincial Forest Department. In the NWFP Forest Department, this staff consisted of one subdivisional officer, three game inspectors and 45 wildlife watchers, but staff had insufficient training in wildlife management and lacked the necessary equipment, including transport facilities. Consequently the wildlife protection situation became worse and the wild artiodactyls reportedly suffered severely from poaching.

During 1969, the formerly semi-autonomous states of Swat and Chitral were merged into the general administration of the country, but almost six years elapsed before wildlife legislation was extended to those states. This had another adverse effect on wildlife; hunters who had been restrained from hunting earlier indulged actively in poaching. However, during 1972, a project was launched in Chitral for management of wildlife (NCCW 1978). The same year, Chitral Gol, Drosh Gol, Purit Gol, Gehrait Gol and Agram Basti were declared game reserves. Except for Agram Basti, which supported ibex, the game reserves were designed to provide protection to markhor (Khan 1975) and urial.

The Government of Pakistan established the Wildlife Inquiry Committee in 1968 to review the status of wildlife in the country. The committee submitted its report in 1970 (GOP).

In partial implementation of the recommendations of the Pakistan Wildlife Inquiry Committee, a separate Wildlife Wing was created in the NWFP Forest Department in 1975. This wing was given the task of wildlife management in the province. The same year, the NWFP Wildlife Act, discussed in Section 1.5.3, was promulgated. The Wildlife Wing was retrenched in 1979 and organized again in 1982. An independent Wildlife Division created for Chitral is responsible for wildlife administration, development and management activities in the District.

The Chitral Wildlife Division, headquartered in Chitral town, is headed by the Division Forest Officer (DFO), who is currently assisted by the following field staff:

Position	Number
Range Officer - Wildlife	3
Deputy Ranger - Wildlife	8
Head Watcher	2
Wildlife Watcher	62

Figure 6 indicates the official posts of Chitral Wildlife Division staff and the location of Division facilities.

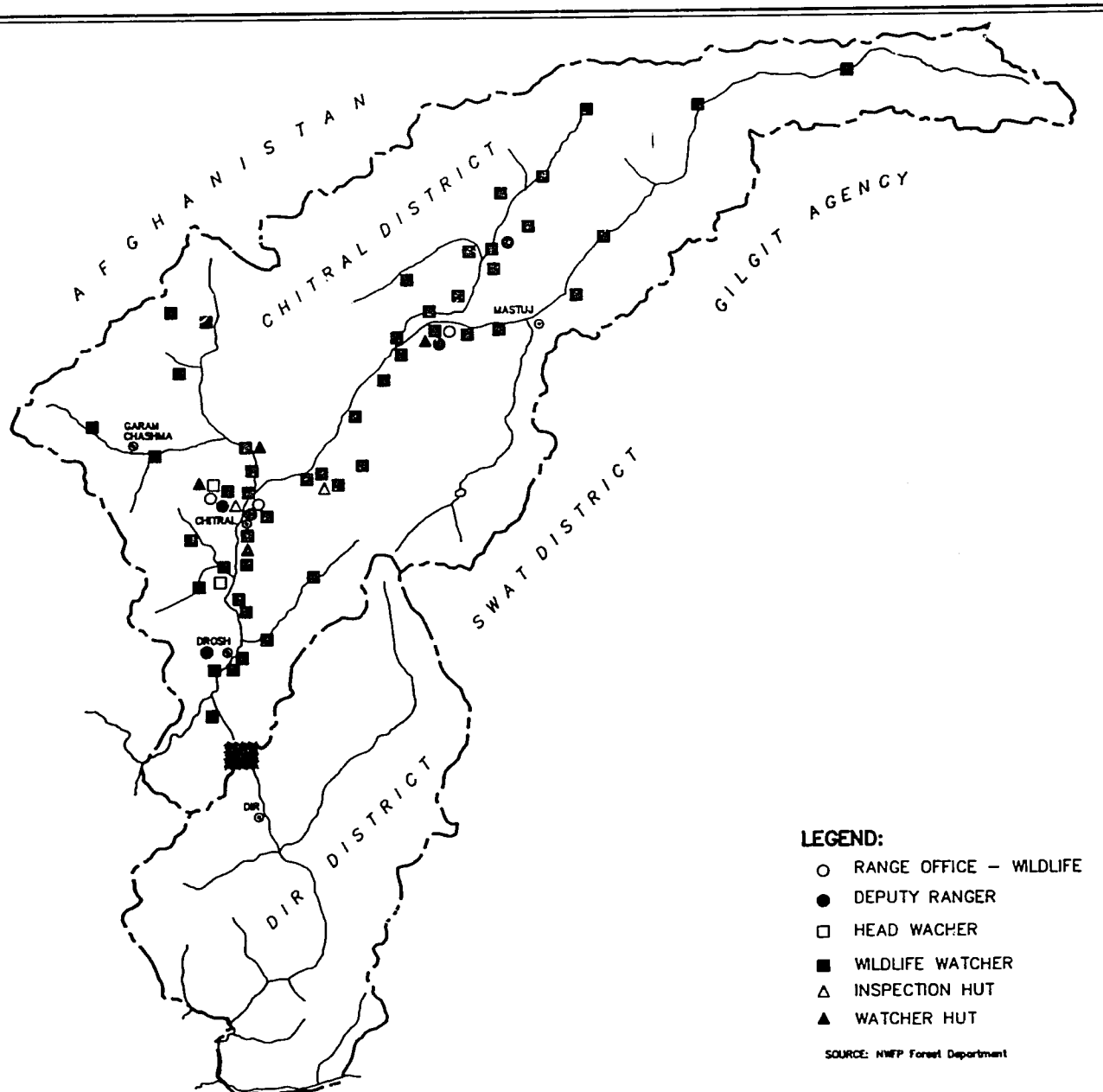
The staff of Chitral Wildlife Division conducts some extension programs as part of their routine duties. Their objective is to create awareness of the value of wildlife and wildlife conservation. Periodic lectures are delivered in schools, sign boards are displayed and formal meetings are held.

Most of the NWFP officers prefer not to serve in Chitral District, because of its isolation from the rest of the country for six to seven month each year. Quite often the officers returning from Chitral to Peshawar are delayed, due to the non-availability of flights. Further, only a few senior officers succeed in performing inspections of their departments in Chitral during winter. As a result, the administration and performance of duties is adversely affected.

3.4.5 Protected Areas

For the purposes of protection and management of wildlife, several protected areas have been established in Chitral District. These include one national park, one wildlife sanctuary and five game reserves, shown on Figure 7. No wildlife management areas have been designated in Dir, although three games reserves have been proposed.

Boundaries of the national parks, wildlife sanctuaries and reserves are defined by an official notification. Usually, the prominent natural features, such as rivers and ridges, are taken as boundaries. There is a provision for demarcation of boundaries by erecting boundary pillars.



Environmental, Economic and Social Soundness Assessment

CHITRAL ACCESS PROJECT

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

North

30 10 0 10 20 30 40 50 km

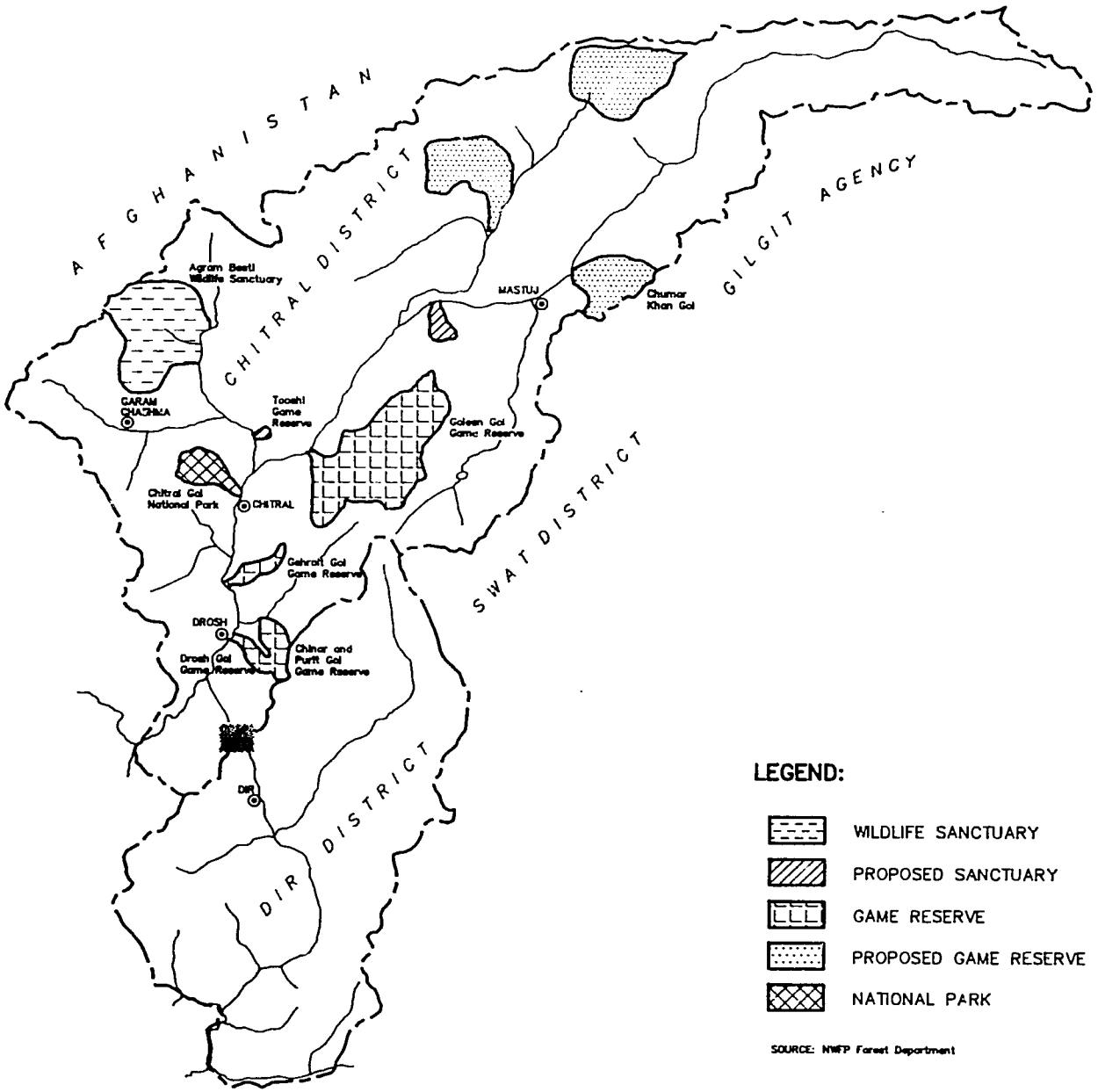
Approximate Scale: 1 : 1 000 000

TAMS CONSULTANTS, Inc.

December 1987

WILDLIFE DIVISION POSTS AND FACILITIES

Figure 6



Environmental, Economic and Social Soundness Assessment

CHITRAL ACCESS PROJECT

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

North

30 10 0 10 20 30 40 50 km

Approximate Scale: 1 : 1 000 000

TAMS CONSULTANTS, Inc.

December 1987

PROTECTED AREAS

Figure 7

Provisions for the protected areas are listed below for each type of area, followed by a capsule description of the specific protected areas in Chitral.

National Park

A national park is an area declared by the government for protection and preservation of scenery, flora and fauna in its natural state. Such areas must be the property of the government and be accessible to the public for recreation, education and research, subject to such restrictions as the government may impose. Access roads, rest houses, hostels and other buildings or facilities, the management of forests and the obtaining of forest produce must be accomplished so as to avoid impairing the intent of establishment of the park.

The following acts are prohibited in a national park:

- Hunting, shooting, trapping, killing or capturing of any wild animal inside or within a three-mile radius of its boundary;
- Firing any gun or doing any other act which may disturb any animal or bird or doing any act which interferes with the breeding places of any animal or bird;
- Felling, tapping, burning or in any way damaging or destroying, taking, collecting or removing any plant or tree;
- Clearing or breaking-up any land for cultivation, mining or for any other purpose; and
- Polluting water flowing in and through the national park.

Wildlife Sanctuary

A wildlife sanctuary is an area set aside by the government as undisturbed breeding ground for the protection of wildlife. This area has to be the property of the government; access thereto by the public is prohibited and no exploitation of forest is allowed except for reducing fire hazards, epidemics or insect attacks or other natural calamities. The following acts are prohibited in a wildlife sanctuary:

- Entering or residing;
- Cultivating any land;
- Damaging or destroying any vegetation;

85

- Hunting, killing or capturing any wild animal or firing any gun or other firearm within one mile of the boundaries;
- Introducing any exotic species of animal or plant;
- Introducing any domestic animal or allowing it to stray within the boundaries;
- Causing any fire;
- Polluting water.

Game Reserve

A game reserve is an area declared by the government where hunting and shooting of wild animals is not allowed except under a special permit. A permit may specify the maximum number of animals or birds that may be killed or captured, and the area and duration for which such permit shall be valid.

Chitral District Protected Areas

Except for the agriculture fields and human settlements in and around them, which are privately owned, the below mentioned national park, wildlife sanctuary and game reserves are the property of the state.

Chitral Gol National Park. This park is situated to the west of the town of Chitral and extends over an area of 7,750 hectares. The prominent wildlife includes markhor, urial, snow leopard, wolf, hill fox, chukar partridge and Himalayan snow cock. Prior to 1971 this area was a hunting preserve of the Mehtar of Chitral. In 1971, it was declared a wildlife sanctuary. Its status was upgraded to National park in 1984. This National Park supports a population of from 340 to more than 400 Kashmir markhor, representing probably the largest concentration of this subspecies in the world. Along with the adjoining Kalash valleys of Rambor, Bomburet and Birir, Chitral Gol has been recommended for official declaration as an area of unique world natural and cultural heritage.

Agram Basti Wildlife Sanctuary. This sanctuary is situated in Arkari valley and extends over an area of 29,366 hectares. Prominent wildlife includes ibex, snow leopard, leopard, wolf, red fox, chukor partridge and Himalayan snow cock. A former hunting preserve of the ruling family, this area was designated a wildlife sanctuary in 1983.

Tooshi Game Reserve. This game reserve is located on the left bank of the Lutkoh River, 10 kilometers north of Chitral Town. It covers an area of 1,545 hectares. Prominent wildlife includes markhor and Chakur partridge. Tooshi Game Reserve and Chitral Gol National Park together represent the

86

main concentration of Kashmir markhor in the world. Snow leopard and lynx also visit the reserve. A former preserve of Prince Burhanuddin, this tract was declared game reserve in 1979. It is a proposed wildlife sanctuary. It is planned to extend its limits to cover the Shasha area near Shahghor.

Goleen Gol Game Reserve. Goleen Gol Game Reserve is located 15 kilometers northeast of the town of Chitral near Koghozi village. The reserve covers an area of 49,750 hectares. Common wildlife includes ibex, markhor, snow leopard, wolf, lynx, Himalayan snow cock and Chukar partridge. The reserve was notified in 1982. It is a transition zone between the ranges of ibex and markhor.

Gehrait Gol Game Reserve. This reserve is situated on the left bank of Chitral River near Gehrait village. It extends over an area of 4,800 hectares. It was established in 1979. Noteworthy wildlife includes markhor, snow leopard, black bear, Himalayan snow cock and Chukar partridge.

Chinar and Purit Gol Game Reserve. This game reserve is situated in Shishi valley and adjoins Drosh Gol Game Reserve. It covers an area of 6,446 hectares and was notified in 1979. Prominent wildlife of the reserve includes markhor, leopard cat, Himalayan snow cock, and Chukar partridge.

Drosh Gol Game Reserve. This reserve is situated near Drosh. It was notified in 1979, and has an area of 2,060 hectares. Prior to 1971 it was a hunting preserve of the former governor of Drosh. Markhor, snow leopard, Himalayan snow cock, monal pheasant and Chukar partridge are found in the reserve.

Proposed Areas. Two additional game reserves are proposed to be established in markhor range of lower Chitral. Also in lower Chitral, a national park is proposed to comprise the three Kalash valleys of Birir, Bomburet and Rambor. One wildlife sanctuary and three game reserves are proposed for the ibex zone in upper Chitral.

3.5 Aquatic Ecology

3.5.1 Habitat Types

Two aquatic habitat types are found in the Chitral-Dir project area: temperate river waters and alpine lakes.

Temperate River

The temperate river waters flowing though Chitral and Dir Districts are habitat for otters, several species of fish and migratory waterfowl. Major seasonal variations in flow volumes are characteristics of these rivers.

Three stream networks in Chitral District are currently identified as being suitable habitat for trout: Lutkho River, upstream from its confluence with Arkari Gol; Rumboor Gol and Bomburet Gol upstream of the Mastuj River; and Shishi River, upstream from its confluence with the Mastij. All these networks are in lower Chitral. A one-year survey of the streams of upper Chitral is planned for 1988 to determine their suitability for stocking with trout. A stream is considered suitable if its waters are clear and it is accessible to fishermen. New hatcheries in addition to those described at 3.5.3 may be established if suitable locations and conditions are found.

Alpine Lake

These deep, cold-water lakes occur in Chitral District above 3,500 meters altitude. Shandoor, Bashkar and Qaramber Lakes are the major alpine lakes of the district.

These lakes, along with the ponds and lagoons around them, serve as the staging and molting grounds for several species of migratory waterfowl, including mallard, poachared pintial, pigeon, green-winged teal, grey-lag goose and several others. The habitat around these lakes is highly disturbed during summers due to livestock grazing and the cutting of shrubs for firewood.

3.5.2 Fish Species

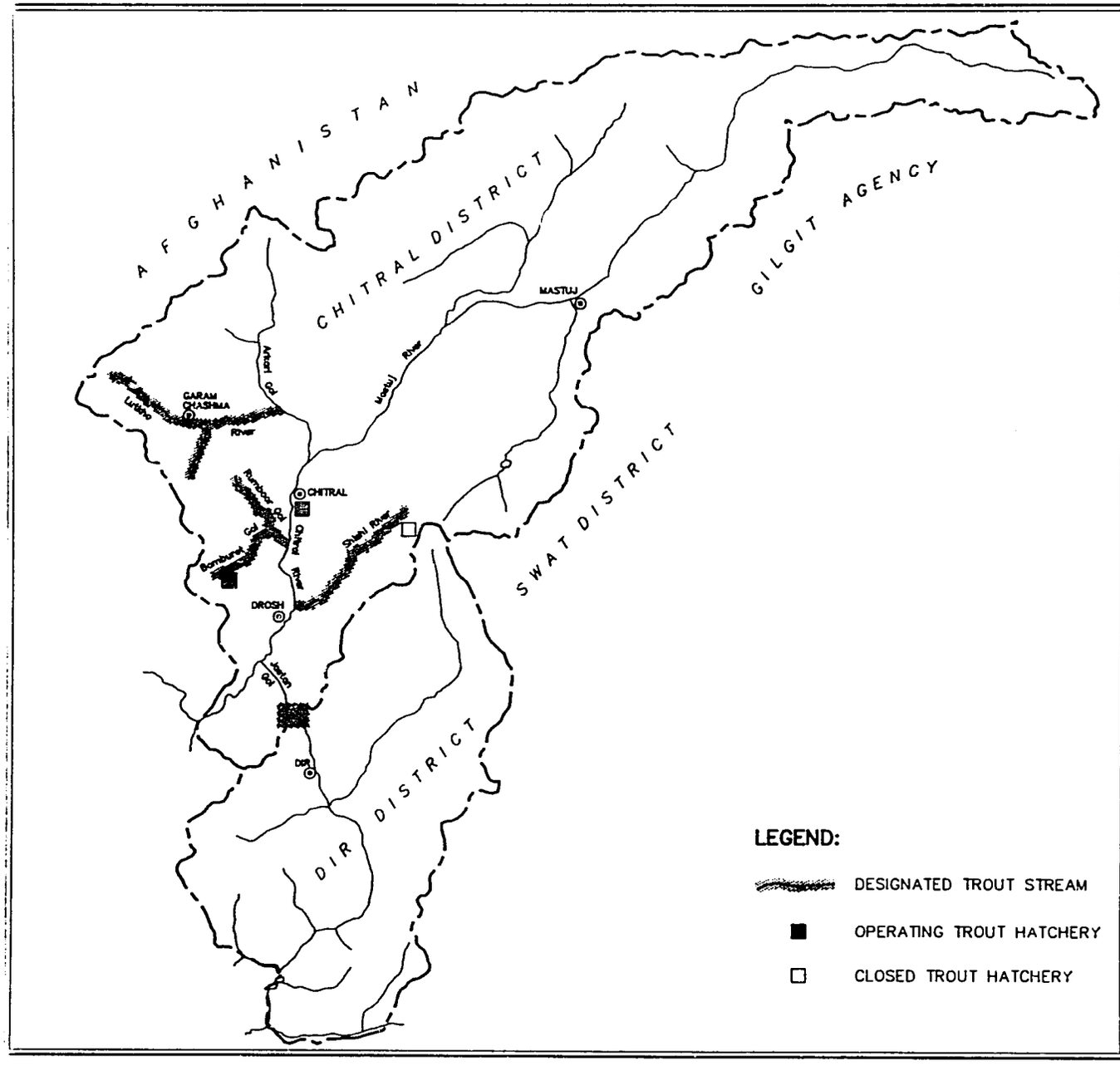
The rivers and lakes of Chitral and Dir support a variety of fish. Indigenous species identified in the two districts include those indicated in Table 3-7. Exotic brown trout (*Salmo fario*) has been introduced in the Lutkoh River, Shishi River, Goleen Gol, Rumboor Gol, Bomburet Gol, Shandoor Lake and Qaramber Lake in Chitral District (see Figure 8). The Chitral District Fisheries Department also plans to introduce exotic rainbow trout (*Salmo gairdneri*). Trout are seldom found in the waters of Dir District, except during the winter.

Table 3-7

INDIGENOUS FISH OF CHITRAL AND DIR DISTRICTS

	Common Name	Scientific Name	Feeding Mode
Fish of Chitral and Dir			
	Swati	Schizothorax spp.	Forage
	Minnow	Oreinus spp.	Forage
	Hill-stream Catfish	Glyptosternum spp.	Carnivore
Fish of Dir			
	Mahaseer Loach (Barbus tor and Tor-putitora)	Nemacheilus spp.	Forage Carnivore

88



Environmental, Economic and Social Soundness Assessment

CHITRAL ACCESS PROJECT

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

North

30 10 0 10 20 30 40 50 km

Approximate Scale: 1 : 1 000 000

TAMS CONSULTANTS, Inc.

December 1987

TROUT FISHERY

Figure 8

The quality of the trout habitats is high. These lakes and streams are not glacier-fed and generally run clear. Glacier-fed aquatic habitats, however, are regularly turbid and are subject to seasonal deterioration. At flood discharge, the glacial streams carry heavy sediment loads, making the waters muddy and unsuitable for many forms of aquatic life. The sudden floods occasionally deposit large volumes of silt and boulders in the rivers, natural fish and duck ponds, burying much of the aquatic life.

3.5.3 Fisheries Development

The Chitral District Fisheries Department, headed by an Assistant Director of Fisheries, administers fisheries programs in the District. The principal activities of the Department are the operation of trout hatcheries, stocking streams and issue of fishing permits.

Spawning of trout is successful in the natural streams of Chitral. However, due to high susceptibility to predation and other natural or man-induced environmental stresses incurred during the long hatching and fry stages, few individuals survive to fingerling size. The trout populations of the District are, therefore, dependent on stocking for recruitment.

Two trout hatcheries are currently in operation in Chitral: Jughoor Hatchery near Chitral town and Bomburet Hatchery in the Kalash Valley, both established during 1961 and 1962. The Bomburet Hatchery occupies about one-half acre at the head of Bomburet Gol. It has two brood tanks, a hatching tank and two rearing tanks. The Jughoor Hatchery is located about three miles south of Chitral town. Both hatcheries rear trout for sport fishing. A third hatchery is planned for an undetermined location along the Lutkho River. The Fisheries Department expects to begin construction in 1988. A hatchery in Shishi had been planned to be fully operational in 1982 and a sub-hatchery at Golain was also planned (Pakistan Agricultural Research Council, 1981). The Shishi hatchery was opened and later shut down. Neither is currently operational.

The installation of hatcheries in Dir District has been recommended (Khan 1980) at locations along the Punjkora River and at Chakdar, Rabat, Khal, Munda and Lalgilla. No action is known to have been taken in response to these suggestions.

Between the Jughor and Bomburet hatcheries, approximately 200,000 eggs are layed annually during the period November and February. Many more eggs are produced than can be accommodated in the larvae and fry stages. Expansion of the facilities in 1988 is planned to overcome this limitation.

Fry appear from 28 to 30 days after hatching, depending on the water temperature. At age six- to twelve-months, from 20 to 25 thousand fingerlings are released

90

from Bomburet Hatchery into Bomburet stream, and an equivalent number from the hatchery at Jughoor into the Lutkho River. After the planned expansion, combined releases from the two hatcheries are expected to increase to between 100- and 150-thousand fingerlings, according to the Assistant Director of Fisheries (Mohammad Afzal, Chitral District Fisheries Department, September 27, 1987).

Each year, approximately 1,000 fingerlings are retained to ultimately become brooders when they reach an age of about two and a half years and a size of greater than nine inches. Approximately 200 brooders are maintained at each of the two hatcheries, for a period of between six and eight years.

The Pakistan Agricultural Research Council (PARC-1981), in the Agricultural Committee Report on Chitral, reported that the total quantity of feed available each month for feeding hatchery fish and the quality of the feed were highly inadequate. The Assistant Director of Fisheries (Mohammad Afzal, Chitral Fisheries Department, September 27, 1987) stated that the quantities and quality of fish feed currently provided are sufficient.

Other problems were raised by the PARC in its 1981 report. The breeding stock used in Chitral is highly inbred since no new blood has been introduced. According to the Assistant Director (Mohammad Afzal, Chitral District Fisheries Department, September 27, 1987), no action has been taken since the release of the PARC report to improve genetically the hatchery trout stock, nor do any plans exist to do so in the future.

The Bomburet hatchery is impacted by siltation and others regularly steal breeders and fries from the uncovered tanks of the Jughoor hatchery. These problems will be rectified in 1988, with the installation of three siltation tanks at Bomburet and the construction of a metal mesh fence around the perimeter of the hatchery at Jughoor. Other improvements planned for 1988 include doubling the size of the hatching room at Jughoor.

3.5.4 Regulation of Fishing

The trout fishing season extends from March 10 to October 10. Trout fishing licenses are issued for Bomburet stream and the Lutkho River. Approximately 1,000 licenses are issued annually, at a cost of Rs. 15 each. A license permits the holder to take five trout, although no estimate of the actual number of fish caught is available. Unlicensed fishing also occurs.

Dr. Abdul Aleem Chadhry, technical consultant to the World Wildlife Fund - Pakistan (September 1, 1987), claimed that explosives and nets are used by fishermen in Chitral. Explosives are not permitted in either the trout fishery or the

-91

indigenous fishery; nets are permitted only in the latter. The Assistant Director of the Chitral District Fisheries Department (Mohammad Afzal, September 7, 1987) denies that any transgressions of these limitations have occurred.

3.6 Socio-economics, Land Use and Infrastructure

3.6.1 Population and Demography

Chitral District is part of the North West Frontier Province (NWFP), the smallest of Pakistan's four provinces. The province accounts for about nine percent of Pakistan's area; its population of about 13 million represents 13 percent of the total for Pakistan (IFAD 1987). Chitral District covers about 14,850 sq. km., about 20 percent of the province's area, and contains approximately 1.9 percent of the province's population.

Chitral District is divided into Chitral and Mastuj subdivisions, and furthur divided into seven sub-tehsils (some sources cite six). They are called "sub" because of their small size compared to tehsils in other parts of Pakistan. Chitral town is the adminstrative seat of the district and Chitral subdivision; Booni town is the adminstrative center for Mastuj subdivision. The population is represented by two forms of elected council, District Council and Union Councils. The 11 union councils represent the most direct form of elected local government. (The sub-tehsil is an administrative division only). The village is the strongest unit of organization for the rural population, but does not have a formal governing role. Villages are represented through one of 121 councillors (one for every four or five villages) in the union council.

The Chitral District population in 1981 was 208,560 and was reported to have increased at an average annual rate of 3.25 percent (NWFP Bureau of Statistics 1987). The population was estimated in mid-1986 at 243,000, reflecting a growth rate of 3.1 percent since 1981, plus some 30,000-40,000 Afghan refugees (ADB 1987, IFAD 1986). A January 1987 estimate (NWFP Bureau of Statistics 1987) places the population at 251,000 with an average density of 17 persons per square kilometer.[1] The population, all classified as rural, is overwhelmingly agrarian and rural, living in some 570 villages. The main town and market centers are Chitral town (population 25,000) Drosh, Mastuj and Booni (population 3,700) located along the Chitral-Mastuj River valley. Denser populations are found in Chitral

---

[1]As the basis for projecting quantities of goods to be transported, the Draft Feasibility Report (PRC 1987) lists a 1985 population for the "Chitral area" of 325,000 and projects growth to 600,000 by the year 2010, along with an increase in the standard of living and industrial development. This apparent discrepancy with lower population figures for Chitral District could not be resolved, since no definition for Chitral area was provided.

92

subdivision (22 persons per sq km) in the southern part of the valley than in Mastuj subdivision (12 persons per sq km) in the north.

Official migration statistics from the 1981 census indicate: 1,478 in-migrants (1971-81) and 1,757 out-migrants. Sex ratios recorded for Chitral indicate 107 males per 100 women, perhaps reflecting a once common tradition of exporting females to other regions (see Appendix G), or possible under-counting of the female population. Male residents frequently migrate outside the district to work as laborers elsewhere from which they send earnings back to families, an important supplement to the local farm economy. Migration appears to be both seasonal and long-term. No estimate of the proportion of each type is available. (Given the small number of out-migrants reported in the statistics, it is possible that seasonal migration is dominant or that longer-term migrants still report residence in Chitral.) Migration to Persian Gulf countries has reportedly increased. According to IFAD studies (IFAD 1986), however, migration is mostly to parts of Pakistan and is seasonal; migrants return to Chitral during peak agricultural periods. Largely as a consequence of high out-migration, Mastuj subdivision has a smaller population growth rate than Chitral subdivision (IFAD 1986). This difference presumably reflects the more remote situation, less well-endowed resource base and harsher conditions in the upper part of the valley.

In 1980, 29,411 housing units, all classified as "rural" were reported (NWFP Bureau of Statistics 1987). The work force (persons 10 years and above) numbered 73,202 persons (2.2 percent of NWFP) in 1985-1986, with 80 percent classified as engaged in agriculture, forestry, hunting and fishing. No registered industries and no industrial employment were reported (NWFP Bureau of Statistics 1987). Family size has been estimated at 8.3 persons (IFAD 1986). The survey of villages and households conducted for the ADB/IFAD project indicated that household size reached 11 and more on medium and large sized farms.

The Kho constitute the dominant ethnic group in the Chitral valley; they represent a distinct language group from neighboring regions. About 15 percent of the population belong to ten smaller groups. By and large the population is Moslem, with the exception of the Kalash a socially and linguistically distinct group (see Appendix G). Except for women of the Kalash group, purdah is generally practiced. (See Appendix G for additional discussion of women in Chitral.)

Until Chitral was formally incorporated as a district of NWFP in 1969, the area was frequently at war with its neighbors, which together with its physicial remoteness substantially isolated and insulated the peoples of the valley from the outside world. Chitral society was traditionally divided into three social classes: the ruling family of the Mehtar; the Arbabzadas or middle class; and the Faquir-miskiin or poor. Today, the distinction is largely between the small

number of large land-holders, mostly descendants of the Mehtar's family, and the majority of small farmer families. Newer groups are the Pukhtun merchants, increasingly involved in the valley's commerce, and provincial officials from Peshawar.

Additional information about Chitral's population is presented in Appendix G.

3.6.2 Land Use and Land Tenure

Land Use

Chitral district has highly rugged topography ranging from 1,060 meters at Arandu to 7,800 meters at Trich Mir, with numerous mountain peaks at elevations of 6,000 meters or more. The mountain ranges have steep to very steep slopes which border narrow valleys and rivers. In general, the higher mountain slopes are devoid of any soil cover and vegetation. At places where the soil cover is present on the steep slopes it is shallow and stony with little vegetative growth. This situation is related not only to the severity of the slopes, but also to unmanaged grazing and woodcutting over centuries.

The total area of the Chitral District is about 14,850 sq. km. Non-agricultural land accounts for approximately 1.45 million hectares (97.8 percent). Net remaining area is, therefore, slightly over 33,000 hectares (2.2 percent) of which 15,000 hectares (1.0 percent) have never been cultivated and about 18,100 hectares (1.2 percent) are cultivated. Nearly all of the cultivated area is irrigated by some 1,000 small, communually-owned systems. Of the non-agricultural land, forest land is presently estimated at 55,000 hectares, less than 4 percent of total district area (ADB 1987). Official statistics of the NWFP (Bureau of Statistics 1987), however, indicate that forest is only 2.8 percent of the land area. About 15 percent of the District is rangeland that is considered potentially plantable for forestry (ADB 1987).

Other data reveal a distribution of land uses that indicates a high proportion of glacial area the perpetually snow covered area given below may be overestimated based on observation of the EA field team.

	Percent
Glacial area (perpetually snow covered)	47
Rock outcrops and areas with less than 10 percent soil material	25
Forest and grazing area	24
Agriculture and other*	4
Total	100%

* Other includes water bodies, cultivable wastes, sand bars, gravel areas within the river regime, homesteads, public utilities and the like.

Source: IFAD (1986).

94

The Reconnaissance Survey of the Soil Survey of Pakistan provides data on land capability in the Chitral valley, shown in Table 3-8.

Table 3-8
CHITRAL VALLEY LAND CAPABILITY CLASSES AND SOILS

Land Capability Class[1]	Soil Series	Approx. Area (ha)	Remarks
ir I	Ayun	2,210	Loams, silt loams, no limitation, 0-2% slope
ir IIs	Shali, Sin, Drosh Luo, Koghozi, Gahariat	3,150	Silt loams to silty clay loams, moderately calcareous well-drained and moderately deep
ir IIIs	Sin, Koghozi, Gahariat Sheri Shishi	10,720	Shallow, excessively drained loams, silty loams and silty clay, underlain by gravels and stones, 0-5% slope
ir IVs	Drosh, Lao, Shali	4,993	Shallow sandy loam, excessively drained stoney gravel
	SUM ir (irrigatable) Area	21,073	
d IIIc d IVs	Bamboorati	11,100	Shallow, gravelly sandy loams, excessively drained; used for dry farming and unmanaged grazing; low potential for irrigation
g VIe	Alt. below 2100 m	47,895	Shallow to moderately deep soil cover mixed with partially weathered parent material; slope 5-50%; low range potential; scanty vegetation due to unmanaged grazing, high erosion in places
g VIIe	Alt. 2100 - 3300 m	47,530	
g VIIIe	Alt. above 3300 m	237,060	
t VI e	Alt. 2100 - 3300 m	80,740	Deep well-drained non-calcareous silty clay loams, stones and boulders in substratum, partially in forest
VIII	Alt. below 3300	143,215	rock outcrop
	Alt. above 3300	300,240	rock outcrop
Total area Classified[2]		888,853	

[1]ir = irrigation; s = soil limitation; e = erosion; d = dry lands farming; g = rangeland; t = timberland
[2]Remaining area not accessible due to high altitude

95

While statistics vary by source, the general conclusion is clear. An overwhelming percentage of the District is mountainous, rocky and/or snow-covered and unsuitable for agriculture. Given the apparent absolute limit on agricultural land, more refined evaluations of forest resource potential, plantable rangeland and exploitable rangeland are recommended to provide the basis for land use planning and policy.

The rural population lives in 570 villages, generally located on alluvial fans and river terraces where irrigation is available. Villages communally own pastures, forests, roads and the irrigation channels and communally organize labor to maintain these facilities.

Land Tenure

Land tenure is not "settled," in that owners do not have legally recognized titles. Tenure has evolved over the past 30 years from a complicated mixture of early feudal arrangements to the more recent pattern of owner-cultivation. Land is relatively evenly distributed, and the majority of the population has a small amount of land. A 1986 survey showed that 94 percent of households worked land and that 97 percent own the land they work (ADB 1987; Institute of Development Studies, NWFP Agricultural University, Agro-Socioeconomic Study of Chitral District 1986). Survey results confirmed the 1980 Agricultural Census which reported that: 99 percent of farmers fully or partially own their land and 96 percent of the farm units are smaller than 5 hectares. Table 3-9 presents the data on tenure from the 1980 Census.

3-9
FARM UNITS BY TENURE AND SIZE
CHITRAL DISTRICT
(PERCENT)

Farm Size (hectares)	Owner		Owner/Tenant		Tenant		Total	
	No.	Area	No.	Area	No.	Area	No.	Area
Under 2	72	35	12	8	1	1	85	44
2-5	9	18	2	5	-	-	11	23
5-10	2	8	*	1	-	-	2	9
10-20	1	10	-	2	-	-	1	12
Over 20	-	9	-	3	-	-	1	12
Total	84	80	15	19	1	1	100	100

* Less than 0.5 percent
Source: Pakistan Census of Agriculture 1980, as derived from ADB (1987).

Compared to statistics for the NWFP where 87 percent of farmers own their land and 82 percent of the farm units are smaller than 5 hectares, the incidence of the landless farmer is lower, but so is farm size. Farmers work an estimated 67 percent of farm land in Chitral compared to 41 percent in the

-96'

NWFP as a whole. The average farm area per household is estimated at 1.3 hectares and the average cultivated area at 0.7 hectares. The small scale of the farms and the dependence on subsistence agriculture account for the region's poverty and inability to maintain a self-sufficient economy. It should be noted that Afghan refugees are not farmers and do not own farms.

Projected Land Use Change

The prospects for overall land use change are not great. Additional area suitable for cultivation is estimated at 3,000-5,000 hectares, assuming irrigation is provided (IFAD 1986). The IFAD/ADB Chitral Development Project will provide irrigation development of 3,400 non-irrigated hectares 2,400 hectares of new land) and additional irrigation water for another 2,000 hectares, resulting in an overall area of 5,400 hectares to be improved. Some increased urbanization is likely but would affect very small land areas. Forest resources (see 3.4.5 and 3.8) are in danger of further depletion, but the total area is still small compared to the District's land area as a whole. Rangeland management to help protect forest and utilize grazing areas more productively offers the most significant potential for changes in land use, but no major programs directed to this issue are pro osed.

3.6.3 Employment and Economic A tivity

The population of some ;,000 rural households is principally engaged in agriculture; nly 6 percent do not work any land. The Peshawar Agricultu al University survey, as noted above, found that 97 percent f the farmers owned their own land. Nonetheless, only 38 perc nt of the population were engaged in full-time farming; some) percent were employed as casual labor which included part-tin farm work, while 33 percent were either salaried or self-em loyed. The survey did not include women who are responsible f r much of the farm work. Typically, one or two men in each fa ily leave the farm to seek wage labor, much of it outside of th valley, while much of the burden of running the farm falls upo women.

Per capita income within the valley is low at only $102 per annum (ADB 1987), comprise of $52 of retained farm production which is consumed and a cash income of $50. This income is well below the absolute poverty level of $188 set by the World Bank.

Off-farm wage earning opportunities are mainly in the construction industry, especially road maintenance, driving and the service industries of Chitral town. There is little manufacturing employment within the valley other than a small weaving operation outside of Chitral town. Government employment, the police and the Chitral Scouts also provide salaried jobs. The unemployment rate is fairly low at about 8 percent, but it is the willingness of Chitrali men to move outside of the valley in order to find work that keeps it this low.

Additional information about the economy is presented in Appendix F.

3.6.4 Infrastructure

The population of the Chitral Valley lives in conditions of little comfort and enjoys few of the benefits usually associated with an established infrastructure. Public services such as electricity, potable water, telecommunications and sewage disposal are not available to the majority of the population.

Water Supply and Sewage

Water is typically routed to houses and villages in conduits and aqueducts to be used for drinking, cooking and wash water; rinse water and sewage are typically returned to the same conduit. Downstream users receive polluted water, a factor contributing to ill-health and infant mortality. Neither toilets nor septic systems are commonplace.

Chitral town is only partially served by piped drinking water (see 3.3, Water Resources). In recent years, the NWFP Department of Irrigation and Health has assisted in the construction of some 30 water-supply schemes which now serve 28 percent of the area's population (compared to 47 percent for NWFP as a whole). Safe drinking water supplies are considered available in only about 26 of 570 villages (ADB 1987).

Improvement of the Chitral town water supply and other villages is planned as part of the IFAD/ADB development project. The water distribution system of Chitral town will be connected to good quality water meeting WHO standards from Angarghun Springs (22km north of Chitral). Development plans call for construction of distribution systems to 15 villages (14,000 persons) along the new line and to six villages south of the town. In addition, individual supply systems will be provided for some 50 villages (ADB 1987).

Housing

Dwellings in the countryside are typically built by laying sharp-angled rocks on top of one another to form walls of 50cm to 60cm thickness. Timber is used as horizontal reinforcement at about 1m intervals on both the inside and the outside of the wall. These reinforcing members are hewn at the site where trees are felled, usually high up in the flank of a valley, and they are square in cross-section for the most part. Dimensions vary from 10cm to 30cm square. At the height of about 2.5m round tree trunks are laid across the walls 25cm to 40cm apart to support a roof constructed of boughs laid across the tree trunks (or boards if available) and several layers of tamped earth and straw. These layers are retained along the

98

edges of the roof by stones. Dwellings have one room, one door, no windows, a dirt floor and unfinished walls. In some cases, inside walls are plastered with mud. A roof opening acts as a chimney or vent for fire inside the dwelling. In some houses, kerosene or LP gas is used for heating and cooking.

Transportation

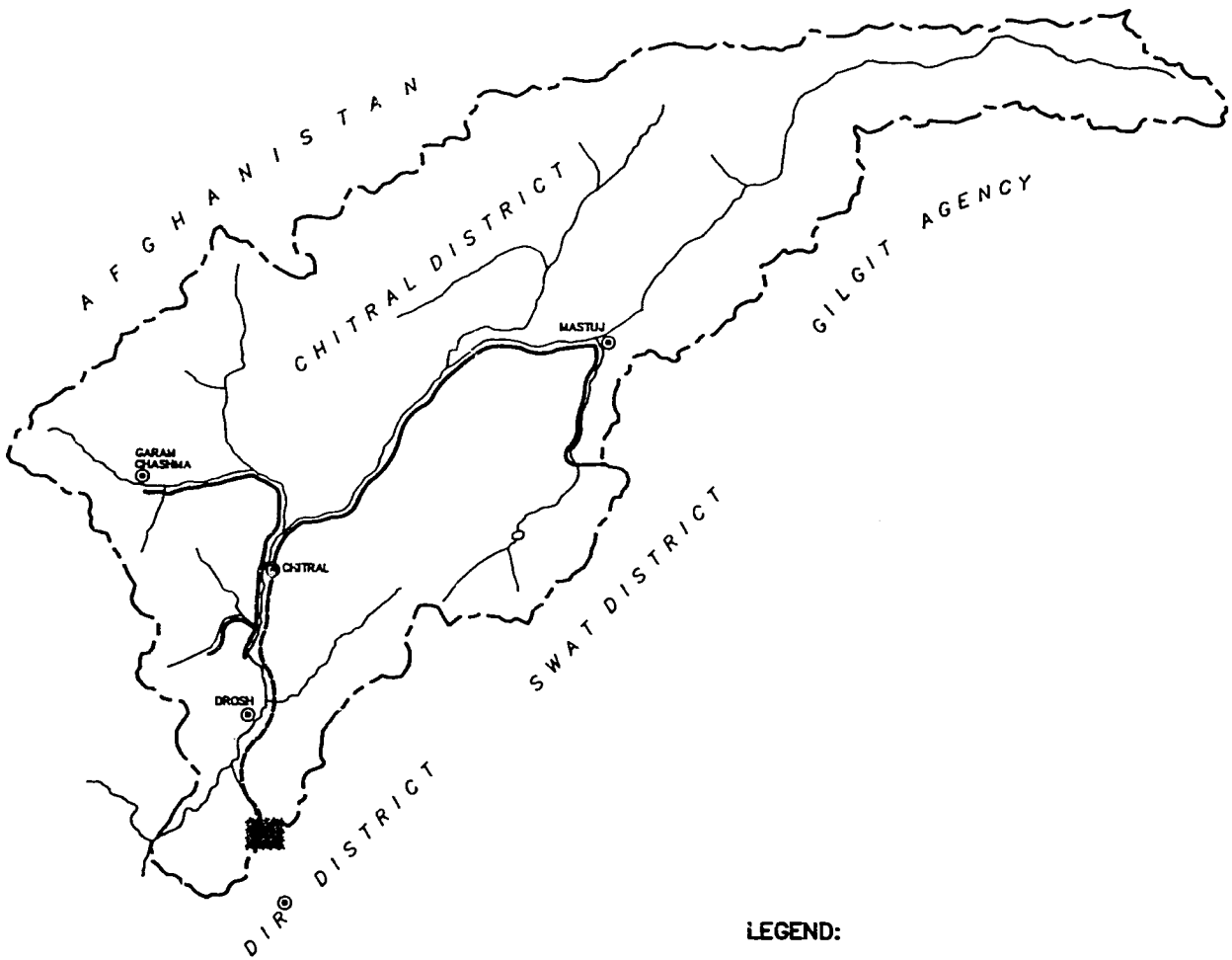
The road network within Chitral District consists of 1,005km of roads of which almost all are reported to be shingle-surfaced or earth-surfaced road (ADB 1987). The 65km metalled (hard-surfaced) road, leading south from Chitral town toward Lowari Pass, has recently been surfaced a short distance to the north. Data compiled by the NWFP Bureau of Statistics (1987) show a total of 1,228 km of road of which 9km were black-topped and the remainder were shingled. Estimates of the road network made by the EA field team indicated only about 250 km of jeepable trails and road. Despite the variation in data, the conclusion to be drawn is the same. The road network is poor. Most roads, winding along steep slopes, are narrow and in a poor state of repair; only a few roads through major valleys are jeepable during fair weather (see Figure 9). In winter, vehicular access across the Lowari Pass is cut off (see Chapter 1) and the interior road network is difficult to traverse.

Larger villages are connected by jeep-trail or, south of Chitral toward Arandu and the Lowari Pass, by roads capable of carrying six to eight-ton trucks. Most of the Chitral Valley, however, can only be reached by jeep or animals. Access to most dwellings in the countryside is by footpath. Beasts of burden can use these paths to carry loads to and from the villages. Studies performed for the IFAD/ADB Chitral Area Development Project indicate that 60 percent of transportable loads are performed by headload, 10 percent by animals, 15 percent by jeeps and the remainder by other means. The distance from a village to a market center or to a rural road averages 10-15km (IFAD 1986).

The Department of Communications and Works, responsible for planning, design, construction, operation and maintenance of roads in NWFP, maintains an office in Chitral. This department is re-aligning a section of the Chitral-Booni road and is constructing 63km of new roads. Construction of secondary roads (narrow and low cost) and their, maintenance is performed through district and union councils, using funding from the NWFP Department of Local Government and Rural Development (ADB 1987 and IFAD 1986).

The IFAD/ADB development project includes plans to upgrade the earth and shingle-surfaced Chitral-Booni road. This road, the principal connection between lower and central/upper Chitral serves about 53 percent of the District's population.

99



LEGEND:

JEEPABLE TRACK (Seasonal)

ROAD SUITABLE FOR 8-TON TRUCKS

Environmental, Economic and Social Soundness Assessment

CHITRAL ACCESS PROJECT

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

North

30 10 0 10 20 30 40 50 km

Approximate Scale: 1 : 1 000 000

TAMS CONSULTANTS, Inc.

December 1987

ROADWAY NETWORK

Figure 9

The project will also finance construction of about 60 unpaved link roads (250km in all), to be cut in mountain slopes, but designed to be passable by four-wheel drive vehicles.

Education

The Chitral District provides 186 primary schools, 25 middle schools, 26 high schools, 1 degree college and 1 commercial college (NWFP Bureau of Statistics 1987). The NWFP Bureau of Statistics shows a total enrollment of 21,790: 16,300 in primary school; 3,900 in middle school; 900 in high school; 300 in college and 90 in commercial college. The number of teachers is 1,156. Student/teacher ratios are generally lower than that of schools in most other districts in NWFP. (It should be noted, however, that published enrollments by type of school are quite inconsistent when data used in the tabulation of student/teacher ratios are compared with other enrollment data in the same source.)

The participation rates (1985-1986) for school-age groups indicate that in the young age group (5-9 years), 45 percent of an eligible population of 36,000 participate. For the middle group (10-12 years), the estimated population is 19,000 of which 21 percent are enrolled. For the secondary group (13-14 years), the estimated population is 8,000 of which 11 percent are enrolled (NWFP Bureau of Statistics 1987).

Statistics provided by ADB (1987) regarding school enrollment portray a quite different picture: total enrollment is stated to be 9,050 or about 8 percent of the school-aged population. Information collected to support a social soundness assessment (Appendix G) indicates that teachers, especially in girls' schools, are reluctant to spend long periods in the District and thus, posts are not always served.

The literacy rate for persons 10 years and above is 14.4 percent, but is higher for males (24.12 percent) than for females (2.93 percent). These rates are somewhat higher than those for Dir. Most of the rural populataion (all of Chitral is so classified) in NWFP has similar literacy rates, but urban populations have much higher rates, especially for females.

Health Facilities

Chitral District has four hospitals (a health institution with 10 or more beds, unless defined as a Rural Health Centre). Dispensaries (fewer than 10 beds) number 27. There are three Rural Health Centres (designed to serve a population of 10,000 to 50,000, with up to 25 beds, a laboratory, x-ray and minor surgery). Fifteen Basic Health Units (designed to serve 5,000 to 10,000 people for comprehensive health care) are linked to the Rural Health Centres. In addition, the District has one TB clinic, 12 Maternity and Child Health Centres, and three Leprosy Clinics for a total of 65 health institutions. The average population per institution is 3,800, compared to 9,100 for Dir and 10,600 in NWFP as a whole. The number of

hospital and dispensary beds is 166, equivalent to a population per bed of 1,467, considerably lower than Dir or NWFP (NWFP Bureau of Statistics 1987).

Medical/para-medical staff working in Chitral government health institutions in 1985 included 22 doctors, 5 dental surgeons, 58 compounders, 10 midwives, and 178 para-medical staff (NWFP Bureau of Statistics 1987).

The favorable ratios of total population to health facilities or hospital beds, however, supply no information about actual use of such facilities by Chitral District's population. If statistics of annual or average daily use of health facilities could be compared, one might be able to judge the relative impact of the District's poor road network. Similarly if data were available on need for emergency transport or specialized need to go outside the District for health care, one might have a better way to judge the constraint imposed by lack of vehicular access over Lowari Pass.

According to the social soundness investigation (Appendix G) health worker positions, especially female, are not always served, since persons formally posted to them are reluctant to stay for long periods in such an isolated area.

Electrification

Chitral District is not connected to the national power grid. Electricity is supplied instead by hydropower. Total capacity is 1.5MW, of which 1,000kw is generated upstream of Chitral town to supply the town and its vicinity. There is a small station (100kw) for Garam Chashma and adjacent villages and a station at Shishi Gol (300kw) supplying power to Drosh. Increased capacities are planned for both. New, small-hydro plants are proposed for Ayun and Booni. Mini-hydro plants (19) with 12.5 to 20kw each have been established at various locations, but most are reported not to be operational due to lack of spare parts and maintenance problems (IFAD 1986). Additional development of hydropower is planned with assistance from the Federal Republic of Germany through preparation of a master plan for construction of small-hydro plants in NWFP. This project includes identification of feasible sites and construction of a model station (slated for Chitral).

The responsibility for developing and maintaining small-hydro stations has recently been transferred from the Irrigation Department to the Small Hydels Development Organization under the Provincial Secretary, Irrigation and Public Health Organization.

Currently Chitral District has 2,544 electrical connections of which 2,512 are domestic/commercial, 28 are industrial, and one is for a tubewell. Only 18 of 571 villages are electrified at present. The District of Dir has 22,352 connections for a population six times as large (NWFP Bureau of Statistics 1987).

102

Linking Chitral Valley to the national power grid is not considered economically feasibile (ADB 1987; IFAD 1986). Nevertheless, a 66kv permanent power supply is reportedly planned to be available by government authorities to serve the Chitral Valley in connection with the proposed Lowari Tunnel. The incoming line would be run from a power grid station at Chokiatan, 8 km south of Dir, scheduled for completion by the end of 1989. This power supply would be taken over the Lowari Pass to supply Chitral Valley requirements (PRC Draft Feasibility Report 1987). The differences in assumptions of PRC and IFAD/ADB regarding power supply are critical, both with regard to tunnel construction and Chitral Valley development.

Communication

There are 444 telephone connections in Chitral compared to 991 in Dir, equivalent to a population per phone of 557 and 980 respectively. Chitral District has 73 post offices compared to 83 in Dir (NWFP Bureau of Statistics 1987).

Development Programs

District Annual Program. The annual development program in Chitral District (1986-1987) totals Rs 66.5 million, distributed among agriculture (12 percent), rural development (8 percent), water and power (7 percent), transport and communications (23 percent), physical planning and housing (17 percent), education and training (25 percent) and health (8 percent). This figure compares well with Dir District at Rs 91 million: development monies in Chitral District average Rs 265 per person compared to Dir at Rs 92 per person (NWFP Bureau of Statistics 1987).

Externally financed projects include the Aqa Khan Rural Support Program (see 3.7.3 for more detail), the ADB/IFAD Chitral Development Project (see 3.7.4) and the previously described hydropower project. The UN High Commission for Refugees is assisting re-afforestation in southern Chitral and ADB in cooperation with other donors is considering the financing of a master plan for Pakistan's forestry sector, including Chitral.

3.7 Agriculture and Livestock

3.7.1 Agriculture

Area and Production

The agricultural soils of Chitral are mainly found on elevated terraces and floodplains along rivers. These soils are generally well-drained and moderately deep with low to moderate content of gravels.

The cultivated area in Chitral District is estimated for 1984-1985 at 18,100 hectares of which 16,500 were irri-

gated. (Statistics for 1985/1986 and 1986-1987 are virtually the same.) Current fallow was 7.2 percent of the cultivated area (NWFP Bureau of Statistics 1987). Cropped area is about 25,200 hectares, since some areas are sown twice. Cropping intensity is 140 percent, 75 percent intensity in winter and about 65 percent in summer. Cereal crops are dominant (92 percent of cropped area) of which wheat is the most important. Kharif or summer crops are sown in April or May (March in higher altitudes) and the season lasts until October. Rabi or winter crops are planted from September through November and harvested in June, July or August, depending on altitude.

The cropping pattern, production and yields (1985-86) are shown below in Table 3-10. Average crop yields in NWFP as a whole are shown for comparison.

The average yields of almost all crops except fruit are lower in the Chitral Valley than yields in NWFP as a whole. Although higher yields are considered possible, technology suitable varieties and extension work are lacking, along with insufficient area-specific research.

Table 3-10
CROPS PRODUCTION AND YIELDS (1985-86)
Kharif (spring/summer)

Crop	Chitral Area (ha)	Chitral Production (mt)	Chitral Avg. Yield (Kgs/ha)	NWFP Avg. Yield (Kgs/ha)
Maize	6,995	11,684	1,670	1,690
Rice	2,835	4,549	1,604	1,624
Pulses	242	135	558	729
Vegetables	206	1,440	6,990	9,767
Chillies	5	4	800	1,091
Fodder	240	1,995	8,312	14,668
Apricot	35	350	10,000	9,099
Apples	120	1,612	13,433	11,338
Pears	12	192	16,000	12,313
Peaches	5	14	2,800	6,927
Pomegranite	10	140	14,000	8,275
Walnut	105	1,356	12,914	10,611
Almond	4	10	2,500	2,938
Persimmon	1	2	2,000	15,746
Grapes	10	38	3,800	3,560
Potato	320	2,560	8,000	11,463
Rabi (fall/winter)				
Wheat (irrig.)	7,640	9,460	1,238	1,758
Wheat (non-ir.)	300	194	647	777
Barley	5,365	6,706	1,250	1,211
Vegetables	37	291	7,865	13,216
Fodder	970	11,070	11,412	26,070

Source: Department of Agriculture Chitral.

104

Irrigation

Irrigation systems developed over centuries have a long history of operation and effective maintenance. Channels have been constructed along near-vertical side slopes, varying in length from two to eight kilometers. Each system irrigates between 10 and 70 hectares. Channels are maintained by the beneficiary population. The Irrigation Department of the NWFP has provided some assistance in maintenance and reconstruction of damaged channels and construction of new channels. Construction of these works in higher areas of difficult terrain has met with difficulty; only 400 hectares out of a potential 1,530 have been irrigated under this program.

Agricultural Inputs

Animal manure is in common use for fertilizer, although chemical fertilizer use has increased over the years. The Chitral Agriculture Development Authority (ADA) reported 1,928 metric tons sold in Chitral in 1986-87 of which 36 percent was urea, 61 percent DAP, one percent nitrophosphorous and 2 percent TSP. Fertilizer is sold at uniform, fixed prices. Although fertilizer prices are being deregulated in Pakistan as a whole, no private companies operate in the District, probably because of the small size of the market and logistical problems. ADA is responsible for nearly all fertilizer sold in Chitral (ADB 1987). Reported prices (obtained by ACE) were:

DAP	= Rs 146/bag (50 kg)
Urea	= Rs 128/bag
NitroPhosphorous	= Rs 75/bag
TSP	= Rs 95/bag

The ADA in Chitral District subsidizes the cost of transporting fertilizer as follows:

Dir-Drosh	= Rs 12/bag (50 kg)
Dir-Chitral	= Rs 19/bag
Chitral-Booni	= Rs 25/bag
Chitral-Mastuj	= Rs 38/bag
Chitral-Garam Chashma	= Rs 28/bag

Fertilizer is mainly applied to wheat, maize, rice and some vegetables and fruit trees. An average application rate of 108.5 kg per hectare (derived through dividing fertilizer sales of 1,928 metric tons by 17,7000 ha in wheat, maize and rice) is low, but considered by IFAD to be relatively high for an underdeveloped region. Fertilizer storage facilities in Chitral are, however, in poor condition, resulting in product deterioration. Because of transport cost subsidy, there is doubt that all fertilizer products reach Chitral, perhaps, being diverted to areas closer to the point of origin (IFAD, Annex VI 1986).

105

The use of improved seed in the Chitral Valley is limited, because farmers prefer seed from their own crops. The quantity of improved wheat seed provided by ADA has increased somewhat over the years, but dropped in 1986. (The seed price became higher than wheat supplied by the Food Department.) High yield varieties are in less favor, because they have short stalks and do not provide the same amount of straw for animal feed as local varieties.

The use of pesticides and fungicides has decreased over the past 10 years. Procurement and distribution of chemicals has been deregulated and only a limited range is currently stocked by the private sector. The government has supplied leftover stocks, but these have dwindled. In 1986-87 ADA began to supply Chitral, but only small quantities were available (ADB 1987).

Crops treated for various pests in 1979-80 are shown in Table 3-11, as a representative example of the kinds of diseases for which agro-chemicals are used.

Most of the pesticides used were organophosphates or carbamates; very few chlorinated hydrocarbons were used. There are no comparable statistics available for the most recent years. Local agricultural authorities say that protection measures for field crops are not in wide use, although they are increasingly used on orchard crops. In any event, no serious outbreak of disease in the major crops has occurred. Authorities attribute this situation to the cool temperate climate and short season. IFAD (1986) reports, however, that insects and diseases cause substantial crop loss.

Table 3-11
TREATMENT FOR PESTS AND DISEASES (1979-80)

	Pests and Diseases
Orchards	Codling, moth, aphids, mites, borers, scales, shot hole borers, etc.
Maize	Stem borers, cut worms, jassids, aphids
Potato	Cutworms, aphids, blight
Vegetables	Cutworms, aphids, butterflies, jassids
Pulses	Worms
Rice	Hoppers and blast
Wheat	Army worms, aphids, powdery mildew, weeds
Wheat seed	Loose smut and bunt
Maize seed	Smuts
Paddy seed	Soil borne diseases
Rodent control	Rats
Store fumigation	Weevil

Source: Agriculture Experts Committee Report on Chitral, (1981).

Mechanization

Land preparation is mainly carried out with bullock power, about 99 percent of farmers using animal power only. All crops are harvested by hand using traditional methods, although threshing is increasingly mechanized and the straw residue is sought after as livestock feed.

Tractors were estimated to number 45 and threshers 40 (ADB 1987). Official statistics (NWFP Bureau of Statistics 1987) indicate 53 tractors of which 16 were government tractors. Other statistics for 1986-87 indicate a total of 85 tractors, 77 wheat threshers, 10 bulldozers and 3 rice husking machines. Some mechanization in Chitral District may have been stimulated by shortage of labor caused by an exodus of males to work in the Middle East. Small farm size and the presence of boulders, however, make mechanization difficult.

Marketing

Sales of farm products are negligible with an auto-consumption estimated at over 90 percent of farm production. Salaries and wages account for 82 percent of farm cash income (IFAD 1986). The output of small farms is such that non-agricultural employment is an important means of sustaining the household. Fruit and nuts could be a cash crop but little is sold due to transport and marketing problems.

Agricultural Institutions

Agricultural support services are provided by a variety of institutions. The Peshawar Agricultural University is responsible for research, but the specific needs of Chitral are not well-served, due to agro-climatological differences between Chitral and the location of the University's research institute servicing Chitral. Agricultural extension is the purview of the Agricultural Extension Directorate of the Department of Agriculture, Forestry, Animal Husbandry and Cooperatives (DOA), but activities are hampered by remote village locations, the valley's road network and the size of Chitral, given current operating and staffing levels. Horticultural extension is the responsibility of the Fruit and Vegetable Development Board, an autonomous organization within DOA, but operations are limited to two fruit tree nurseries. Provision of fertilizer seed and chemicals and operation of warehouses is largely carried out by the Agricultural Development Authority because deregulation and privatization of these activities have not been effective in Chitral District. Many components of the IFAD/ADB project (3.7.4) address institutional issues.

Agricultural credit is provided by the Agricultural Development Bank of Pakistan, the NWFP Cooperative Bank, the Habib Bank and the Moslem Commercial Bank. Loans (364) in 1985-1986 totalled Rs 10 million (ADB 1987). Availability of credit is good and the recovery rate is considered excellent.

Food Support

The food grain deficit, estimated at 30 percent of annual need (approximately 41,000 metric tons), is made-up by imports. Other estimates of grain deficit are slightly higher at 15,000 tons; only 26,000 metric tons are available for consumption after post-harvest losses to an estimated annual cereal production of 33,000 metric tons. Shortages are especially severe in winter. Cultivation of fodder for livestock is also inadequate to maintain good stock.

Commodities supplied to Chitral under the Food Security Agency of the Ministry of Agriculture include wheat, sugar and vegetable oil. All are sold at fixed prices in special retail outlets. The cost of transporting these commodities is born by the GOP. Table 3-12 shows amounts and prices for 1986.

Table 3-12
FOOD SECURITY COMMODITIES

Item	Quantity 1986/87 (metric tons)	Retail Price (Rs/kgl)
Wheat	7,500	1.8
Sugar	1,600	9.0
Vegetable ghee	1,200	13.77

1 IFAD, Annex VI (1986). ADB (1987) cites 9,000 mt of wheat in 1985/86, 1,400 mt of sugar and 1,200 mt of edible oil.

The cost of transporting the commodities are: Peshawar to Chitral, Rs 450/mt; Chitral to Mastuj, Rs 690/mt; and Chitral to Garam Chashma, Rs 270/mt. Transport cost of wheat to Mastuj is nearly equal to the retail value of the wheat itself (IFAD 1986). The subsidy to meet the transportation cost to Chitral in 1987 was Rs 12 million. (Total transport subsidy, including petroleum was about Rs 20 million as noted in Appendix F.)

3.7.2 Livestock

Livestock contribute an estimated 30 to 40 percent of farm income. Livestock population has increased in the past decade as shown in Table 3-13.

From 1976-1986, annual rates of growth were 2.96 percent for cattle, 3.16 percent for sheep and 2.57 percent for goats. Livestock ownership is widespread; on average, a small farm household has 4 or 5 cattle, 6 sheep, 8 goats and some chickens. In addition to livestock ownership by village households, transhumant herdsmen (Gujars) around Ayun, Bamburet and Brer have herds with an average size of 100-150 and some large landowners have large herd sizes, which are maintained by gujars.

108

Table 3-13

CHITRAL LIVESTOCK POPULATION

Type	1976[1]	1986[1]	1986-87[2]
Cattle	71,580	95,811	102,600
Buffalo	-	8	*
Sheep	97,310	132,935	140,000
Goats	169,384	218,385	230,000
Poultry	169,360	198,900	200,000
Asses	1,869	10,230	*
Horses	600	719	*
Mules	-	91	*

1 Chitral Area Development Project (IFAD 1986 and ADB, 1987)
2 Communication with Livestock Division
* Not estimated

Horses, asses and mules are mainly used for transportation. Cattle provide draft power for cultivation as well as milk and beef. Goats and sheep provide milk, meat, wool and hair for clothes, carpet and rope. Livestock products are mostly consumed by the household and very few are marketed.

Animals are small with low productive capacity, because of climatic and nutritional conditions. Improving the herd by artificial insemination has just begun. Major problems are insufficient food supply from lack of nutritious fodder during the winter, overgrazed summer pasture (see 3.4.5) and animal disease.

Estimated livestock production and values are provided in Table 3-14.

Table 3-14
LIVESTOCK PRODUCTION AND VALUE

Product	Units	Quantity	Value (Rs 000)
Meat	tons	1,050	17,850
Milk	tons	21,050	96,750
Ghee	tons	600	48,000
Wool & Hair	tons	--	7,500
Hides & Skins	number	62,500	1,250
Eggs	number	2,250,000	2,250
Poultry	tons	150	5,250
By-Products			
Animal Refuse	tons		2,911
		TOTAL	181,761

Source: Draft Chitral Area Development Project (IFAD 1986).

109

Animal husbandry is the responsibility of the Directorate of Animal Husbandry and the Directorate of Veterinary research. In Chitral, there are an Assistant Director of Animal Husbandry and two veterinary hospitals (Chitral and Drosh) plus 10-13 veterinary dispensary centers (number varies with source of data). The department does not function as an extension service due to lack of funds for travel.

3.7.3 Agha Khan Rural Support Program (AKRSP)

Since 1983 the pace of area development has been assisted by the AKRSP, a private organization with funds from the Aga Khan Foundation and bilateral donors (Canada, U.K. and Netherlands). The project aims to organize and fund villages to make a collective effort to improve their well-being through active participation at the village level. Components of this program in Chitral follow.

- Establishment of 168 village organizations (VO's) by the end of 1986.
- Provision of grants to VO's for Productive Principal Infrastructure (PPI) such as irrigation channels, link roads, bridges or the like.
- Land development plans.
- Short-term production loans to VO's.
- Training of VO's in various aspects of agriculture and livestock care and breeding.

The program has been well-accepted by the population and has been found to be very practical. To date, 156 structures have been built under the program: 95 irrigation channels, 31 link roads, 24 flood protection bunds, 3 bridges, 1 water storage reservoir, 1 hydropower station and 1 irrigation syphon. The total cost was more than Rs 28 million through 31 August 87 (ACE 1987). Future components include additional VO's, infrastructure grants, land development schemes and development loans.

3.7.4 IFAD/ADB Chitral Area Development Project

The Chitral Area Development Project is to extend over a period of seven years and is estimated to cost $U.S. 39.1 million financed by: a loan of $11.1 million from IFAD; co-financing of $23.5 million from ADB; and a contribution of $4.5 million from GOP (ADB 1987). A beneficiaries contribution of $6.7 million brings total cost to $45.8 million. The GOP main executing agency is the NWFP Planning and Development Department.

110

The project is designed to increase food production, increase annual income, and improve the economic, social and nutritional well-being of the project's target group of 22,000 households who own less than 2 hectares of land (or are landless) through communal development activities, strengthened agricultural support services and infrastructure (IFAD 1987). The project entails a variety of specific components: small-scale, scattered works; grass-roots participation; and use of an established institutional and social framework, as noted below.

1. Village Level Physical Infrastructure: 80 new irrigation plus rehabilitation of 80 existing schemes benefiting 5,400 hectares; 60 (250 km) village access roads and 20 woodlot nurseries.

2. Strengthening of Institutions: Village organizations and women's organizations (coordinated with AKRSP); training of village organizers and staff.

3. Strengthening of Agriculture Support Services: research substation; agriculture extension activities; seed multiplication farm, fruit tree nurseries, input supply (fertilizer, chemicals and storage facilities); forest nursery; and livestock development, including animal health, improved genetic potential and increased productivity with no increase in numbers or worsening pressure on grazing resources.

4. Upgrading of Chitral-Booni Road to provide all weather truckable access.

5. Improved water supply to Chitral town and additional individual village water supplies.

3.8 Forestry

3.8.1 Forest Area and Type

Estimated area of forest in Chitral District is 55,000 hectares (ADB 1987). Forest area of about 41,000 hectares in lower Chitral is shown in Figure 10.

Most of the Chitral Valley was probably forested at one time, with the possible exception of the areas north of Mastuj. For example, "Tribes of Hindoo Koosh" (John Biddulph 1880) states:

> "The valley widens, its whole character changes and, at four miles below the junction, Chitral is reached. The hills, no longer rocky and bare, slope back gradually with rounded tops with sides thickly clad with pine forest, and the distant peaks on either hand are hidden by the lower intervening hills. The

climate too is changed and, instead of the arid, rainless character of the valleys hitherto described (Mulklo Toorikho and Tirich in the north), it becomes like that of Kashmir, with heavy and frequent rainfalls."

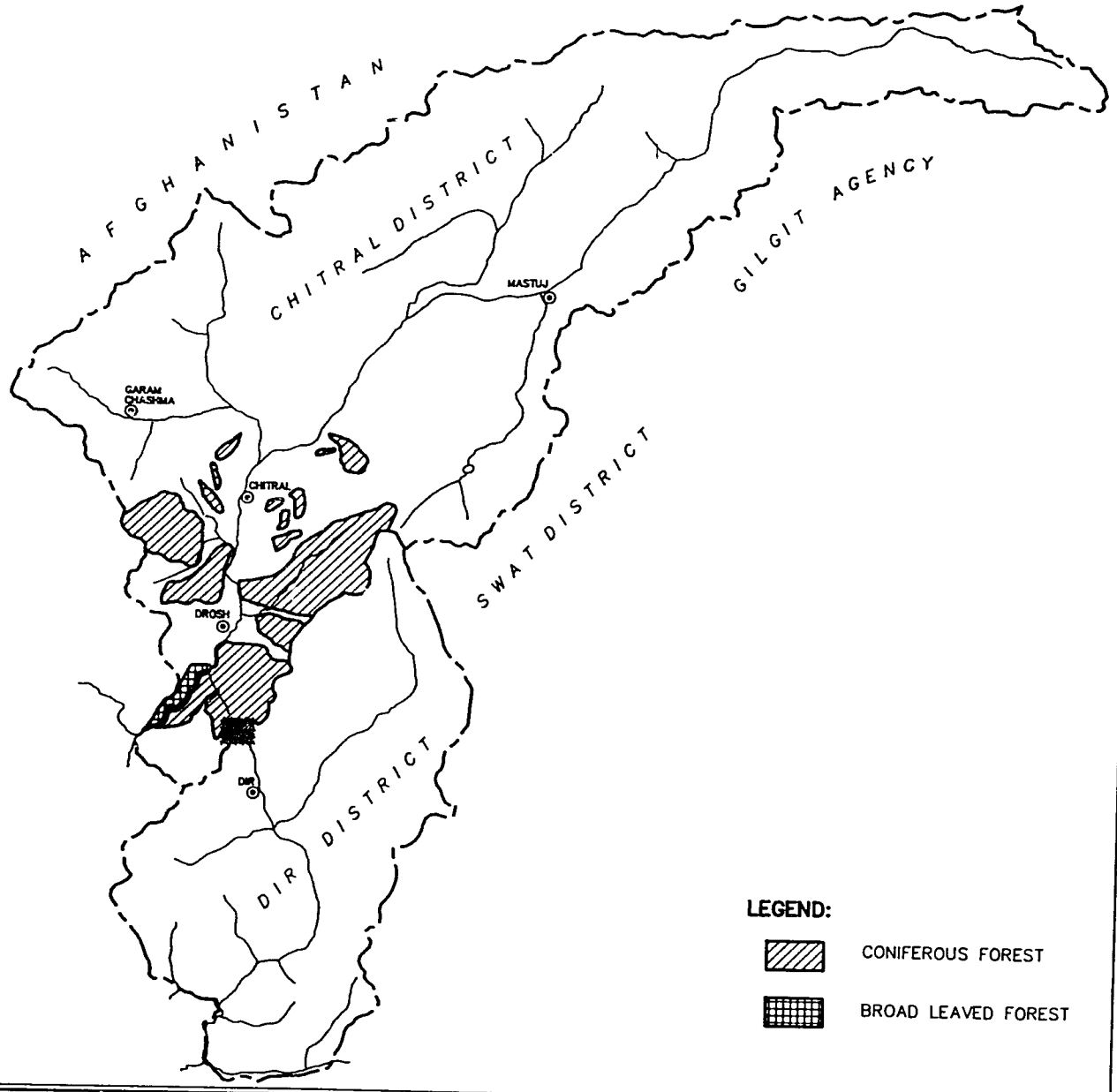
Large areas have since become denuded and severe erosion is present. Apparently, large tracts of land were clear cut for sale as timber, approximately 25 to 50 years ago. The removal of timber appears to coincide with a change in climate. The ADB (1987) project report concludes that there is probably irreversible agro-ecological change, precluding the possibility of easy or speedy reafforestation.

Two bands of different tree types comprise the existing forest: conifers occupying high altitudes and broadleaf trees at lower altitudes and in the valleys. The conifer forest (estimated to be two-thirds of forest area) is characteristically open and is considered to have greater capacity for self-regeneration than the broadleaf forest. The latter has very little capacity for self-regeneration, since it is more accessible and has been more easily exploited. Broadleaf trees supply fuelwood and some, like the holly oak, provide browse and winter feed for animals. There is an ever increasing pressure on the broadleaf forest for fuelwood to provide heat in winter and cooking fuel. Principal species of trees in Chitral District are shown in Table 3-15.

Table 3-15
TREE SPECIES OF THE CHITRAL VALLEY

Conifer	
Silver Fir	*Abies pindrow*
Deodar	*Cedrus deodara*
Kail	*Pinus wallichiana*
Juniper	*Juniperus excelsa*
Spruce	*Picea smithiana*
Chilghoza pine	*Pinus gerardiana*
Broad-leaf	
Birch	*Betula utilis*
Horse chestnut	*Aesculus indica*
Holly oak	*Quercus dilatata*
Maple	*Acer caesium*
Bird Cherry	*Prunus cornuta*
Walnut	*Juglans regia*
Oak	*Quercus ilex*
Shank	*Fraxinus zanthoxyloides*

112



Environmental, Economic and Social Soundness Assessment

CHITRAL ACCESS PROJECT

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

North

30 10 0 10 20 30 40 50 km

Approximate Scale: 1 : 1 000 000

TAMS CONSULTANTS, Inc.

December 1987

FORESTS

Figure 10

3.8.2 Forest Management

The forest area includes 36,500 hectares under a management plan (about 12,000 hectares under management are classed as protected forest). A 25-year management plan for conifer forest was established in 1964. It stipulates that 400,000 cubic feet of commercial wood and 100,000 cubic feet of wood for domestic purposes can be cut. The major species cut is Deodar (rotation of 100 years); the rest of the species have a 125-year rotation.

Conifer forest is mature and overmature. The Forest Department marking for cutting is to a diameter limit of 24 inches plus decayed, crooked or damaged trees to a lower limit of 6 inches. A major problem in maintaining this conifer forest is little regeneration, caused by indiscriminant grazing throughout the forest. Until grazing is stopped, neither natural nor artificial restocking will be feasible and the size of the forest area will continue to diminish until cutting stops or the forest disappears.

Responsibility for forest management rests with the NWFP Forestry Department under the DOA. Two nurseries (3 hectares in total) in Chitral provide planting material to individuals and small reafforestation and rangeland reclamation projects. Staff for Chitral District is composed of a divisional forest officer, three range officers, 11 foresters and 45 forest guards (ADB 1987).

3.8.3 Logging

Commercial logging is carried out under the direction of the Forest Development Corporation which has its head office in Saidu-Sharif, Swat. Wood is one of the few products exported from Chitral District. Contractors carry out operations by hand, using axes and saws, and move the timber by rolling it to the roadside, by floating it down streams, or by mule transport. In Chitral, Deodar accounts for 75 percent of the cut; spruce and pine comprise 15 percent and 10 percent, respectively.

Costs of cutting, bucking and rolling to roadside plus various taxes are:

	RS/Cubic foot
Harvesting to Roadside - logs	8.59
- cants*	15.64
District Council Tax	11.25
Forest Department Duty	2.25
Trucking to Chakdara Market - logs	11.82
- cants	7.66

* Squared logs

114

Total costs are Rs 33.91 for logs and RS 36.80 for cants delivered to the market at Chakdara near Dir. Cost is about one-third the value of the product outside the valley. The logs and cants from Dir and Chitral are auctioned in the market at prices and volumes shown in Table 3-16.

Table 3-16
PRICE AND VOLUME OF LOGS AND CANTS

	Species	Price (Rs)	Volume (cu.ft.)	Percent of Volume
Logs	Deodar	96.31	765,897	58
	Blue Pine	58.53	172,043	13
	Fir/Spruce	41.36	392,025	29
Cants	Deodar	124.49	161,149	62
	Blue Pine	98.29	50,111	19
	Fir/Spruce	66.34	49,444	19

Cutting for domestic purposes is carried out by citizens permit. The cost of a permit is RS 26 per cubic foot; permit holders take logs or cants to one of the 20 small saw-mills in the district where they are custom sawed for RS 4 per cubic foot. Fuelwood is expensive at about Rs 35 per 40 Kg which is roughly equivalent to three cubic feet of dry wood or one cubic foot of green wood.

3.8.4 Future Forestry Plans

The Forest Department and an extension staff are working to carry out a planting program to help reduce pressure on the natural forest. They are operating nurseries and have a target of 10.1 hectares in nurseries. Farm communities along the river are also planting trees along property boundaries, irrigation canals and in areas not suitable for crops.

In 1988, the Forest Department will prepare a new management plan, based on an inventory. (The existing management plan was based on only an estimate of growing stock.) Along with the inventory, a map will be prepared; measures to protect the forest from grazing as well underplanting to aid natural regeneration will be prescribed.

3.9 Tourism

3.9.1 Tourism in Pakistan

Tourism is a fast growing segment of the economy of Pakistan. The role of tourism in contributing to the foreign exchange earnings of Pakistan is fairly significant. Tourism also provides employment opportunities and helps some less developed regions of the country through the process of income transfer.

115

The history of foreign tourist arrivals in Pakistan during the period 1972-1986 can be seen from the indices in Table 3-17. Foreign tourist arrivals were 432,300 during 1986, showing a minor decrease of 1.9 percent from 440,500 during the previous year. This drop followed an upward trend in tourist arrivals for four consecutive years from 1981 to 1985. Earnings of foreign exchange from tourism during 1986 decreased by 3.1 percent to US $180.2 million from a 1985 level of 186.0 million. Tourism receipts as a percentage of the gross national product of Pakistan were 0.61 percent during 1984-85.

The top ten countries generating tourists to Pakistan are indicated in Table 3-18 (Government of Pakistan 1986). During 1985, tourist arrivals by air were 280,100 representing a 63.6 percent share of the total arrivals (Government of Pakistan 1986). Land arrivals totaled 160,000 or 36.3 percent. The sea traffic to Pakistan was insignificant in 1985; its share was 0.1 percent and comprised approximately 300 tourists.

3.9.2 Tourism in Chitral

Chitral District attracts tourists both from within and outside Pakistan. Pakistanis travel to Chitral for sightseeing and business and to escape the summer heat. Foreigners visit Chitral for sightseeing, trekking, hiking and business. During 1986, 1,775 foreigners registered with the Office of the Deputy District Commissioner in Chitral.

Chitral Valley enjoys an enthusiastic reputation as a paradise for tourists, as suggested by the following excerpt from a Pakistan Tourism Development Corporation (PTDC) brochure:

> This 322 km. (200-mile) long mountain hideout, nestling high in the Hindu Kush range, is a place of fascinating scenic beauty and grandeur. Chitral's collection of rugged mountains, sulphur springs, rivers teeming with trout, orchard-dotted slopes, friendly people and annual festivals are enchanting beyond description. For the modern day traveller this scenic region offers an exciting experience.

Although Chitral can boast the rugged beauty of the Hindu Kush mountains, severe environmental degradation is apparent throughout the more accessible lower valley. The mountain slopes have generally been deforested and erosion is widespread. Only a few streams and lakes run clear, as discussed in Section 3.3. In addition, much of the attraction of Chitral is common to the northern areas of Pakistan, particularly Gilgit and Hunza. The principal tourist attractions of Chitral and the majority of its tourism activities are concentrated in lower Chitral. Chitral town, the Kalash valleys and Garam Chashma (Hot Springs) are visited by most tourists. Approximately 75 percent of the foreign tourists visit the Kalash valleys and Garam Chashma; virtually all spend at least one night in Chitral town. The three Kalash valleys, Birir,

116

Table 3-17

TOURIST ARRIVALS AND EARNINGS

Year	Arrivals (1000's)	Percentage Change	Receipt (Million US$)	Percentage Change
1972	101.0	0.0	10.6	0.0
1973	141.9	40.5	18.9	78.3
1974	154.5	8.9	20.8	10.1
1975	172.0	11.3	32.3	55.3
1976	197.3	14.7	40.6	25.7
1977	220.4	11.7	60.4	48.8
1978	291.5	32.2	82.9	37.2
1979	318.6	9.3	100.0	20.6
1980	299.0	-6.1	153.9	54.0
1981	290.2	-3.0	128.2	-16.7
1982	313.7	8.1	187.0	45.9
1983	365.1	16.4	201.6	7.8
1984	407.3	11.6	177.9	-11.8
1985	440.5	8.2	186.0	4.6
1986	432.3	-1.9	180.2	-3.1

Source: Planning, Development and Research Wing; Toursim Disvision; Government of Pakistan; Islamabad.

117

Table 3-18

PRINCIPAL TOURIST GENERATING
COUNTRIES DURING 1985

Country	Arrivals (1000s)	Percentage Share	Position
India	191.3	43.4	1st
U.K.	81.2	18.4	2nd
U.S.A.	23.9	5.4	3rd
Bangladesh	11.3	2.6	4th
F.R. Germany	9.9	2.2	5th
Canada	8.9	2.0	6th
Japan	8.5	1.9	7th
Iran	8.0	1.8	8th
Saudi Arabia	6.5	1.5	9th
France	4.3	1.0	10th

Source: Government of Pakistan 1986.

Bomburet and Rambor have been proposed for establishment as a national park, in part to "protect and ensure the perpetuation of the said [Kalash Kafir] culture with natural fauna and flora...." (Khan 1975).

The tourist season in Chitral extends from May to October, inclusive, but tourism appears to be concentrated in the period from June to September. During December, a small number of tourists, exclusively foreigners, visit Chitral to hunt large game species, primarily markhor and additional game when permitted. Only two markhor licenses are sold each year, at a cost of US $10,000 per animal.

Access to Chitral is adequate during the tourist season, but limited during the winter. During 1986, according to the Registration Office of the Chitral Police, approximately 60 percent of the tourist travel to and from Chitral was by plane; the remaining 40 percent was by road. Throughout the tourist season, the road over Lowari Pass between Dir and Chitral generally remains passable. The road is rugged and the trip uncomfortable. One or two flights from Peshawar to Chitral and an equivalent number of return trips are scheduled each day. Flights are frequently grounded, however, by high winds, precipitation or fog, especially during the winter months.

Accommodations in Chitral District comprise 15 hotels: nine in Chitral town; five in the Kalash valleys of Bomburet, Rambor and Birir; and one in Garam Chashna. Table 3-19 provides, for 1986, the hotel occupancy rates and US dollars spent. The table is based on data collected through interviews with the managers of selected hotels in Chitral. Approximately 116 rooms are available in Chitral District, providing almost 200 beds. The number of room-nights spent in Chitral during the 1986 tourist season is estimated to have been only about 4,000. This represents an occupancy rate of only 21 percent, indicating a significant capacity to absorb future increases in demand.

3.10 Palentological, Archaeological and Historical Resources

3.10.1 Paleontological Resources

Fossils have played a major role in geologic interpretation of Chitral, especially its stratigraphy and structure. Since fossils are rare in Chitral District, their preservation for future re-evaluation is merited, especially because the interpretation of stratigraphy and structure are in many areas still debatable.

119

Table 3-19

HOTEL ROOM-NIGHTS AND US DOLLARS SPENT
IN CHITRAL DISTRICT DURING 1986

Location	No. of Hotels	No. of Rooms Total	No. of Rooms Double	No. of Rooms Single	Available * Room-Nights	Available * Bed-Nights	Actual Room-Nights Total No.	Actual Room-Nights Total % of Avail	Actual Room-Nights Tourism Pak.	Actual Room-Nights Tourism Foreign	Actual Room-Nights Business Pak.	Actual Room-Nights Business Foreign	US Dollars Spent ** Total	US Dollars Spent ** Tourism	US Dollars Spent ** Business
Chitral	9	75	48	27	13,800	22,632	2,948	21	860	1,105	860	123	23,962	15,972	7,990
Bomburet	3	20	11	9	3,680	5,704	792	22	346	90	346	10	1,138	626	511
Rambor	1	7	4	3	1,288	2,024	277	22	121	32	121	3	398	220	178
Birir	1	7	4	3	1,288	2,024	277	22	121	32	121	3	398	220	178
Garam Chashma	1	7	4	3	1,288	2,024	277	22	121	31	121	4	398	218	180
District	15	116	71	45	21,344	34,408	4,571	21	1,569	1,290	1,569	143	26,294	17,256	9,037

* Based on 184 days in May to Oct. tourist season.

** Based on single-room and double-room costs provided by three representative hotels in Chitral. Assumption were made as to the proportion of room-nights spent in double rooms and those spent in single rooms. The cost of double-rooms ranged from US $1.70 to US $17.20; Single-rooms from US $1.15 to US $14.35. All US $ rates are based on an exchange rate of 17.4 rupees per US $.

Fossil finds in the Chitral District have included those listed below.

1) Two miles (3.2km) south of Drosh, fossils occur in a limestone bed on the east bank of the Chitral River.

2) One mile (1.6 km) south of Pasti, on the north-east-trending ridge, a 5-foot (1.51m) bed of gray dolomitic limestone contains rugose corals of Devonian age.

3) One mile (1.6km) upstream of Pasti, west of the Pasti fault, Devonian corals occur.

4) Corals and brachiopods occur near Reshun.

5) Devonian fossils are found in the upper Turikho Valley near Warkup, 4 (6.4km).

6) Devonian fossils occur in the Owir Gol upstream from Barum;

7) On the steep slope 2 miles (3.2km) north of Pasti and east of the Pasti fault, there are limestone beds which contain Permian fusulinids.

8) Near Gokhten Girri Pass, between Pasti and Partsan there are Devonian or Carboniferous age fossils.

9) In the upper Arkari Valley, Mesozoic fossils occur.

10) In the vicinity of Baroghil Pass, Devonian fossils occur.

11) A locality in the Chitral Gol contains brachiopods.

3.10.2 Archaeological and Historical Resources

It is reliably documented that in ancient times the Chitral Valley served as part of the silk route from China through the Baroghil, Yarkhun and Shandur passes and thence through the Kunar Valley and on to Kabul-Jalal Abad. Ample evidence also exists that lapiz lazuli of Badkhshan was in great demand in Afghanistan, the Indus Valley, Iran and Central Asia since the early Bronze Age period in the 4th and 3 millennium BC. It is entirely plausible that both the Badaklshis and Chitralis participated in this trade.

Investigations made previously in the vicinity of Ayun have resulted in discovery of a late Bronze Age cemetery complex. An Italian mission in the early 1970's excavated a

121

few burial sites of the late Bronze and early Iron Age periods only a few miles from Chitral. In 1982-83, Mr. I. Hasan Ali and a professor from the University of Utah located several sites from this early Iron Age period in the area between Chitral and Mastuj. The presence of the late Bronze Age and early Iron Age burial sites attests to the presence of Indo-European tribes in the second and first millennium BC. Early historic sites demonstrate occupation during the Kushan period in the first and fourth century AD. The ancient inscription (900 AD) at the village of Barenis about 27 miles north of Chitral, states that at that time the area was Buddhist country under King Jaipal of Kabul.

After the Muslim invasion, most people were converted to Islam with the exception of the Kafirs, an animist tribe previously very numerous in Afghanistan and the Chitral Valley, but now confined to three small valleys in the south, the Birir, Bomburet and Rambor. This group retains its religious and cultural customs, but there is pressure to convert to Islam even though they are protected to some extent by law.

There is no evidence of any archaeological sites on close to the Lowari Pass or within three to six miles on either side of the proposed tunnel.

The Chitral Valley requires a systematic field survey to examine thoroughly the sites already discovered. Plans to develop the most promising sites as a part of the national heritage and as a group of tourist attractions are needed. One step in this direction is the establishment of a museum in Chitral town which is now underway. This museum can form a nucleus of knowledge and expertise around which further initiatives can be developed.

3.11 Mineral Resources

3.11.1 Existing Mining

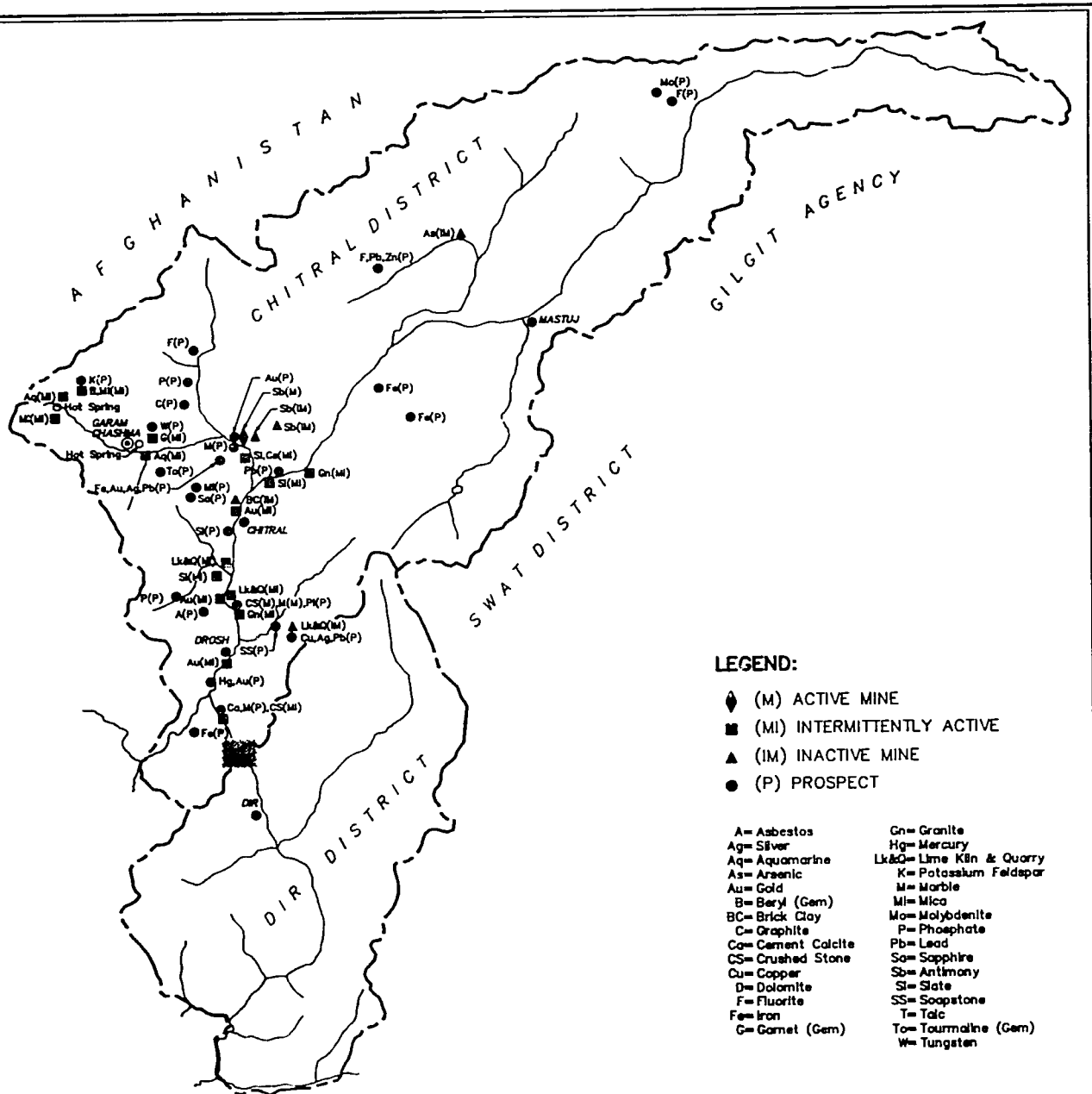
Mineral production in the Chitral District is very small. The only metallic elements mined are antimony, a little gold and, formerly, arsenic. Some marble, granite and slate building stone are intermittently mined. Sand and gravel, and clay are mined locally for construction of walls and buildings. Calcite and dolmite rocks are mined for road metal and lime. Mica is mined intermittently as are gems (beryl, aquamarine, tourmaline, garnet and sapphire). Table 3-20 lists active and formerly active mines.

There are about 70 mining locations in the Chitral District. None of the operations are continuous throughout the year. When roads are snow-covered, there is little activity, because there is virtually no snow removal. The narrow roads with high banks and steep gradients make it too dangerous to transport minerals from a mine throughout the winter.

122

Table 3-20
MINES, SMELTERS, MINERAL PROSPECTS AND GEOTHERMAL ENERGY
IN CHITRAL DISTRICT

Metallic Mines	Yearly Production
1 Antimony (active; sulphur prospect)	5.5 Short Tons, Trioxide
3 Gold (intermittently active)	Few Ounces
6 Arsenic (inactive)	
Non-Metallic Mines	
1 Marble (active)	Few Tons
1 Marble (inactive)	-
3 Road Metal (active)	about 1,000 Tons
2 Lime (intermittently active)	Few Tons
1 Lime (inactive)	-
2 Mica (intermittently active)	Few 100 lbs.
1 Beryl (gem)	Few lbs.
1 Aquamarine (intermittently active)	Few Ounces
1 Tourmaline (intermittently active)	Few Ounces
1 Garnet (gem) (intermittently active)	Several lbs.
1 Fluorite (intermittently active)	Few lbs.
1 Fired Brick Clay (inactive)	-
10's of Mud Brick Clay (active)	Few Tons
Few Sand and Gravel (active)	Few 1,000 Tons
10's of Slate and other (active) Building Stone	Few 100 Tons
Smelters or Processing Plants	
1 Antimony (active)	
2 Lime Kiln (intermittently active)	
1 Fired - Brick Kiln (inactive)	
1 Road Metal Crusher and Screen	
2 Asphalt Mixing Plants	
Mineral Prospects	
3 Iron	1 Dolomite
1 Copper (silver, lead, sulphur)	2 Slate
1 Gold	2 Sulphur
1 Gold (silver)	
1 Turgsten	**Geothermal Energy**
1 Molybdenum	
1 Mercury	1 Hot Spring Bathing and Laundry
3 Fluorite	1 Hot Spring (not utilized)
Mineral Prospects	
2 Phosphate	
1 Talc & Asbestos	
1 Soapstone & Serpentine	
1 K-feldspar	
2 Granite	
1 Marble	



Environmental, Economic and Social Soundness Assessment

CHITRAL ACCESS PROJECT

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

North

30 10 0 10 20 30 40 50 km

Approximate Scale: 1 : 1 000 000

TAMS CONSULTANTS, Inc.

December 1987

MINERAL RESOURCES

Figure 11

3.11.2 Mineral Prospects

There is potential mineral production as revealed by prospects of iron, gold, silver, copper, tungsten, marble and calcite for cement as well as many other minor, mineral and rock prospects. Figure 11 illustrates active, intermittent and inactive mines as well as mineral prospects. A full review of minerals and development potential is presented in Appendix K. At least half of the district has never been traversed by a geologist; therefore, additional exploration could well lead to additional finds of exploitable quantities of minerals.

3.12 Aesthetics

The existing visual environment can be examined with regard to three components: visual structure, visual quality, and visual sensitivity. Visual structure is a means to analyze the appearance of a scene from a point of observation, particularly the relationship between the point of view and the objects viewed. Visual quality is an indicator of the attractiveness of a place, a concept more subjective than the analysis of structure. Visual sensitivity describes the ability of a natural or man-made landscape to absorb visual change and is a measure of how readily the appearance of a place or area is affected by the introduction of something new. As land uses change from less intense activity to more intense development, they are considered less sensitive to visual change. Homogeneous areas are typically more sensitive than heterogeneous areas. In general, flat areas are visually more sensitive compared to hilly or diverse topographic areas.

The existing environment in and around the Lowari Pass and along the approach roads is relatively undeveloped with few architectural or man-made elements. It is generally a medium to high quality landscape with great topographic relief and diversity. The natural landscape is dominant. Rock outcrops and tallus slopes control overall appearance at higher altitudes. Fir trees are scattered along the rock slopes; at lower elevations, vegetation increases and fir trees are replaced with other forms of trees, shrubs and grasses. The area exhibits a strong form as a result of the severe topographic relief and high vividness, resulting from the contrasting vegetation with the sun bleeched rock outcrops.

Based on the low intensity of land use development (high visual sensitivity); the moderate homogeneity of the area (moderate visual sensitivity); and the great topographic relief (low visual sensitivity); the surrounding environment can be defined as one which exhibits a moderate visual sensitivity.

The existing population of viewers is small and confined to the few local residents and travelers on the road. There are no major parks or preserves within the viewshed of the Pass. The closest area is the Drash Goo Game Preserve, about 10 miles away.

In Chitral Valley, natural features are generally dominant, bare slopes contrast with forested ones, and severe topographic relief is present. Some views like that of Tirich Mir are especially important and are characteristically portrayed in travel literature. Deforestation and erosion, however, detract from overall visual quality. In an area as large as the Chitral Valley, there are clearly aesthetically spectacular views as well as unattractive ones. No detailed visual analysis was undertaken in view of the relatively minor significance of the issue.

3.13 Noise

No noise monitoring was performed, since noise was not considered to be a major concern. Noise sources are noted here in a qualitative fashion. Noise in the Chitral District is primarily from motor vehicle engines (including Bedford trucks) and horns, along with a few industrial type facilities. These noise sources include a rock crusher with associated rotating screens, quarry blasting, and a few roadway asphalt mixing mills. Miscellaneous noise sources include air compressors and pneumatic drills. Noise sources such as these are generally in isolated locations. In Chitral town, the largest concentration of population, noise sources are largely created by the typical, daily activities of residents and by incoming and outgoing flights about four times a day.

There is little noise in or near the Lowari Pass except for motor vehicles.

Chapter 4

Environmental Impacts of Proposed Project and Alternatives

4.1 Construction, Operation and Maintenance Impacts of Tunnel and Other Alternatives

4.1.1 Air Resources

No-Action

Pollution attributable to the no-action alternative would consist of exhaust fumes from the same average of approximately 400 vehicles a day during the 6-month period that the pass is traversable, plus a small quantity of wood smoke produced by the few people living along the road, principally in the village of Lowari. These minor pollution sources would have little effect on ambient air quality. In the long term if insufficient maintenance limited traffic to porters and trekkers and prevented vehicular use, air pollution would be negligible.

Tunnel and Approach Roads

Construction of the tunnel would temporarily increase the quantity of exhaust fumes from the operation of heavy machinery, earth movers, compressors, diesel generators, etc. During tunnel construction, dust would be added to the air because of soil excavation, dumping, grading and construction vehicles.

There are two potential sources of air quality impacts of the Lowari Tunnel: (1) impact of approach roadway vehicular traffic on the surrounding community; and (2) impact of vehicular emissions within the tunnel itself. No significant impacts are expected in the first case since vehicular volumes are low, most vehicles are diesels (having lower carbon monoxide emissions than gasoline powered vehicles), and there are little or no sensitive receptors near the roadway alignments. While the percentage increase in traffic appears to be significant, reflecting an increase from 401 vehicles in 1987 to 3,140 in 2022 (PRC 1987), the absolute number of vehicles is not significant (a few hundred in any given hour) from an air quality standpoint. Increased motor-vehicle related air pollutants due to increased traffic would also be offset by the trend towards bigger and newer trucks which would probably be better maintained and have less emissions than current trucks. This trend towards new trucks is already evident on the Dir side of the Lowari Pass.

The question of in-tunnel impacts needs to be explored in more detail, given the length and design of the tunnel and the possibility of emergency situations. The ventilation requirements for the Lowari Tunnel were calculated in accordance with the latest recommendations and regulations published by the International Committee for Ventilation of Road Tunnels. Due to the high percentage of diesel vehicles that would be using the road tunnel, the fresh air requirements were based on smoke emissions as opposed to carbon monoxide (CO) emissions.

It should be noted that ventilation requirements for tunnels designed in the United States differ from that overseas. For example, the US Environmental Protection Agency (in a supplement to their Guidelines for Review of Environmental Impact Statements for Highway Projects) states:

> "For the users of highway tunnels at or near sea level, it has been determined that an adequate margin of safety would exist if the concentration of CO does not exceed 125 ppm (mg/kg) and the exposure time does not exceed one hour."

Since issuance of the supplement, 125 ppm has been widely adopted in the US as the design criteria for tunnels located at or below an altitude of 3,200 feet (1000 meters). For tunnels above 1000 meters, the 1987 HVAC Handbook recommends seeking the advice of medical authorities in establishing a CO design level, since vehicular emissions are increased and human tolerance to CO exposure is reduced at higher altitudes. The CO design standard for the Lowari Tunnel is 250 ppm.

The number of vehicles and traffic load (tons) passing through the road tunnel were projected for the years 1985 through 2035. This forecast, plus the topographical characteristics of the tunnel alignments (prinicipally gradient, since fresh air requirements increase with steeper gradients), was used to estimate the fresh air requirements for the tunnel. Three different schemes were considered for the tunnel ventilation system (PRC 1987) as described below.

Longitudinal ventilation. Such a system introduces or removes air from the tunnel at a limited number of points, thus creating a longtudinal flow of air within the roadway. Air injected into the tunnel roadway at one end of the tunnel mixes with air brought in by the piston effect of the incoming traffic. This system is most effective where traffic is unidirectional. Such is not the case with the cross-section recommended by the Draft Feasibility Report for the Lowari Tunnel. Common design practice in the US has limited the use of longitudinal ventilation systems to tunnels under 1000 meters. Alternative alignments for the Lowari Tunnel are each over 8000 meters in length.

Air velocity stays uniform throughout the tunnel, and the concentration of contaminants increases from zero at the entrance to a maximum at the exit. Adverse external atmospheric conditions can reduce the effectiveness of this system. Longitudinal ventilation is enhanced by mounting fans at the tunnel ceiling.

Standard longitudinal ventilation systems are the most economical systems, because they require the least extensive mechanical equipment. As the length of the tunnel increases, however, the disadvantages become apparent, such as excessive air velocities in the roadway and smoke being drawn the entire length of the roadway during an emergency.

Semi-transverse ventilation. This system uniformly distributes or collects air throughout the length of the tunnel. The supply air version of the system is the most accepted and produces a uniform pollutant level throughout the tunnel, because fresh air and the vehicle exhaust gases enter the roadway area at the same rate. This system is not affected by adverse atmospheric conditions. The air flows the length of the tunnel in a duct fitted with periodic supply outlets. Semi-transverse systems are used in tunnels up to about 1000 meters, at which point the tunnel air velocities become excessive.

Full transverse ventilation. This system is used in large tunnels. A full exhaust duct added to a supply-type semi-transverse system achieves uniform distribution of supply air and uniform collection of vitiated air. With this arrangement a uniform pressure wll occur throughout the roadway and no longitudinal air flow will occur, except that generated by traffic piston effect, which tends to reduce contaminant levels. With respect to rapid removal of smoke and heat from the tunnel under emergency conditions, a full transverse ventilation system provides the ideal emergency ventilation system.

The ventilation system chosen for the Lowari Tunnel is a longitudinal ventilation system with jet fan operation. Jet fan operation is heading in the opposite direction, but not with a simultaneous atmospheric pressure difference of more than 5 mm WC (water column) between the portals. Therefore, the jet fans must be of the reversible type. To meet the tunnel fresh air requirements up to approximately the years 2000 to 2005, 28 jet fans would be required. After 2000 to 2005, however, the total air requirement cannot be met with a simple longitudinal ventilation system. Even assuming a 30 percent reduction in vehicle emissions due to emission controls, roughly 140 fans would be necessary. This large number of fans with high operating costs suggests that the tunnel ventilation system be modified to provide intermediate ventilation station for air exhaust and air injection. Due to the bi-directional traffic and to unbalanced atmospheric conditions at the portals, this system must also be reversible. The Feasibility Report (PRC 1987) recommends retaining flexibility with regard to expanding the initial system and allowing for possible construction of a ventilation shaft at a future date.

As noted at 5.2.1, further analysis of ventilation is recommended because of potential safety risks.

Improved All-Road Access

Assuming vehicle projections to be the same, improvement of the roadway over the pass would have approximately the same impact on pollution during operation as a tunnel alternative, except for the portion within the tunnel itself. During construction, the effect on air pollution would be less, since less heavy construction equipment and machinery would be in use.

4.1.2 Geology, Physiography and Soils

No-Action

The no-action alternative has little effect on geology and physiography except in so far as maintenance of the existing road would require that new switchbacks be constructed and cuts be made. Impacts to soils, as related to streams and to wildlife, are explained at Water Resources, Terrestrial Ecology and Aquatic Ecology (4.1.3 and 4.1.4., and 4.1.5).

Tunnel and Approach Roads

Geology. Granite and metamorphosed volcanic rocks would be broken and crushed during construction of the tunnel and approach roads. This loss of rock would be insignificant compared to the size of the geologic formations.

Attention needs to be given to constructing the tunnel to withstand potential earthquakes during the expected lifetime of the structures. Bridges should also be specially designed to withstand earthquakes.

Active faults would need to be identified in greater detail and any expected offset of such faults should be further considered in the design of the tunnel, roads and bridges. Many small faults pass through the tunnel alignment. Cross-sections in the PRC Feasibility Report show a major fault subparalleling the tunnel alignment, although that report's area geologic map shows no mapped faults. Faults were observed within the mapped area during EA reconnaissance. These faults and their strike would need to be mapped more precisely to determine whether or not faults occur within the alignment finally chosen for tunnel construction. (An aerial photographic lineament study is recommended to reveal possible faults which could be field-checked.)

Natural sands and gravels for construction purposes might be mined from the bed of Lowari Khwar around Dir, between 40 and 80 road-kilometers south of a tunnel south portal, and from the bed of the Chitral River at Magar, Mir Khani and Drosh, approximately 25 to 40 kilometers north of a tunnel north portal (PRC 1987, page 6-39). Riverbed mining activities

-130

would result in the temporary suspension of fines and alteration of the contour of the beds at and proximate to the mining sites. The beds and banks of both Lowari Khwar and the Chitral River are geomorphically dynamic features, and would adjust incrementally until a new state of dynamic equilibrium were achieved. Adjustments would comprise changes to the normal patterns of fluvial erosion and sedimentation, dependent on river conditions at the time of mining and characteristics and locations of the mining activities.

Physiography. The principal effects of tunnel construction on the landscape would be the filling and leveling of areas near portals with rock excavated from the tunnel. Some slopes would probably be made steeper to make improved access roads. Steeper gradients might occur at the toe of a large mass of colluvial or glacial material or rocks which dip toward the road, creating the possibility for landslides. Steeper slopes would also be subject to increased erosion. Design criteria for roadways must, therefore, incorporate protective measures.

To prevent landslides, further studies should be made to identify landslide-prone areas and cutting of toes in such areas would need to be minimized. To reduce erosion in areas of steeper slopes, gabions and other containment barriers could be constructed. Steep banks could be seeded with plants to reduce erosion. Further detail on rock disposal for tunnel excavation is provided below.

Soils. Some soil would be excavated and some buried by construction of the tunnel and, especially, by construction of access roads. The amount of soil lost could be reduced by excavation and stockpiling of topsoil for later distribution in areas which lack topsoil. Some soil erosion and stream siltation might occur from road construction as noted under Water Resources and Aquatic Ecology (4.1.3 and 4.1.5).

Spoil Disposal. With specific reference to tunnel construction, rock disposal requirements are large. At each portal, these requirements would vary with the alignment alternative and the method of tunnel construction chosen. Table 4-1 indicates the quantities of excavated materials at the north and south portals for alignment alternatives AM and AO, with and without pilot galleries. The actual volumes of rock requiring disposal would depend on the bulking factors specific to the rock materials excavated. A discussion of the spoil disposal requirements at South Portal A and North Portals M and O follows.

Table 4-1
TUNNEL AND SHAFT EXCAVATION QUANTITIES
AT NORTH AND SOUTH PORTALS

Excavation Quantities
(cubic meters)

	Alternative AM without Pilot Gallery	Alternative AM with Pilot Gallery	Alternative AO without Pilot Gallery	Alternative AO with Pilot Gallery
North Portal	218,500	152,500	261,000	176,000
South Portal	336,500	402,500	315,000	400,000
Shaft	546	546	631	631
Total	555,546	555,546	576,631	576,631

Source: PRC 1987, Figures 6.5 to 6.8, Pages 6-31 to 6-34.

South Portal A. The disposal of up to 400,000 cubic meters of excavated rock material from tunnel and shaft excavation would require the filling of a section of a narrow stream channel at the south portal, Portal A. This stream, Nirga Khwar, is a tributary to Lowari Khwar and occupies a narrow, rock-strewn ravine, around which the existing road bends. The spoil would be disposed of on both sides of the stream and totally within the confines of the ravine, a portion of the material being used to create a platform for the crushing and screening plant and material stock piles. A rock spoil embankment would be constructed across an approximately 60-meter section of the ravine, opposite the south portal, to carry the proposed approach road over Nirga Khwar. The stream would be carried under the spoil by a 65-meter long culvert, sized for the maximum flows. As appropriate, the quantity of spoil requiring disposal would be reduced by utilizing the material excavated from the tunnel as fill to improve the existing south approach road.

North Portal M. The construction of alignment Alternative AM would be accomplished either with the driving of a pilot gallery from the north portal prior to the main excavation or without a pilot gallery. The installation of a pilot tunnel would reduce the excavation quantities extracted at North Portal M from 218,500 to 152,500 cubic meters; the difference would be removed and disposed of at the south portal, where adequate dumping capacity is available. A corresponding shift in the areal magnitude of impacts in the vicinity of the north and south portal would occur.

Approximately 45,000 cubic meters of cut material, primarily from rock excavation, would be utilized to construct access facilities and create platforms elevated above the flood level. These areas, sites for installation of minimum plant

132

requirements for tunnel or gallery excavation, would be constructed within the existing floodplain of Trangar Gol, a tributary to Ashret Gol. An additional, undetermined volume of the excavated material would be used as fill for the north approach road. Surplus excavation material would be dumped within the floodplain, behind a dike structure with slope protection which would be built along Trangar Gol.

North Portal O. Installation of a pilot gallery, driven from the north side, is recommended for the preferred alternative, Alignment AO, in the Draft Feasibility Report (PRC 1987, page 8-5). A reduction from 261,000 to 176,000 cubic meters of excavated material and a corresponding reduction of filling activities within the floodplain of Trangar Gol would be realized through utilization of a pilot tunnel. Portal O is situated on the south bank of Trangar Gol and would be linked to the north approach road by a 120-meter long open cut tunnel across the stream. Trangar Gol would be diverted over the open-cut tunnel, with flood protection dikes upstream and downstream of the crossing.

Approximately 60,000 cubic meters of material excavated from the flood plain would be used to create the embankments for the proposed new road section and temporary platforms for site installations. Construction of the open-cut tunnel section and parts of the temporary platforms wil occur in the Trangar Gol stream channel and flood plain. As tunnel excavation proceeds, the cut material would be used to produce coarse and fine aggregates for concrete and road pavement works. The surplus material from tunnel excavation would be incorporated into embankments for improvement of the existing north approach road (PRC Engineering, Inc. 1987, page 6-36).

Improved All-Road Access

Some rocks would be removed for construction of a roadway, but an improved roadway alternative would not generate the large volume of excavated rock associated with a tunnel.

Effects on slopes similar to those described for the tunnel and its access roads could be anticipated.

The amount of soil lost would be a special concern during road construction. The all-road alternative entails a 50 km length of improved or new road, as opposed to 28 km for the tunnel.

Attention to earthquakes should also be paid in the design of bridges and roadway.

4.1.3 Water Resources

No-Action

Future use and maintenance of the existing road over Lowari Pass would continue to contribute small quantities of

sediment, roadway debris, road salt and oil to down-slope streams and rivers. These quantities have been insignificant in the past and no increase is anticipated under the no-action alternative. The gradual decrease in serviceability and potential closure of the existing road over Lowari Pass would result in significant reductions in the levels of road-derived contaminants entering aquatic habitats.

Tunnel and Approach Roads

Water Courses. As indicated under Geology, Physiography and Soils (4.1.2), tunnel construction would require the placement of excavation materials (for access facilities, site installation platforms, roadway embankments and surplus spoil disposal) within the channels or floodplains of Nirga Khwar at the south portal and Trangar Gol at the north. In addition a 120-meter long open-cut tunnel would be built across Trangar Gol, requisite to construction of the preferred alternative, Alignment AO. This activity would require excavation and placement of structures within the stream channel and diversion of the stream.

Construction activities along approximately 28 kilometers of roadway and the resultant slope disturbances would generate localized soil erosion and sedimentation in adjacent water courses. Short-term increases in the rate of erosion would also occur during construction of requisite stream crossings within the creek at pier and culvert locations and within abutment and approach roadway zones. Excavation and fill operations, removal of existing vegetation, ground preparation, and the operation of equipment and vehicles used in construction would be contributing factors. According to the Draft Feasibility Report (PRC 1987, page 6-18), the foundations of bridge piers and abutments would be located away from the main stream channels. Impacts on water resources would thereby be minimized.

Water Quality. Short-term rises in quantities of suspended solids and in the degree of water turbidity would result from construction, disposal, and sand and gravel mining operations. Periodic flushing by stream flows should ensure that execution of the project would have no lasting effect on ambient water quality values and that potential adverse impacts on dissolved oxygen levels, nutrient enrichment, and to fish and other aquatic life would be short-lived.

Water Supply. The Draft Feasibility Report proposes the installation of two pumps at each portal to withdraw water from nearby streams to supply water to storage tanks in buildings for drinking/sanitary use during construction and during operation as well in the tunnel for fire fighting and cleaning purposes. It is maintained that water is available from these streams throughout the year (PRC Engineering, Inc. 1987, page 4-29).

The impacts of these withdrawals on aquatic habitats would vary with the rate of withdrawal and with seasonal fluctuations in stream flows. The proposed water supply pumps have a combined capacity at each portal of 25 cubic meters per hour (M^3/H) or 0.25 cubic feet per second (cfs). The Draft Feasibility Report designates Trangar Gol at the north portal and Nirga Khwar at the south portal as the probable locations of water intakes. The minimum seasonal flows of these streams are not known, a factor precluding an accurate assessment of the impact of the proposed withdrawals on stream ecology. During field investigations on September 12, 1987, however, it was roughly estimated that the flow in each stream was about 5 cfs. If this value is assumed to be comparable to the minimum seasonal flow, the planned 0.25 cfs withdrawal represents only about 5 percent of this critical flow. An accurate assessment of these impacts, however, would require quantitative analyses of the minimum seasonal flows of Trangar Gol and Nirga Khwar and of the response of associated aquatic fauna to proposed quantities of water withdrawal.

Improved All-Road Access

Sedimentation impacts resulting from construction related slope disturbance, soil erosion and streambed disturbance during the reconstruction of the existing road over Lowari Pass would be comparable in character and extent to those discussed for the tunnel and access roads. Although 17 additional kilometers of roadway would require reconstruction under this alternative, distances between the roads and the stream channels rapidly increase uphill from the proposed portal locations. Therefore, only limited additional impacts on affected streams are anticipated.

After termination of construction activities, minor inputs of sediments and contaminants to nearby streams would continue throughout the design-life of the roadway. These impacts would be comparable to those characteristics of the no action alternative, comprising sediment, roadway debris, road salt and oil.

During construction, water would be needed to supply construction workers needs. Due to the mobile nature of the construction work and smaller-sized camps, impacts on water resources and quality are considered minimal.

4.1.4 Terrestrial Ecology

No-Action

Anticipated adverse impacts associated with the no-action alternative are the continued degradation and disturbance of wildlife habitats proximate to the existing road over Lowari Pass. Soil disturbance, erosion and sedimentation, and the disposal of road debris would continue to degrade the habitats in the immediate vicinity of the road. Vegetation, soil and other habitat elements would be removed when adjustments

135

are made to the roadway alignment to by-pass curves or tangents which are no longer serviceable. Local concentrations of noise, smoke and dust pollution would continue to define a zone of disturbance avoided by most wildlife species. If the road deteriorated to a condition of no longer being serviceable to vehicular traffic, effects on wildlife would diminish.

Tunnel and Approach Roads

Approximately 160 hectares of terrestrial habitats would be permanently impacted by construction of the proposed tunnel and requisite roads. These impacts are the result of spoil disposal, the construction of camps, shops and offices at the portals, and the construction of the north and south access roads. An additional 15 hectares of existing road would be abandoned. (See Land Use, 4.1.6.) These impacts would occur primarily within three terrestrial habitat types: dry temperate coniferous forest; dry evergreen oak forest; and agricultural field and orchard. The vegetative component of these habitats would be subject to removal and disturbance by construction activities. Due to disturbances associated with existing roadway use, most wildlife species otherwise representative of these habitat types are already absent from areas surrounding the existing road and therefore would be absent from the corridor of the proposed tunnel and roadway alignment. Thus, destruction of habitat elements would occur, but no increased disturbance to wildlife is anticipated.

The detonation of explosives and the operation of construction equipment would temporarily generate noise and air pollution affecting a zone greater in extent than that currently disturbed because of the existing road. Therefore, abandonment of some habitats beyond the zone of disturbance of the existing road and the loss of certain species currently inhabiting areas proximate to the road is expected. The zone of disturbance and the composition and extent of wildlife migrations would depend on construction staging and types of equipment employed. These construction-related disturbances would be temporary and it is expected that the wildlife would return after construction operations are terminated.

Disturbances resulting from operation of the proposed tunnel and approach roads would be less than those currently associated with the existing road. Regular traffic over the existing road between the north and south portals would cease. A coincident reduction to the extent of disruption of soil, vegetation and other habitat elements would occur. Improved habitat might result in increases to the Chukar partridge population of Lowari Pass. Over time, musk deer, marmot, monal pheasant and Himalayan snow cock might re-colonize the area. Replacement of the existing dirt road with new, paved access roads would also result in reductions in noise and air pollution impacts to wildlife habitats between Dir and the south portal and between the north portal and Ashret.

Improved All-Road Access

Approximately 250 hectares of wildlife habitat would be permanently removed during reconstruction of the existing road between Dir and Ashret and over the Lowari Pass. Forty-eight hectares of existing road would be abandoned. Impacted areas comprise alpine dry steppe, dry temperate coniferous forest, dry evergreen oak forest and agricultural field and orchard. The disturbance of soils and removal of vegetation would cause erosion and sedimentation along the length of construction. The felling of trees and removal of other vegetation would also decrease habitat quality.

Devegetation, erosion, sedimentation and roadway noise, however, have previously degraded the habitat value of areas close to the existing roadway. Observations of wildlife in the area are rare and wildlife populations are low. The impacts on wildlife resulting from roadway construction would therefore be nominal. After construction, the return of some wildlife species to marginal areas along the roadway corridor might occur to the extent that reductions in noise and airborne dust levels were experienced.

4.1.5 Aquatic Ecology

No-Action

As indicated under Water Resources (4.1.3), continued entrance of small quantities of sediment, roadway debris, road salt and oil into down-slope streams and rivers is anticipated to occur under the no-action alternative. Soil erosion and the consequent transport of sediments to waterways is a major problem throughout lower Chitral. Although the existing road through Lowari Pass aggravates this situation, its contribution to the turbidity and sediment loads of nearby streams and associated aquatic ecology impacts is probably negligible. Likewise, the significance of the minute quantities of road-derived debris and oil entering the streams is minor, having no lasting effect on the size or composition of aquatic populations and communities.

Tunnel and Approach Roads

Benthic organisms would be subject to burial by the placement of excavation materials within the channels of Nirga Khwar and Trangar Gol. Removal of aquatic organisms would also result from excavation of an open-cut tunnel across Trangar Gol (under the preferred alternative), the construction of structures within streams, and from the mining of sands and gravels in Lowari Khwar and the Chitral River. Further disruptions of aquatic communities would occur in response to changes in sedimentation and erosion patterns. Channelization of stream flows at bridge crossings, culverts and the diversion of Trangar Gol would increase water velocities and scour and could detrimentally impact the suitability of local habitats to some forms of aquatic life.

137

Disturbance of stream beds would cause temporary rises in turbidity, reducing light levels and causing concurrent reductions in primary productivity over considerable distances downstream of construction activity. This increase in the quantity of suspended particulates would also reduce the hunting efficiency of primary consumers and cause a gradual blanketing of benthic communities by a rain of fines.

Increased turbidity and alterations of erosion and sedimentation patterns would be temporary and extend only briefly beyond the five-year construction period. As particulates settle out, turbidity would gradually decrease and light levels would increase to pre-project levels. Cessation of project-related adjustments to stream cross-sections would permit the re-establishment of benthic communities.

Anticipated rates of water withdrawal to supply construction and tunnel operation requirements are not likely to be detrimental to aquatic communities.

Improved All-Road Access

No permanent impacts to aquatic organisms would occur with establishment of all-road access other than those associated with the existing, or no-action conditions. Sediment, roadway debris, road salt and oil would wash into proximate waterways in quantities of little or no significance to the functioning of benthic and pelagic communities.

Temporary impacts would comprise increased turbidity and sedimentation over already high levels. These impacts would result from slope disturbance during roadway construction, placement of structures in stream channels and flood plains, and mining of sands and gravels for construction materials. A gradual return to pre-project levels would occur upon completion of construction activities, promoting concurrent recovery of aquatic communities.

4.1.6 Socio-economics, Land Use and Infrastructure

No-Action

The no-action alternative has negligible effects on the currently small population residing in and near the Lowari Pass. Road maintenance temporarily brings in road workers; the need for more substantial maintenance to keep the road passable in the long-term would produce an incremental increase in the number of such workers. This scenario also results in negligible effects on economic activity and infrastructure.

With respect to land use, however, the no-action alternative means continued alteration and modification of the landscape in order to keep the road passable.

The no-action alternative would probably be associated with fewer accidents (vehicle collisions, load shifts and the like) compared to a tunnel with improved approach roads or to an improved all-road access. The current unsafe condition of the road with its numerous switchbacks effectively inhibits vehicles from reaching speeds that could lead to serious collision. Driving the road requires such care that most types of accidents appear to occur less than would otherwise be the case.

If the road over the pass deteriorated to a point that it could not be used by vehicles, then modifications in land use would be restricted to whatever small alterations were made by foot-travelers, presumably to facilitate their trip. There would be no vehicle accidents, but injuries or illness to foot-travelers would likely occur and there would be no quick means to transport victims to safety.

Tunnel and Approach Roads

Population. Tunnel construction would require an average of 300 construction workers (PRC 1987) over 4.5 to 5.5 years; independent estimates as high as 500-800 construction workers have been made by the EA team. Assuming the latter to be a maximum or worst-case condition, a considerable influx of construction worker population to each portal could be anticipated. In addition, relatives are likely to accompany construction workers and merchants are likely to be attracted to establish a bazaar. The Camp population at each portal is estimated at 3,000 to 4,000 persons. While there is a small village (estimated at about 500 persons) near the south side of Lowari Pass, additional population during the construction period would represent a significant change over existing conditions.

Once a tunnel is in operation, portal locations would become small centers of activity, particularly if tolls are charged, loads are inspected, or the like. The construction camp at the north portal would very probably become a permanent village, perhaps at a reduced size, to provide tunnel maintenance and service for vehicles and their occupants. For the same reasons, the existing village near the south portal would probably have a larger population after construction has ceased.

Mobile camps would also need to be established along access roads (Dir to south portal and Ashret to north portal) in order to rebuild road access that is compatible with tunnel design criteria. Temporary population increases would result in various locations.

Land Use. Alterations in land use are small, even considering the anticipated camp population of construction workers and others. Land use along the 8km tunnel corridor is limited to small amounts of low intensity agriculture, grazing and wood-gathering. Land use along the 21km road from the

139

south portal to Dir and the 7km road from the north portal to Ashret is similar to that along the tunnel corridor. An estimated 100 or so habitations scattered along the road are more concentrated along the road from the Lowari Pass to Dir. The following land use changes are estimated:

	Area of Land Use Change (ha)
Tunnel (Camp and Spoil Disposal Area):	
North Portal	7*-10
South Portal	9*-12
	16 -22
Reconstructed Access Roads:	
South Portal - Dir, 21km x 50m	105
North Portal - Ashret, 7km x 50m	35
	135
TOTAL NEW LAND USES	151-157
Abandoned Existing Road (due to reconstruction):	
South Portal - Dir, 3km x 30m	9
North Portal - Ashret, 2km x 30m	6
TOTAL ABANDONED ROADWAY	15

* Based on PRC Feasibility Study. Larger number represents potentially greater area due to larger estimate for construction camp population.

At strategic locations along approach roads to and from the tunnel, small areas may experience more intense development. A larger volume of vehicles (up to 894 per day in 1992 and over 3,000 per day by 2022 according to the PRC Feasibility Report) would increase potential demand for traveler-oriented services. The reduced length and duration of the journey, however, would largely offest the demand effect, since travelers would have less need to stop along the way. While the degree of such land use change cannot be quantified, it is believed to be of minor consequence and mitigatible through land use controls, should impacts be greater than anticipated.

Employment and Economic Activity. During the construction years, increased employment (300 minimum to 800 maximum jobs) would be available. These employment opportunities might, but would not necessarily, benefit persons of Chitral who may not have the appropriate skills and training, unless such is provided. Based on field observation and interviews with local officials, Afghan refugees currently perform road-building and repair in the Chitral District. The construction labor force could well be drawn from other parts of Pakistan or

from the refugee population. Local contractors stand to gain, assuming they sub-contract some of the work.

Some degree of multiplier effect could also be anticipated. (The multiplier effect is the extent to which initial expenditures are re-spent to create new jobs or new expenditures, i.e. for every rupee spent on construction some additional jobs and rupees worth of good and services are generated as money is recirculated in the economy. Multipliers of 1.5 to 3.0 are common in develped economies.) Taking a conservative approach (a multiplier of 0.5 to 1.0), 500 direct new jobs would be expected to create 250 to 500 additional jobs. The actual magnitude of the multiplier effect is not known for a project of this type in the region of interest. Whatever the magnitude, multiplier effects would not all flow to the economies of Dir and Chitral Districts, since both areas depend to a high degree on goods and products imported from other parts of Pakistan or other countries. Thus, a large proportion of the multiplier effects would become diluted within the much larger economy of Pakistan.

Operation and maintenance of the tunnel and approach roads would generate 50 (PRC Feasibility Study) to 100 jobs. The lower figure does not include 28km of approach roads. This permanent employment could benefit the populations of Chitral and/or Dir, if training programs are undertaken in tunnel control room operation, rescue and vehicle repairs, electro-mechanical equipment maintenance and snow plow operation.

Assuming permanent villages are established at each portal, a small number of additional long-term jobs in service-related activities can be expected. Some minor employment in establishments serving travelers may be generated along the approach roads (see Land Use discussion above).

Infrastructure. Housing, preferably in compact, multi-story structures due to the lack of available level land, would be required along with provision of lanes for access and utilities. Health care facilities and/or an emergency medical center would be highly desirable in order to prevent the spread of diseases in a relatively confined camp population living in close quarters, care for workers' health and treat accident victims. Depending on the child population accompanying workers and wives to the camps, it might be necessary to provide schools at the camp sites during the estimated 4.5 to 5.5 years of construction. (These components appear not to have been included in the design costs for a tunnel).

To protect ground and surface waters, sewage treatment and adequate water storage would need to be provided along with facilities for power generation. Fuel supplies for workers are desirable in order to avoid further use (and possible depletion) of forests for firewood.

141

Transportation and Safety. Tunnel and access road construction would create increased accident risk from two sources: accidents during tunneling and the use of heavy equipment; and vehicular accidents or collisions during the transport of equipment, people and materials to the portal sites. Safety training procedures for construction workers are recommended as well as provision for an emergency medical center and emergency transport of serious accident victims. A specialized driver training program would be needed to help reduce accidents during the transport of heavy construction equipment and materials.

During tunnel operation, the risk of accidents is an impact meriting attention. The consequences of traffic accidents would be reduced by tunnel design, e.g. provision of safety niches (included in PRC design of the tunnel) which can shelter people for a limited time and permit them to call for help. Although the proposed tunnel design does not call for safety barriers, the possibility of vehicle collisions could be reduced by the installation of a concrete barrier between the opposing lanes ("Jersey barrier"). Gaps could be left opposite safety niches so evacuation is possible to or from either portal.

Another means to improve safety is through operational measures. Speed limits must be enforced. Wreckers and ambulances, should be made available at each portal to permit orderly removal of disabled cars and injured drivers or passengers. For numerous reasons, an inspection of all vehicles entering the tunnel would be desirable. Safety checks could be made to ensure that loads on trucks are correctly stowed and properly secured, that vehicles are in acceptable condition to make safe passage through the tunnel and that highly flamable or dangerous materials are not being transported except by special convoy. In addition, an emergency preparedness plan dealing with accidents, breakdowns, spills and fire in the tunnel and along its approach roads could be formulated and rehearsed on regular schedule. A clean-up plan is warranted as well to re-establish traffic flow and minimize the possibility that an accident and/or spill induces or creates additional accidents.

Approach roads need to be kept free of snow and/or sliding rock and debris with a fleet of maintenance equipment. The re-design of the roads must provide for structures which shield roads from avalanches and protect them from rock slides.

Along approach roads, accidents would likely be greater than existing conditions. Although the road would have an improved surface, fewer switchbacks and easier turns, this improved design would permit higher speed and the road would carry more traffic. Higher speed and more traffic creates the likelihood of more accidents. Tunnel accidents, spills and tunnel panic reactions could be diminished by the preparation and implementation of a driver awareness program to educate drivers and familiarize them with the hazards of driving in a

long tunnel. Such instruction and appropriate literature could be distributed to trucking firms, government agencies and at checkpoints along approach roads.

Improved All-Road Access

Population. Building an all-road access is estimated to require a work force of about 600 men over a period of four years (for the longest stretch of highway) to seven years in all. Owing to the seasonal nature of highway construction (particularly in the section over the Lowari Pass) and the fact that operations would move along a 50 km stretch of road (from Dir to the pass, through the pass and to Ashret), mobile camps are likely to be established. Camp population would remain in any one place for a relatively short time period, reducing the likelihood of large permanent camps attracting followers and families. Lowari village, however, would probably be a likely place for mobilization of activities and could be expected to experience population growth. Other strategic locations might attract sufficient population during construction and afterward, assuming a higher volume of vehicles, to result in small permanent settlement(s) providing services to travelers.

Land Use. Construction of an improved all-road access would result in land use changes affecting the following areas:

	Area of Land Use Changes (ha)
Reconstructed/New Access Roads:	
Dir - South Portal, 21 km x 50 m	105
South Portal - Lowari Pass, 10 km x 50 m	50
Lowari Pass - North Portal, 12 km x 50 m	60
North Portal - Ashret, 7 km x 50 m	35
TOTAL NEW LAND USES	**250**
Abandoned Existing Road:	
Dir - South Portal, 3 km x 30 m	9
South Portal - Lowari pass, 1 km x 30 m	3
Lowari Pass - North Portal, 10 km x 30 m	30
North Portal - Ashret, 2 km x 30 m	6
TOTAL ABANDONED ROADWAY	**48**

Operation and maintenance of an improved road access would initially affect the same land area as that impacted by construction. Increased traffic at the volume projected in the PRC Feasibility study could result in demand for additional roadside business to serve travelers, resulting in minor additional changes of vacant or farm land use to commercial/retail nodes. As noted earlier, how-

143

ever, the shorter trip would diminish the need for such business.

Economic Activity. Construction employent opportunities in road-building are estimated at 600 jobs over a four-year period. Expected long term employment for road operation and maintenance is 50 jobs. Previous comments with respect to direct effects on the Chitral District employment, multiplier effects and training programs apply to the road as well as the tunnel alternative. Along the roads, particularly in strategic locations where traveler-oriented business is suitable, additional minor employment opportunities may be generated.

Infrastructure. Infrastructure requirements for an improved all-road access are fewer compared to a tunnel, since construction camps are more likely to be mobile. Because infrastructure is lacking, portable sanitary facilities and arrangements for transport to emergency medical facilities would be needed. If permanent camps are established in selected locations for mobilization purposes, e.g. at Lowari village, facilities for water, sewage disposal and housing should be considered.

Transportation and Safety. Accident risks would be associated with construction of an improved all-road access. The absence of tunneling reduces the risk of major and serious construction accidents, but the risk of accidents during the transport of construction materials and equipment remains and a driver safety training program would still be needed.

Once improved road access were available, there would be more road accidents (vehicle collisions, load shifts and the like) than is currently the case. An improved road would permit a higher volume of traffic to operate at faster speeds. A more safely designed road would reduce the need to stop or slow down at switchbacks and would diminish inhibitions associated with the hazardous condition of the existing road. Drivers could more easily exceed speed limits or ignore precautions necessary on any mountain road. A driver awareness program merits consideration.

4.1.7 Agriculture and Livestock

No-Action

This alternative would have negligible effects on agriculture and livestock grazing, except that road maintenance would result in alterations to the landscape, somewhat diminishing the land available for grazing in mountainous terrain. In the long-term, were the road to progressively deteriorate to a condition permitting only foot traffic, more area would be available for grazing.

144

Tunnel and Approach Roads

There are a few small patches of agriculture along the roadside that would be impacted. The hillsides along the Lowari Pass are used for grazing of livestock, mainly goats. Change in grazing area, however, would be minimal and the quality of the pasture is marginal.

Improved All-Road Access

Minor losses of agricultural and rangeland uses are anticipated due to road construction (see 4.1.6, Land use).

4.1.8 Forestry

No-Action

No impacts on forestry are predicted. Incremental felling of trees would occur in conjunction with road maintenance and modification of switchbacks as they deteriorate. In the longer-term, if the road became passable only for foot-travelers, even less pressure on the forestry resource would be experienced.

Tunnel and Approach Roads

There could be some cutting of timber on the approach roads and over the pass with construction of a tunnel and approach roads, due to the increased presence of population. Although timber would be required in construction of the camp or in the tunnel, it could be obtained through timber auction. The allowable cut of trees in Chitral is regulated by a management plan and there is little illicit felling (estimated at less than 5 percent of the cut). However, the cheaper cost of cutting on the Chitral side relative to the Dir side could also create extra pressure on remaining forest in Chitral.

Sanctions against tree cutting would be needed in order to inhibit the construction camp's population from cutting trees for firewood. Provision of heating and cooking fuel to workers would eliminate the temptation to cut wood for those purposes.

The risk of forest destruction because of fire would be increased with more traffic and the presence of more people. Cautions (and fines) against throwing lighted cigarettes out of vehicles or building fires along the road should be incorporated into a driver awareness program.

Improved All-Road Access

Similar effects on forestry as described above are anticipated. If a roadway were to replace the proposed tunnel, pressure on the forest may be reduced in the specific vicinity of tunnel portals, but pressure to cut forest along a greater

145

distance of roadway would be expected. Similar methods, including sanctions on cutting, to reduce impacts would be appropriate.

4.1.9 Tourism

No-Action

Lowari Pass is, in itself, a modest tourist attraction. Although the police do record the number of people crossing over the pass, it is not possible to determine how many of these are tourists attracted to the pass itself. Continued use of the existing road over Lowari Pass would maintain its current appeal to tourists, at least until the road is no longer serviceable by jeeps, in about 10 years, if existing levels of maintenance are continued. If permitted to deteriorate to a condition suitable to foot traffic alone, the track over Lowari Pass would be accessible only to trekkers.

Tunnel and Approach Roads

Substitution of the current road over Lowari Pass with the proposed tunnel would reduce tourist access to the high mountain pass. Only trekkers and those tourists who could arrange transport to by-pass the tunnel via the service road would gain access to Lowari Pass. Other tourists might, however, choose the easier vehicular access instead of air transport.

An eight-kilometer long tunnel would, in itself, represent a lure to tourists and to the curious, partially compensating for the losses engendered by reduced road access. One would anticipate that the presence of a tunnel would generate many official visits by dignitaries and representatives of government agencies in Pakistan and from abroad.

Improved All-Road Access

Reconstruction and improvement of the existing road would facilitate tourist access to Lowari Pass. Provision of a modern, paved road, however, may reduce its attraction to some fraction of tourists who prefer the dusty, rugged switchbacks of the existing track.

4.1.10 Paleontological, Archaeological and Historical Resources

An examination of the Lowari Pass tunnel alignment, approach roads, and all-road access brought to light no evidence of paleontological deposits or of archaeological or historical sites. Construction is not expected to affect these sensitive sites, whatever the alternative. Since archaeological and historic resources are typically specific to location and since an all-road access has not been geographically pinpointed, the possibility exists that this alternative might

146

encounter such resources. Mitigation or avoidance is usually possible during roadway design or construction.

Indeed, unanticipated archaeological or historic resources are often uncovered during construction of major projects affecting a relatively large geographic area. Precautions, therefore, are recommended; awareness on the part of construction managers and coordination with GOP and university experts are suggested.

4.1.11 Mineral Resources

No-Action

Mineral resources would not be directly affected by this alternative. One could expect use of available minerals and building materials in road maintenance/rebuilding. If, however, a current mineral prospect in the vicinity of the road were to become a proved and economically important resource (changed world market conditions or the like), the no-action alternative would be a severe constraint on exploration.

Tunnel and Approach Roads

A mineral resource which could be directly impacted near the Lowari Pass or approach roads is calcium carbonate. High content calcium marble near Ashret on the northern approach road could be mined for portland cement to be used in road, bridge, and tunnel construction. (This material could also be useful as crushed stone for road metal.) According to the PRC report, cement can be delivered in bulk to Dir; five state factories exist as well as a private enterprise near Peshawar. The likelihood of cement-related mineral extraction in Chitral would depend upon market conditions and the inclinations of the construction contractor. If a cement plant were to be built, it would more likely be on the Dir side where there is easier access to fuel.

Crushed stone, whether from marble or granite, would likely be used as road metal in construction and upgrading of tunnel approach roads. Sand and gravel deposits near the tunnel would be used in the production of concrete. Since resources are large, their use for tunnel and road construction is unlikely to cause depletion. Dust and noise would be produced in extracting road materials. Large-scale sand and gravel mining would also increase silt quantities in streams (see Water Resources, 4.1.3 and Aquactic Ecology, 4.1.5).

Improved All-Road Access

Primary impacts related to construction, operation and maintenance are similar to those described for the tunnel alternative. Chitral-derived materials for road metal would probably be used, assuming competitive cost. Since such materials are plentiful in the general vicinity, then use seems probable.

4.1.12 Aesthetics

No-Action

The visual condition of the existing road would remain largely as it is today. As the road deteriorates, areas may experience increased visual effects resulting from a deteriorated and unsightly roadbed, increased landslides, rock falls, and washouts. Modifications of the landscape would also occur in conjunction with regular maintenance of the road due to the fact that such maintenance requires alterations to switchbacks.

Tunnel and Approach Roads

The visual impact of the tunnel would be relatively small, assuming sensitive disposal of the spoil material. Approach roads would probably have the greatest visual impact. The degree of visual impact would be determined by the route chosen and the types of cuts and fills used along the roadway. Additional visual impacts might occur as a result of the land use alterations in the environment and increased presence of people.

Improved All-Road Access

The impact of an all-weather road would depend on the alignment chosen, extent of widening of existing road and types of cuts and fills. If the rugged topography were dissected with large cuts and fills, visual impacts would be substantial. Visual impacts from snow fencing are judged to be minimal.

4.1.13 Noise

No-Action

Noise impacts would continue to be negligible due to the small volume of traffic, the paucity of population and the lack of sensitive receptors other than wildlife.

Tunnel and Approach Roads

Construction noise associated with blasting, tunnel excavation, rock removal, and operation of heavy equipment would represent a considerable change over existing conditions. The principal affected population would be involved in the construction activities. Noise impacts during construction of the tunnel could be minimized by the use of baffles and mufflers and workers in the tunnel or outside would wear ear protectors.

Noise from road construction would be minimized whenever possible by the use of equipment mufflers. Furthermore, machinery operators could wear ear protectors. There are

148

few people living near the pass so that disruption or annoyance to the general population would be minimized.

Operation and maintenance of a tunnel and approach roads are not expected to generate noise impacts of any consequence.

Improved All-Road Access

Impacts are similar with respect to road construction. In absolute terms, construction activities would generate less noise, since extensive tunnel blasting and heavy equipment use are comparatively less. As for a tunnel and approach roads, mitigative measures could be implemented to reduce the effects of noise on construction workers.

Operation and maintenance of all-road access are not expected to produce noise impacts of consequence.

4.2 Secondary Impacts of Improved Access

Secondary impacts of improved vehicular access to the Chitral Valley for tractor-trailers capable of carrying 70-ton loads development would not generally differ whether access is via a tunnel and rebuilt approach roads or via a rebuilt/newly constructed road.

The principal difference between alternatives is that an all-road access is more likely to be closed for a longer duration than a tunnel alternative, because of weather problems and snow removal. It is estimated that an approach road to a tunnel would be closed four to five times per season for approximately one to five days or four to 25 days on an annual basis. An all-road access alternative would be closed for four to five one-to-two-week periods or approximately one to two months on an annual basis. While this difference is not sufficient to create major differences in environmental impacts of secondary development, a longer potential closure does represent a risk with respect to the strategic and military purposes of improved access.

It is important to realize, in judging secondary impacts of improved road access, that access in and of itself is only a precondition for certain kinds of development: an endowment of developable resources must also be present and, when present, they must be economically exploitable. With respect to social or other services provided by the public sector, improved access may facilitate their delivery, but does not increase their funding level. The likelihood of development in Chitral, its nature and magnitude is based upon the economic feasibility analysis (Appendix F). Further detail on social impacts is contained in the social soundness assessment (Appendix G).

4.2.1 Air Resources

No-Action

Total emissions from the two major air pollution sources in the Chitral Valley, burning wood for fuel and exhaust fumes from diesel and gasoline engines, would continue essentially unchanged under the no-action alternative, provided the road over Lowari Pass is maintained at the current level of service. If, however, the road were permitted to degrade to a condition serviceable only to jeeps or impassable to any vehicle, (anticipated in 7-10 years at current levels of maintenance) exhaust emissions in the valley would be substantially reduced.

Improved Access

Secondary impacts of improved access on air resources would be minimal. Air pollution from an increased number of vehicular sources would not represent a significant increase in pollutants and would probably be offset through use of bigger, newer trucks and better maintenance.

Possible new sources of air pollution could come about, if there were large-scale mining, smelting/refining operations, or manufacture of cement and related truck traffic. Current information on mineral reserves and the economic feasibility of their exploitation suggests, however, that neither large-scale mining nor smelting nor refining industries are likely to develop in the valley. Examination of mineral resources of the valley indicates a large variety of prospects, but very few (only sand, gravel and other materials for road construction and, in the long-term, marble) have sufficiently large tonnages, are in such high demand and/or are so easily mined that exploitation in the near future is likely. In any case, mitigative measures for point sources related to mining or associated activities could be included in the design of new facilities, should prospects become viable (see 4.2.11).

4.2.2 Geology, Physiography and Soils

No-Action

The impacts of the no-action alternative on the geology of the Chitral Valley would include the continued mining of metallic and non-metallic minerals, clay, sand, gravel, slate and other building stone. Although periodic changes in the character, volume and location of mining activities would occur, major expansions of existing mines or the opening of high-volume mines are not anticipated. The potential closure of Lowari Pass to vehicular traffic would reduce the extent of mineral exploration and any likelihood that prospects would be determined to be sufficiently large or valuable to warrant exploitation.

-15D

Geomorphologic impacts would be closely tied to changes in economic sectors, especially mining, agriculture, livestock and forestry. Soil erosion and sedimentation impacts due to mining practices under the no-action alternative would be a continuation of the current pattern of scattered sources, covering small areas and contributing generally low volumes of erosional materials to downslope watercourses. Expansion of irrigation, agriculture and farm woodlots and improvements in agricultural practices expected to result from the IFAD/ADB Chitral Development Project (see 4.2.7) would improve the soil retention potential and, perhaps, increase the rate of soil genesis of some marginal lands throughout the river valleys of the District. Overgrazing of alpine and forest livestock pastures and continued over-cutting of forests, however, would aid in perpetuating the chronic loss of previously productive land to erosion. The sedimentation of watercourses and irrigation ditches characteristic of the last several decades would also continue.

Improved Access

Anticipated changes in the mining industry with improved access to the Chitral Valley are discussed at 4.2.11. Although increased exploration and investigation of many prospects are predicted, the commercial exploitation of only a few minerals appears likely. Disturbance of soil and vegetation during both exploration and any subsequent exploitation would contribute to erosion and sedimentation in localized areas, but such effects could be mitigated. Since improved access is not expected to have any significant impact on the expansion of agriculture or livestock grazing, there would be no geomorphologic impacts as a result of more extensive use of land for these purposes. To the degree that the IFAD/ADB project were more successful as a result of better access, erosion control practices could become more widespread.

Increased commercial exploitation of forests could result from reduced transport costs (see 4.2.8). In the absence of suitable controls, any increased rate of commercial extraction would lead to expansion of deforested area and further erosion. The success of the IFAD/ADB village woodlot program would help to reduce deforestation caused by cutting of forests for domestic purposes.

4.2.3 Water Resources

No-Action

Maintenance of existing access to Chitral would result in the continued entry of sediments, road debris, oil, agricultural chemicals, human and animal wastes into surface waters, as well as agricultural chemicals and petroleum-related wastes into groundwater. Sediments from farms, roads and barren hillsides would continue to add to the turbidity of streams and irrigation ditches, requiring the periodic clearing of the ditches. Untreated human and animal wastes and road-derived

151

oils would add to the degradation of surface waters. Petroleum spills are currently evident at filling stations and automobile repair shops. Continued groundwater pollution from these sources would occur. If the road over the pass deteriorated to the point where it were no longer passable, then vehicular sources of pollution would be substantially reduced.

The IFAD/ADB Chitral Area Development Project would promote the use of fertilizer and agricultural chemicals throughout the cultivated areas of Chitral District. Although rainfall is low in Chitral, irrigation will carry a large proportion of these chemicals into some of the streams and lakes of the district. It is anticipated, however, that the quantities of agricultural chemicals in use in the district would be relatively small, even after initiation of the IFAD/ADB project. To the extent that existing access conditions restrict the availability of fertilizer and chemicals, impacts would be even smaller.

Improved Access

If there were an increase in the rate of commercial forest resource exploitation (see 4.2.8), deforestation would result in decreased infiltration and increased erosion. Transported sediments would contribute to the turbidity of streams and the sedimentation of irrigation ditches. Similar impacts would occur in response to anticipated mineral exploration, any expansion of mineral exploitation and any associated road building or infrastructure construction. These localized impacts could be mitigated.

With regard to impacts on water supply and distribution, see 4.2.6. Although use of fertilizer and chemicals, as stated above, is expected to increase, training in appropriate application of products is expected to be part of the IFAD/ADB package.

4.2.4 Terrestrial Ecology

No-Action

As discussed at 3.4.4, the effectiveness of the Chitral Wildlife Division is hampered by the isolation of Chitral and the resultant resistance of NWFP officers to being stationed or performing inspections in the valley. Under the no-action alternative, no change to this situation is anticipated for an approximate 5-year period during which the existing road over Lowari Pass would remain serviceable to trucks or jeeps. If in 5-7 years, jeeps could no longer traverse the pass and the track were eventually reduced to a footpath, the relative isolation of Chitral would be greater and the effectiveness of the Wildlife Division would be further compromised.

Further deterioration of the road between Dir and Ashret and any ultimate closure of the pass to trucks or even to all vehicular traffic would greatly reduce the number of

152

vehicles on the roads of the valley, leading, perhaps, to fewer and a smaller extent of passable roads. The resultant decrease or elimination of vehicular traffic from the roads of Chitral would reduce disturbances to wildlife habitats due to road noise. Likewise, the accessibility of more remote habitats would decrease and stresses on those habitats from hunting, trapping, commercial forestry and firewood collection would be alleviated.

Improved Access

Chukar partridge occur and are currently hunted along the road between Dir and Lowari Pass. The extent of this hunting and its impact on the local partridge populations are not documented. Improved access on the Dir side of the pass may increase hunting pressures in areas adjacent to the road. The high levels of use of firearms observed in these areas during field investigations on September 3, 12 and 28, 1987, however, suggest that hunting pressures may also be high and that significant increases are unlikely.

Improved access to Chitral Valley may have severe, detrimental effects on wildlife populations due to increases in hunting. With the onset of winter, many of the large herbivores and predators of Chitral migrate to lower elevations where they are closer to human populations and more susceptible to hunting pressures. Vehicular access to the valley during the winter would subject markhor, ibex, urial, musk deer and wolf, in addition to other species to increases in legal hunting and poaching by hunters from outside the district. These increases would occur during the period most critical to the viability of these wildlife populations.

Markhor populations in lower Chitral and, to a lesser extent, ibex in upper Chitral would be likely to sustain the greatest pressure. Falcon trapping in Chitral, currently limited by the inaccessibility of the valley during winter, would also increase. No increase in subsistence hunting is anticipated. The greatest pressure would come from legal hunting and poaching by sport and professional hunters after trophies, including skins, horns, musk pods and plumage.

It is expected that the Chitral Wildlife Division would be subject to greater demands for expanded hunting quotas and be increasingly burdened by the duty of enforcing those quotas as poaching became more widespread and frequent. The ability of the division to respond effectively to these pressures would to a great extent determine the fate of wildlife in Chitral.

Improved access might enhance the desirability of being posted to the district and thereby improve the number and quality of forest and wildlife officers willing to serve in the valley. The frequency of administrative inspections by senior officers of the Forest Department in general and the Wildlife Division in particular might increase. Ultimately,

these improvements could facilitate the implementation of research and development programs to manage Chitral wildlife and wildlife habitats effectively.

As discussed at 4.2.6, no increase in population and no significant increase in traffic are expected to occur in Dir or Chitral Districts in response to improved access to the valley. Although improved access would result in the gradual increase of vehicle use throughout much of the valley, actual increases in traffic volumes would be minor and would not contribute greatly to the current low numbers of road kills. Road kill numbers are most directly influenced by the size of wildlife populations, their seasonal or diurnal movements, and their timidity toward human populations and activities, factors which are not affected by changes in traffic volumes.

With the IFAD/ADB project, approximately 3,400 hectares of otherwise arable land would be brought under irrigation and another 3,000 hectares would receive additional irrigation water, but this change would not occur in response to improved access in particular. Much of this land is currently barren waste, inhospitable to most species of wildlife and its conversion to agricultural lands would generally benefit wildlife, providing sources of seeds and berries to birds and small mammals and winter forage and cover to herbivores.

The use of agricultural chemicals in Chitral would increase under the IFAD/ADB Chitral Area Development Project, regardless of improved access. The actual quantities applied would still be relatively low. No major increase in livestock numbers is expected to result from improved access. (The IFAD/ADB project is directed toward improved and expanded animal health facilities, as opposed to increased size of the herds, but success in limiting livestock numbers will be difficult.) Although competition with domestic livestock is currently a major problem for Chitral wildlife, this situation would not be aggravated significantly by improved access.

No increase nor decrease in the domestic demand for firewood or timber is anticipated as a result of improved access. The forests of Chitral are currently being exploited at a rate in excess of their capacity. The future of these forests and the wildlife dependent on them will be determined by the decisions made by the Government of Pakistan regarding the management of these resources and would be independent of project development.

Stepped-up mineral exploration would subject wildlife and wildlife habitat to increased disturbance, often in locations previously beyond significant human incursion, due to their remoteness. These disturbances of wildlife habitat and consequent disruptions to the movements and activities of wildlife would be relatively short-lived and recovery rapid. If new mines and requisite infrastructure were developed, impacts would be more severe and of longer duration. The extent and character of these impacts, however, would be specific to the

154

location, scale and constitution of the mining operations; impacts on wildlife and mitigative measures would be addressed best in an environmental assessment required for each mine developed.

4.2.5 Aquatic Ecology

No-Action

The continued deforestation of Chitral will exacerbate the already chronic erosion of the mountain slopes and sedimentation of the streams and rivers. Currently, large banks of sediment clog large extents of the rivers of the valley. Despite anticipated expansion in the use of agricultural chemicals under the IFAD/ADB Chitral Development Project, overall use in the district will remain relatively small and no impacts to the integrity of the aquatic communities should occur. If the road over the Pass continued to deteriorate to the point where it were no longer passable, then any current stress on aquatic communities due to vehicle pollutants would be reduced.

Improved Access

Sources of pollutation would remain small. Improved access would not result in increased use of agricultural chemicals over those anticipated by the IFAD/ADB project. No increase in pressures on either the trout or indigenous fisheries are expected. The rates of exploitation by subsistence fishermen or tourists would increase only nominally and no expansion of the trout hatchery facilities would be required.

The entry into watercourses of petroleum and oil from roadways, filling stations and automobile repair shops might increase in response to increased vehicle use. These pollutants would emanate from scattered, non-point sources and would therefore be difficult to control. The minor quantities of contaminants released, however, would not harm aquatic species or compromise the integrity of aquatic ecosystems. Any increase in commercial exploitation of forests due to lower transport costs would have deleterious effects on streams and rivers which already suffer from effects of erosion and sedimentation; existing sanctions against tree-cutting and a forestry management plan need to be maintained.

4.2.6 Socio-economics, Land Use and Infrastructure

No-Action

Population. The no-action alternative poses no likelihood of short-term alterations in existing conditions, but has serious long-term implications for the valley's population. Lack of improved access would mean continued winter shortages of commodities, continued isolation during winter and continued logistical problems associated with delivery of social services, travel of government personnel and transport of

equipment. If the current levels of repair and maintenance were continued and not increased, the road over Lowari Pass would not be usable by vehicles in 7-10 years. In such a situation, it would not be surprising to experience population loss through permanent out-migration. Winter shortages and deficits, if not remedied by airlift, would potentially contribute to increased malnutrition, sickness or death. Social services for the population would likely deteriorate, since an assignment to Chitral would become even less attractive than it is now and pose even more difficulties of coordination with provincial headquarters.

The no-action alternative would greatly intensify the psychological aspects of isolation. From a socio-political viewpoint, this alternative would have strong strategic and symbolic disadvantages, creating fears about security and contributing to disunity with the rest of Pakistan.

Land Use. The no-action alternative would result in negligible effects on the existing land use pattern. If the road over Lowari Pass were to deteriorate to the point of becoming unusable, commercial exploitation of forests would no longer be viable and less deforestation would be expected. If sufficient out-migration were to occur, less land for cultivation and livestock grazing would be needed and as a consequence man-induced pressures on wildlife habitat would be reduced.

Employment and Economic Activity. In the short-term, little change would occur. In the long-term as vehicular access into the valley deteriorated, commercial activities would likely decline, export of logs would no longer be possible and increased transport subsidies would be needed to permit grain, petroleum or other commodities to enter the valley. The existing subsistence economy would become more isolated from the economy of the rest of Pakistan.

The IFAD/ADB development project would have much reduced chances for success. This project's economic feasibility relies heavily on producing a marketable surplus of fruit. Agricultural inputs of fertilizer, chemicals and seed would not be obtained (except with much higher transport cost) and fruit could not be transported by truck to markets outside the Chitral Valley. Similarly, the component of the project directed to increased cereal production for local consumption would be more difficultly accomplished, because of problems in obtaining agricultural inputs.

Infrastructure. Little change would occur immediately; as the road over Lowari Pass deteriorated, it would become more and more difficult and expensive to transport spare parts or equipment for water supply or power generating facilities. IFAD/ADB plans for improved Chitral town water supply and expanded village water supplies would be more costly to achieve as would proposed hydropower development sponsored by the Federal Republic of Germany. Social services as well as facilities like schools, hospitals and health centers would

suffer even greater lack of support and government officials providing services would presumably be more reluctant to be posted to the area.

Improved Access

Population. No previously unexploited sectors of the economy are projected to grow substantially as a result of improved access; thus, there is no rationale for predicting increased population as a consequence of in-migration to Chitral in pursuit of new or expanded opportunities. While it has been suggested that more Pathans from Dir District would find improved access an advantage and might engage in more business to the disadvantage of the current population, Pathans already play a role in commerce (see Appendix G). In any case, potential opportunities for merchants would probably not generate much population growth.

The access project does not provide long-term, in-district jobs to deter out-migration. To the extent mineral prospects proved exploitable and/or more employment opportunities in this sector or in trucking and commerce become available, better access could help stem out-migration, both long-term and temporary. Easier entry into Chitral, however, also means easier exit from Chitral. As reported to have been the case when access was improved into Gilgit, out-migration could, indeed, increase. Improved access would mean an easier search for jobs outside the district and out-migrants would find it easier to make return visits to their families. It is therefore possible that out-migration could increase, resulting in reduced population growth.

No change in the rate of natural increase is predicted. Health facilities are currently available in Chitral and the population does not generally rely upon obtaining health care outside the valley, except in rare instances. Improved access would facilitate availability of medical supplies in winter, encourage health workers to remain at post and make posting to Chitral more attractive. Despite these benefits to health care, improved access would probably not contribute appreciably to a lower death rate. (In isolated cases, easier emergency transport to facilities outside the valley would mean, of course, that some individuals would not die.) Improved access does not remedy sanitary conditions nor the level of health care funding that would be needed to reduce the death rate. There is speculation that improved access in winter would provide new opportunities and reduce isolation such that fewer children would be conceived. Even if the premises of this reasoning were correct, the majority of the population would probably not alter their behavior; either they lack resources to travel or purchase more consumer goods or they reside in valleys which would still remain isolated from improved access over Lowari Pass. Thus, it would be unwarranted to project a lower birthrate. In the long-term, the presence of improved access would facilitate introduction of services and

157

programs which could contribute to both lower birth and death rates.

Social impacts would be selective depending on a person's livelihood and income. For government employees, easier travel to and from Peshawar would facilitate administrative work; public services, on-going assistance programs or conservation efforts would benefit as well as any planned future programs. For farmers, greater opportunities to export produce would be present, but Chitral products must also become competitive with other sources. For consumers, improved access would reduce costs (to a limited degree) of imported goods and shortages that lead to price inflation at the end of winter. Fewer logistical problems of transport would be encountered and a greater variety of goods could become available to a small minority of the population with sufficient income. To the extent more goods were imported or exported, merchants and transporters would benefit.

Enhanced political security would be assured by all-season access. Greater political integration of Chitral District into the country of Pakistan would result. These strategic and symbolic benefits are of particular importance, given the region's history. As stated in the scoping sessions (Appendix C), the psychological impact of year-round access is perceived to be highly important, e.g., year-round freedom to move in and out more easily, to visit the exterior and to receive visitors and family members returning from work outside. These social benefits cannot be quantified in economic terms, but neither can such advantages be ignored in appraising the project.

Other social impacts, such as incidence of impacts on women and on the Kalash minority group are further described in Appendix G.

Land Use. Potential sources of land use change include: more cropped land, additional urban development or industrialization, large-scale mining, more rangeland or increased commercial exploitation of forest. For various reasons, explained below, potential changes would either not occur or would be so marginal that they would not alter the overall land use pattern.

Assuming the IFAD/ADB project brings under irrigation the relatively small area of remaining land suitable for agriculture, the land use pattern will become more or less fixed. The small size of landholdings and their distribution along the river valleys do not permit extensive agricultural development. While the fear has been voiced that outsiders would buy up land, the distribution of arable land and ownership by many small landholders would make it difficult to consolidate a large holding. Improved access in conjunction with the IFAD/ADB project would stimulate farmers to grow more fruit as a cash crop. Increased planting of fruit trees would probably take the form of incremental increases in trees on each

158

property rather than conversion from grain or vegetables to orchard. The net effect would be more intense use of the limited land suitable for cultivation.

The access project's relatively small impetus to tourism would generate little land use change other than some additional structures in Chitral town and some development along the valley's interior access roads in conjunction with increased travel. Minor amounts of roadside development could be expected in light of IFAD/ADB plans for improved road links industrialization within the valley.

No residential or commercial building boom and no industrialization are anticipated, since no resources to stimulate such development are present.

If one or more mineral prospects were realized and were economically competitive, mining would represent the most significant possibility for land use change. Current prospects, however, do not suggest any immediate change. Improved access would certainly be a stimulus to mineral exploration and contribute to some minor changes in land use during exploratory operations (see Mineral Resources, 4.2.11).

Increased numbers of livestock are possible and even likely, despite efforts of the IFAD/ADB project, but would not be a result of improved access. Although increased use of land for grazing is therefore expected, the IFAD/ADB project will expand production of fodder crops which may help to limit overgrazing.

Commercial forestry exploitation is expected to continue as in the past assuming the current management plan is followed or to decline, if a more restrictive management plan were adopted when the current plan is revised in 1988. The possibility also exists that lower transport costs would lead to illegal felling of trees or pressures to increase the allowable cut. In this event, existing forest would be lost with consequent implications of erosion, stream siltation and effects on aquatic and terrestrial ecology. While these three possibilities present quite different scenarios for forestry exploitation, the effect of each on the overall land use pattern is minor. The amount of remaining forest in Chitral District is already very small. Either the small forested areas will continue to become depleted if current trends continue, disappear if more is cut, or be permitted to regenerate in areas where they now exist.

Employment and Economic Activity. The authorities of both Chitral District and the NWFP Government in Peshawar are of the opinion that construction of improved access to the Chitral Valley will lead to a major increase in economic activity. This conclusion is not self-evident. In the present situation, transport costs are high as the result of the difficult access and, for the same reason, shortages occur in the winter. The reduction in transport costs and the alleviation

159

of shortages brought about by the project would benefit the population, but there is no reason to believe that new economic activity would be stimulated or that an investment boom would occur. The Chitral District is poor, because of its dependence on limited agricultural resources, a situation which enhanced access does not alter.

Improved access would complement the IFAD/ADB Chitral Area Development Project, which is expected to bring an additional 3,400 ha of land under irrigation and a near doubling of fruit production.

The mining sector offers the most potential for generating economic activity. Initially, there would only be increased exploration, generating little extra employment for the local population. In the longer term, exploration might lead to increased mining activity and employment. However, feasibility studies on the prospective mining projects, taking into account world market conditions for a particular mineral, would be needed before economic activity could be forecast.

There is no long-term potential for an increase in the output of forestry as the result of the project, even if forest exploitation were accelerated in the short-run.

A small increase in the number of tourists entering the valley is likely. This increase would be absorbed without any increase in infrastructure, but it should generate some small increase in employment in hotel and related industries. Additional jobs in trucking and commerce are likely along with a short-term stimulus to local construction, if local contractors gain some of the road improvement work.

Given the area's resources, these would be no manufacturing or industrial development.

Improved access together with the ADB Chitral Valley Project should generate some 64.85 million Rs worth of benefits (3.8 million US $) each year. Improved access would complement this investment in an important way.

Appendix F presents the economic benefits of the project in greater detail.

Transportation. The most important alteration to the existing transportation system is, by definition, improved access to the Chitral Valley. Traffic volume, however, would increase slowly. Impacts of improved access to the Chitral Valley would be positive. Clearly, year-round access, either through a tunnel or by way of an improved road over the pass would enhance the aspects of daily life in the valley.

Improved access would result in a transportation system capable of delivering goods and services to Chitral town during most of the year. Improved access would allow the internal transportation system to be utilized more effectively.

160

The upgraded Chitral-Booni road (planned as part of the IFAD/ADB project) together with improved Lowari access would provide a complete all-weather link capable of carrying truck traffic from Dir to the upper Chitral Valley. The flow of goods, particularly fertilizers, insecticides and medications as well as basic staples and consumables, could reach the valley's population without the present annual shortages.

Improved access, a result of the combined effects of this project and the IFAD/ADB project would also permit export of increased fruit and nut production.

The Draft Feasibility Report provides the following traffic projections (PRC 1987, Table 3.8, page 3-7):

Year	Growth Rate	Total Traffic (Both Ways)
1985	10%	459
1992	5%	894
2002	4%	1436
2012	3%	2352
2022	1%	3140
2035	-	3556

These projections are predicated on a base-line population in Chitral of 325,000 for 1985 (PRC 1987, Table 3.3, page 3-2), which is considerably higher than the estimated 1987 population of 251,000. Socio-economic growth scenarios, namely increased standard of living and industrial development, which were utilized to estimate future increases in goods transport and traffic, may also have been more optimistic than those assumed in this EA and in the Economic Feasibility Analysis. [The number of vehicles derived from traffic counts performed between May and August 1987 was 401 (PRC 1987, Table 3.5, page 3-4).]

Health and Education. The long term effect would be beneficial for both health and education in the valley. Special drugs, blood serum or medical supplies in general could be delivered at lower cost during winter or could be more quickly available via an alternate route when planes could not fly. Improved access would facilitate transport to outside facilities for emergencies or specialized care and benefit a small portion of the population who could afford the cost.

The availability of all-season vehicular access would reduce the constraints of isolation during the long winter period. Based upon contacts with residents and government officials (see Appendix G), government employees in health care and education as well as other sectors would experience fewer logistical constraints associated with their duties, would be more willing to accept posts in such an outlying area and would find conditions more conducive to having their families accompany them. Increased ease of contact with headquarters and

enhanced coordination of social services could also be expected.

Power and Energy. Increased electrical power to Chitral Valley would depend on actual availability of a 66 kv line which is assumed to be available as part of the tunnel alternatives, but is not part of its design or scope of action (see 2.3 and 3.6.4).

Increased development of hydropower has been assumed in planning for the IFAD/ADB Chitral Area Development Project, since connection to the national power grid is considered impractical and expensive. In this scenario (no 66 kv line), improved access would only indirectly benefit hydropower facilities to the extent that transport of parts and equipment would be easier. The recurrent problem of lack of spare parts is, however, not simply lack of access to Chitral, but lack of their availablity in Pakistan.

Water Supply and Sanitation. Improved access would have indirect effects, e.g. easier transport of parts and equipment for the installation of new water supplies or repair of existing water systems.

Village Infrastructure. Improved access would facilitate implementation of village infrastructure associated with the IFAD/ADB development program, e.g. village water supplies, village woodlots, irrigation schemes and village link roads. Supplies and equipment could be more easily transported. Link roads plus the upgraded Booni to Chitral road in conjunction with improved Lowari Pass access would provide a superior means of integrating Chitral District's villages into the economy and politics of Pakistan.

4.2.7 Agriculture and Livestock

No-Action

The future of agriculture under the no-action alternative is the continuation of existing conditions and their improvement by the IFAD/ADB Chitral Area Development Project, to the extent project plans can be accomplished without improved Lowari Pass access. This project aims to: increase cropping intensity to 153 percent; increase yields by 10 to 50 percent according to crop; increase cultivated area to 23,500 hectares; more than double cereal production (to a level of self-sustainment for the District); and double fruit production. The use of fertilizer in the IFAD/ADB project is expected to grow from 1300 mt to 3900 mt (an average increase of 8 percent per year compared to 5 percent per year currently). Improved seed is expected to grow in volume from 21 mt to 850 mt at full project development. The use of chemicals is also projected to increase (ADB 1987). The IFAD/ADB project will augment storage capacity for fertilizer (Chitral and six other locations), use the storage locations as sales centers for seeds and chemicals, establish a revolving fund for purchase of

162

chemicals, provide staff for storage facilities and pay operating costs for facilities.

It is doubtful that full expectations of the project could be achieved without improved Lowari Pass access. In particular, the agricultural inputs needed to achieve greater production and productivity as well as marketing of fruit surpluses would be severely hampered by the current state of access and further constrained by any deterioration in access over the Lowari Pass. Currently, there is little fruit sold due to transport and marketing problems.

The IFAD/ADB project also introduces a fodder production program, expands animal health programs and improves genetic potential of cattle and poultry through introduction of improved breeds. The emphasis is on improving the productivity of livestock rather than an increase in livestock numbers. The introduction of these improvements would be hampered by the lack of access under the no-action alternative. Since there is currently no formal marketing of livestock and animal products within the District and none anticipated with the IFAD/ADB project, the no-action alternative would have no impact on livestock marketing or export. Nevertheless, the import of animal food products (chickens, eggs, ghee, milk and meat) would be severely constrained and become negligible as the road over the Pass deteriorated.

Improved Access

Agricultural Inputs. Construction of a tunnel or road would result in reduced transport costs of fertilizer, seed, chemicals and other agricultural inputs. This cost reduction would benefit the Agricultural Development Authority by reducing the transport component of the subsidy they pay.

The absolute amounts of fertilizer and chemicals are not great, given the size of the project area and are projected to be applied in moderate amounts to less than two percent of the total district area (IFAD 1986). The improved distribution system and the training components of the project could be expected to help control amounts and methods of application.

Production. In the short-term, the transport cost of importing grain into the district would be reduced and result in savings on the transport subsidy provided by GOP. Additional savings could be expected, because storage requirements would not be so great, once there were all-season access over the Lowari Pass. With the accomplishment of the IFAD/ADB project, the presence of an upgraded Chitral-Booni road would further reduce the transport subsidy cost. As the long-term goals of increased cereal production were achieved (from 33,000 mt to 70,000 mt at full development), the need for imported wheat would decline.

163

The doubling of fruit production under the IFAD/ADB project and the creation of a marketable surplus relies upon improved access in order to achieve export and marketing of the surplus. Without improved access, one could expect that any initial surplus would not be marketed and that farmers would have little incentive to expand production.

Livestock. Although livestock numbers have been increasing, productivity is insufficient to sustain the population's needs and animal food products are imported. Animals are typically small and not well-developed, a result of the type of stock, malnutrition and disease. There is insufficient forage to feed animals adequately during the winter; rangeland pastures are overgrazed and suffer erosion.

According to some sources, a tunnel or new road would encourage import of feed supplements such as oil cake; this assumption is questionable, considering the quality of the animals and the possibility that imported animal products would become cheaper as improved access lowered the transport cost component. In the long-term, improved access would facilitate achievement of IFAD/ADB project goals to improve the quality of stock and animal health. Since the IFAD/ADB project anticipates that consumption of livestock products will be within Chitral and mostly auto-consumption, improved access would have no effect on export of animal products.

4.2.8 Forestry

No-Action

The no-action alternative, in the short-term, would have little effect on commercial or domestic forest exploitation, assuming the allowable cut under the existing or a revised forestry management plan is regulated. In the longer term, deteriorated access would make it difficult, expensive and eventually impossible to transport logs and cants for export. One would then expect much reduced commercial exploitation of the forest. Domestic cutting of trees for use as fuelwood or timber in the district would be unaffected.

IFAD/ADB project plans include a forest nursery in upper Chitral to assist in conservation planting generally and contour plantings in villages. (Choice of an upper Chitral location reflects the severe lack of tree cover in that area.) The project will also establish woodlot nurseries in about 20 villages of upper Chitral where fuelwood shortages are most acute. Each nursery will provide plantings for half a hectare each year plus seedlings to establish additional woodlots in ten other nearby villages, i.e., 200 woodlot nurseries. Accomplishment of these plans would be hampered by deteriorating access, since inputs of seed, fertilizer, vehicles and equipment would be delivered less easily and at a greater cost.

164

Improved Access

Either a tunnel and new road or an all-road access would lower transportation costs of logs and cants and thus increase net revenues from their sale at auction in Chakdara (Dir District). Because the cost to harvest logs and cants is already cheaper inside the valley than outside the valley and profits would increase, there could be pressure to increase the allowable cut or the temptation to engage in illegal felling.

The result of a larger allowable cut or illegal felling would be devastating, albelt short-term, since the forest would disappear. Sanctions against illegal tree cutting would be essential to prevent deforestation and its consequences, such as severe erosion and a possibly irreversible elimination of forest. A revised forestry management plan which scientifically determined the allowable cut (probably a reduction) would also be required to prevent continued deforestation. Whatever the pressures that improved access might generate for a greater volume of log export, holding the line at the current level of exploitation or, preferably, reducing forestry exploitation is critical. After the fact, improved access would become the likely target of criticism as the cause of increased deforestation rather than a short-term contributing factor to it.

Assuming that commercial forest exploitation can be managed in an ecologically responsible manner, it would be of greater benefit to Chitral if the local sawmill industry could be encouraged to buy and saw export lumber and thus gain the value-added component contributed by this processing.

IFAD/ADB plans for reforestation would be facilitated by improved access and would help to reduce pressure on the remaining forest by providing a closer and more convenient village supply of fuelwood, a particular benefit to village women who now collect fuelwood at distant locations.

4.2.9 Tourism

No-Action

In the short-term, no differences in tourism would occur as a result of the no-action alternative. Gradual deterioration and any ultimate closure of the existing road over Lowari Pass would have profound impacts on tourism in Chitral. Access to the valley by road, the mode currently chosen by 40 percent of tourists, would become increasingly inconvenient and impracticable. It is reasonable to assume that a corresponding decrease in tourism would result.

Many of the vehicles present in Chitral during the tourist season are taken out of the valley during the winter months. As road access to the valley and the number of tourists diminished, incentives to bring in vehicles and the practicality of servicing the tourist industry would be undermined.

165

Likewise, the provision of hotel rooms and commodities directed toward consumption by the tourist industry would be compromised.

Improved Access

The principal effect of improved access on tourism in Chitral would be an increase in the dependability and convenience of road transport between Dir and Chitral. Currently, the crossing of Lowari Pass is uncomfortable for passengers and is hampered by a high frequency of vehicle breakdown. The provision of an improved road between Dir and Ashret would alleviate these problems and marginally improve the attractiveness of the valley to tourists. It would also facilitate the provision of more frequent bus service into and out of the valley. Improved access would marginally decrease the cost and increase the availability of tourist-related consumer items (meat, produce, medicine and luxury goods) and encourage the availability of road transport within the valley. These improvements would combine to make a stay in Chitral somewhat more attractive.

No major increase in foreign tourism would likely result from improved road access, since good air access is already available, the tourist appeal of the valley is limited, and the valley must compete for tourists with other areas of the NWFP which offer similar attractions and better tourist facilities. As indicated in Section 3.9, the current hotel occupancy rate is about 21 percent of available capacity during the May through October tourist season. Any increase in tourism could, therefore, be accommodated without the construction of additional hotel rooms. In sum, an estimated 10 to 15 percent increase in Pakistani tourism is expected to result from improved bus service, but little additional infrastructure would be required.

4.2.10 Paleontological, Archaeological and Historical Resources

No-Action

While this alternative means that adverse effects on paleontological, archaeological or historic resources could not occur, it would also mean that even less incentive would exist to explore and research sites in the valley. Access for both amateur and professional experts would likely decline and with less tourism, even less interest in developing sites could be expected.

Improved Access

The modest increase in tourist traffic would provide some rationale to expend monies on exploring and developing sites. It is possible that an investment of this nature might generate even more tourists to the extent that sites became tourist attractions.

166

4.2.11 Mineral Resources

No-Action

Under the no-action alternative, no change in the very limited mining activities that now exist would be expected. In the long-term, further deterioration of the road would make it more difficult to transport even the small quantities of gemstones, mica, beryl and antimony that are mined. In particular, the current level of exploration activities would diminish as it became increasingly difficult to bring in personnel and equipment to perform exploration.

Improved Access

A major effect of improved access whether by tunnel or road would be to stimulate and facilitate exploration activities. As described in Appendix K, Chitral District offers many mineral prospects, but few which are sufficiently large, sufficiently rich or well-enough defined to warrant the conclusion that mining would be feasible or profitable. With more and more exploratory activity, however, there is an increased likelihood that one or more prospects would be shown to warrant exploitation. Exploration teams, depending on the amount and type of equipment, would disturb vegetation and wildlife, simply by intrusion and additionally by cutting roads, blasting and setting-up camps. Special restrictions regarding exploration in protected areas (parks, sanctuaries and game reserves) would be necessary to avoid or minimize adverse effects. For all areas, preparation of an Exploration Control Plan should be required prior to permitting exploration (see Mitigation, 5.3).

A few mineral resources (principally marble, gravel and sand), however, would be exploited for direct use in tunnel or road construction (discussed previously at 4.1.11). After construction of a road or tunnel, some additional mining would be stimulated as a result of improved access. Local marble, for example, has particular characteristics (see Appendix K) which could find favor in the marketplace; the market is quite variable and quantities exported would not be large (see Appendix F). Other minerals such as mica, beryl and feldspar would be more attractive for larger-scale mining, if access roads to the deposits themselves were built in addition to improving access to Chitral town. Granite and slate could be quarried, but there are other deposits more closely located to the centers of demand than Chitral. There are limestone and marble deposits of Portland-cement grade, but operation of a furnace would require that petroleum be imported. It seems more likely that such an operation would occur outside the district, nearer to Dir, if road or tunnel construction and subsequent demand thereafter were to justify establishing and continuing furnace operation. Of particular interest to the Karachi Steel Company are the deposits of iron ore near Drosh. While these deposits as now defined are not considered economically feasible to exploit (see Appendix F), there is local interest. Whether GOP

161

would choose to exploit these deposits, even if imported ore were more economical, can not be determined.

While no large-scale mining can be predicted on the basis of current information about prospects, the potential does exist and the environmental risks would be relatively great, if exploration did occur. For this reason, mitigation concepts (see Chapter 5) have been incorporated into this report. An Environmental Review or Environmental Assessment as described therein is recommended as part of any feasibility analysis for a mining prospect and a specific Mitigation Plan is to be devised for each site.

The likelihood of smelting or other mineral processing would depend in the first instance upon the extent and nature of the mineral being mined. Because of the lack of fuel in Chitral District, it is unlikely that smelting or processing activities would be carried out there, unless the particular smelting or refining process could rely upon electricity generated by nearby hydropower or by the national grid, if power lines were extended to Chitral. As in the case of mining, a specific Environmental Review or Assessment and a Mitigation plan would be recommended.

4.2.12 Aesthetics

No-Action

No aesthetic impacts due to the no-action alternative are anticipated.

Improved Access

Aesthetic impacts would result only if new mining or increased forestry exploitation were to occur. Any other changes in development represent marginal changes to the existing situation from the standpoint of aesthetics.

4.2.13 Noise

No-Action

This alternative would not have any appreciable effect on noise levels which are local in nature and related to daily activities of the population. Deteriorating access, however, would eventually mean that fewer and fewer vehicles, especially trucks, would enter the valley and thus, this source of noise would be increasingly absent.

Improved Access

The long-term effect of improved access on noise levels would not be significant. The use of newer vehicles and easier grades on the road would somewhat offset increased noise levels expected from increased traffic volumes. There would be no increased development, which is a major potential source of

noise, unless mining were to occur. As indicated at Mineral Resources (4.2.11), criteria and standards for operations would need to be adopted and employed on a case-by-case basis in order to minimize adverse effects of noise.

Chapter 5

Mitigative Measures and Monitoring

This chapter describes mitigative measures and monitoring pertinent to these aspects of the Chitral Access Project:

- construction of tunnel or all-road access;
- operation and maintenance of tunnel or all-road access;
- secondary impacts of all-season vehicular access to the Chitral District;

Implementation priorities for mitigative measures are provided.

The environmental impacts of improved Chitral Valley access are dependent upon the range, extent and magnitude of changes which improved access might generate. If one examines the improved access project per se, very few adverse impacts are expected to occur and, as indicated in the Economic Feasibility Study, measurable economic benefits are not great. In most instances, this conclusion derives from the fact that improved access is a necessary, but not sufficient condition to induce major development. Thus, one can predict that development could trigger various impacts, if improved access and other activities occurred, but better access in and of itself does not generate such impacts. In Chapter 4 of this EA, various beneficial and adverse impacts have been projected, distinguishing between those that are solely a result of better access (mostly primary impacts related to construction and operation of a tunnel or a road) and those that depend upon other changes in conditions, such as successful exploitation of minerals that are now only prospects, or successful achievement of the planned IFAD/ADB Chitral Area Development Project.

This chapter contains a number of mitigative measures, including training programs, and a monitoring plan most of which are not remedies for adverse impacts per se of improved access. These mitigative measures respond to existing circumstances in the Chitral District, which are susceptible to improvement whether or not access is improved. Nevertheless, the access project becomes an appropriate mechanism by which to address existing problems. By the same token, improved access could be blamed, after the fact, for deteriorated environmental conditions which antedated the project. For these reasons, mitigative measures merit serious consideration in conjunction with the Chitral Access Project.

-170

5.1 Mitigative Measures Associated with Construction of a Tunnel or on an All-Road Access Alternative

Many of the mitigative measures associated with construction of a tunnel are generally the same as those associated with construction of all-road access. Similar activities are involved in each with the notable exceptions of much less extensive blasting for an all-road alternative and lesser quantities of spoil disposal. Both alternatives, however, require road reconstruction -- 28 km in the case of the tunnel alternative or 50 km in the case of all-road access. Appropriate distinctions between the two alternatives are made where needed.

Mitigative measures for construction activities are described below and summarized in Table 5-1 which provides additional detail regarding executing agencies and estimated costs. This and all subsequently cited tables are located at the end of Chapter 5.

5.1.1 Advance Site Planning and Infrastructure

Advance site planning attuned to mountainous, remote circumstances and offering protection from environmental degradation is recommended for construction camps housing 3,000-4,000 persons each at the north and south portals of the proposed tunnel. Since such camps are likely to become permanent villages due to the requirements for tunnel operation and maintenance, advance site planning will be particularly important and effective in helping to avoid long-term, adverse environmental impacts. In particular, site planning should address needs for compact infrastructure, efficient internal access within the camp and the construction of multi-story buildings, due to the shortage of level land.

A food storage facility at the north portal camp, a sewage treatment facility and an emergency medical center/infirmary are recommended. The storage facility is important during construction because of winter food shortages on the Chitral side of the Pass. A treatment method for sewage is highly desired as a public health measure and as a means to reduce water pollution. The medical facility would be essential during tunnel construction: (1) accidents can be expected during tunneling and use of heavy machinery; and (2) the close confines of the camp make health care and disease control critical to worker health (also see Safety Measures). Provision for schooling of workers children might also be desirable, assuming workers bring their families to the construction camp.

Mobile camps are likely to be the preferred means for organizing construction of an all-road access or the road component of the tunnel alternative. For mobile camps, attention must be paid to selecting locations along approximately 50 km between Dir and Ashret where basic needs of water, shelter and disposal can be satisfied without environmental damage. During feasibility and design studies for road access, loca-

171

tions should be evaluated and a plan and schedule developed to permit installation of protective measures prior to use of camps by construction workers. In particular, portable toilets and dumping facilities (or latrines) are recommended as a public health measure and to protect surface and groundwater. Assuming surface water withdrawal for drinking and use during construction, water quality analysis is needed to determine potability and evaluation of streamflow is desirable to determine the effect of withdrawals on aquatic life.

In addition to a plan for mobilization, a similar plan for demobilization needs to be devised. Such a demobilization plan should provide for clean-up of materials and equipment, reseeding if appropriate, and other measures to ensure that the landscape is not left degraded.

At strategic locations, during road construction, permanent construction camps may be preferred. The existing south portal location, for example, is a likely spot to centralize operations for mobilizing workers to mobile camps. Certain operations such as rock-crushing might be centralized at various locations. For such permanent camps, mitigation measures would be the same or similar to those described above for the permanent camps at tunnel portals.

For the all-road access alternative, a medical center may not be justified, unless a large permanent camp were established. Nevertheless, provisions for emergency medical care and transport of accident victims are recommended. Food storage facilities must also be planned to supply camp locations north of the pass.

5.1.2 Water Supply Development and Protection

Depending on locations for mobile and permanent camps and availability of surface water, a groundwater exploration program and development of supply may be needed. Structural geological studies emphasizing fault and photographic lineament analyses are recommended for inclusion in an exploration program. It is assumed, however, that groundwater resources in the project area are generally limited.

Protection of groundwater should be accomplished through preparation and execution of a plan directed to minimizing groundwater pollution from such sources as oil, petroleum and sewage. (See below, Spill Prevention, Clean-up and Control.) The plan should address groundwater protection during both project construction and project operation.

For the tunnel alternative, the adequacy of planned surface water supplies would determine the need for development of groundwater sources. If the planned surface water withdrawals from Trangar Gol and Nirga Khwar are determined to be in excess of that which can be sustained by the aquatic communities, groundwater as an alternative or supplemental supply should be investigated.

-172-

For the all-road alternative, any need for groundwater supply would depend on selected camp locations; ease of availability of surface water would be an important criteria in selecting mobile camp locations. The need for groundwater protection, however, remains an important consideration. If portable toilet facilities are used, the groundwater protection plan must specify how disposal would be accomplished.

5.1.3 Soil Erosion and Sediment Control

A soil erosion and sediment control plan is recommended in order to prevent further deforestation, protect wildlife habitats, minimize release of sediments into surface waters (and consequent effects on aquatic organisms), and maintain visual quality of the landscape. The plan would describe the potential for erosion and sedimentation problems of the construction project and explain and illustrate the measures which are to be taken to control those problems. A soil erosion and sedimentation control plan would include the following:

- Project description
- Existing site conditions
- Adjacent Areas
- Soils
- Critical areas
- Erosion and sedimentation control measures
- Permanent stabilization
- Stormwater management considerations
- Maintenance
- Cost Calculations

Soil erosion and sedimentation control measures would include provisions such as stockpiling topsoil; replacing soils on disturbed areas; grading; re-seeding, landscaping, re-vegetating slopes; and terracing areas below a new or rebuilt road.

Also recommended is a spoil disposal plan to optimize the use of excavated materials and minimize impacts to the environment. During the project design phase, the volumes of rock requiring disposal would be determined in accordance with the alignment alternative and method of construction chosen, and estimates of the bulking factors of the rock materials expected to be encountered. The plan would indicate the locations where all spoil would be utilized or disposed and the quantities involved. A preferable location would be hydrologically separate from sensitive water courses and would have a low habitat value. During project construction, the plan would be adjusted in response to design changes or the availability of more accurate estimates of the quantities of materials requiring disposal.

173

5.1.4 Spill Prevention, Clean-up and Control

To enhance safety for road construction workers and the public, protect water resources and preserve habitats, a plan must be developed to deal with the very probable occurrence that petroleum, oil or other chemical products used in road construction would spill. The use, storage and handling of all materials should be carried out to avoid or minimize the possibilities of pollution. The first line of defense is to devise procedures to handle such products, build proper permanent storage facilities (with spill containment) and provide adequate temporary storage in mobile camps. When appropriate, preventive measures can be taken to entrap spillage or discharges to prevent accidental pollution. Clean-up of spills once they occur can be achieved by use of specialized equipment or by having bales of straw and other materials at hand to mop-up residues. Control of spills requires training in product use and in proper disposal of spent or used products as well as monitoring of storage and use.

During tunnel construction, chemical or petroleum product spills pose a special risk because of the confined working conditions and the implications for worker safety and ventilation needs.

5.1.5 Forest and Habitat Protection and Enhancement

In order to prevent increased deforestation in the vicinity of the portal sites or road construction camps, provision of heating and cooking fuel is recommended. In addition, sanctions against cutting of trees should be established and enforced. Greater awareness of forest, range and wildlife resources could be fostered through an educational program offering information about their ecological benefits, the causes and dangers of forest or range fires, and the need to avoid tree-cutting.

In order to compensate for the taking of wildlife habitats along approach roads or an all-road alternative, proximate habitats could be enhanced. In abandoned roadway sections, soil and vegetation could be re-established to permit quicker re-generation of vegetation and habitat.

In the case of tunnel alignment alternative AO, re-establishment of Trangar Gol as a productive stream is recommended, since this tunnel alignment requires that the stream be diverted.

5.1.6 Paleontology, Archaeology and Historic Resources

As tunnel and/or road construction proceed, awareness of archaeological and historic resources is recommended, since it is possible that currently unknown resources might be found. Construction managers should be briefed by local experts, prior to initiation of construction, in order to facili-

174

tate recognition of such resources. Periodic inspection of cuts by experts may be warranted.

5.1.7 Air Quality and Noise

A construction phase tunnel ventilation system would be necessary to protect workers, as would personal protective equipment, such as respirators. Air quality and ventilation needs during tunnel construction are addressed in the PRC Feasibility Report. Critical attention to this issue is warranted in order that tunneling accidents can be minimized. Protective ear equipment for workers and mufflers, deflectors or baffles for machinery would also be needed.

For the all-road access alternative, air quality mitigation measures would not generally be needed. Noise mitigation measures need not be as extensive, since less blasting would occur and workers would not be laboring in a confined space. Ear-protective equipment for workers operating machinery should in most cases suffice.

5.1.8 Safety Measures

Safety training procedures would be essential for construction workers engaged in tunnel building activities, which are likely to be unfamiliar to the majority of workers. Emergency evacuation procedures and communication protocols must be devised and regularly rehearsed. Explosion-proof electrical equipment, stand-by ventilation and lighting and other safe construction techniques would be employed (PRC 1987). A special safety plan should be prepared for all components of tunnel work.

For the road component of a tunnel alternative or an all-road alternative, a safety plan and safety training program are also essential. Protective gear and clothing, along with instructions in its use, and training in equipment use must be provided. Emergency procedures should be incorporated into the safety plan. Weekly safety meetings and regular reviews of procedures should be part of an on-going safety program. The safety plan should also stress public safety awareness to protect the public from construction-related and road accidents.

An emergency medic l center, planned to be part of a construction camp at each portal construction site, plus provisions for emergency transport of serious accident victims are recommended in order that construction accident victims can be treated immediately and incur fewer serious consequences. Such a medical center, if appropriately staffed, could dispense routine health care and public health information to construction camp residents.

For both a tunnel and an all-road alternative, specialized driver training is advised for construction crew drivers delivering supplies and construction equipment to tunnel portal sites or to road camps.

175

Control of explosives would be needed. Pakistan law (refer to Appendix E) already regulates explosives handling, but worker-safety procedures would need to be established in addition. An explosives handling and transport plan in accordance with the Explosives Act of 1884 and incorporating appropriate worker-safety procedures in accordance with industry-wide standards is recommended.

5.1.9 Compensation for Land Acquired

Land acquisition procedures including compensation are established by Pakistan law (refer to Appendix E). In cases where the law may not apply, e.g. roadside burial places, compensation through the District Council is recommended due to the sensitive nature of the issue.

5.1.10 Training and Public Education Programs

As noted above at 5.1.8, Safety Measures, training programs for construction workers and construction crew drivers would be needed. Such programs could be sponsored by the executing agency and given by the contractor responsible for road or tunnel and road construction.

During the construction period, a public safety awareness program is recommended. This program is advised in order to reduce accident risk while the existing road is in use to transport materials and equipment and during the periods when portions of road are being rebuilt. Such a program would also serve as a precursor to a longer-term safety awareness program.

Advance training in construction work should be considered for residents in Chitral and Dir, if it is desired that populations in these districts benefit preferentially from construction jobs.

5.2 Mitigative Measures Associated with Operation and Maintenance of a Tunnel or an All-Road Access Alternative

Mitigative measures associated with operation and maintenance of a tunnel or all-road access are the same or similar in most instances, except for the fact that safety precautions take on heightened significance for a tunnel alternative. Two kinds of safety precautions are discussed -- design criteria and standards (5.2.1) and operating procedures (5.2.2). In addition, provisions for spill control (5.2.3), natural disasters (5.2.4), and training/public education (5.2.5) are presented. These mitigative measures are summarized in Table 5-2.

176

5.2.1 Safety-Related Design Criteria and Standards

Tunnel

Additional safety features can be incorporated into the tunnel component, albeit at higher cost. A safety gallery would improve protection and escape potential in case of fire and provide much enhanced accessibility for maintenance and rescue teams. A safety gallery allows both intervention by small vehicles through the gallery and passage for pedestrians. (According to PRC Draft Feasibility Report, Appendix B, a safety gallery increases construction costs by approximately 20 percent). SOS niches with a hydrant every 250 meters and emergency lay-by areas every 1,000 meters are provided in the PRC draft tunnel design. The design also incorporates telephone communications at each SOS area.

A median barrier (e.g., Jersey barrier) between lanes would help to reduce the possibility of head-on collisions in the tunnel.

With respect to air quality inside a tunnel, further analysis of design alternatives is warranted. More serious consideration of a ventilation system that reduces risk from fire and smoke is recommended. The longitudinal ventilation system without a safety gallery which is the preferred design alternative of the PRC Draft Feasibility Report entails the greatest risk, compared to a semi-transversal or transversal ventilation system. With one of the latter systems, smoke and heat propagation can be limited to a few hundred meters and intervention is easier (PRC Draft Feasibility Report 1987), but costs increase by more than 15 percent compared to a longitudinal system. Longitudinal ventilation, however, must be reduced or stopped in case of fire and there are no means to stop spread of heat and smoke in one direction.

Since no evaluation of sound or noise impacts is provided in the PRC Draft Feasibility Study, the relative costs and benefits of a sound-attenuating tunnel lining merit some consideration.

Roads

Both on tunnel approach roads as well as on any all-road access, a median barrier between lanes would help to reduce possibilities of head-on collisions. Such a feature, however, increases the width needed for a road and thereby increases cost. Emergency lay-by areas and adequate sighting distances around curves need to be considered in the design of 28 km of approach roads for a tunnel or 50 km of all-road access.

Since neither the scope of work for this EA nor that for the PRC Draft Feasibility Report had as its purpose and scope of work a feasibility study of all-road access, no detailed information regarding design options can be provided for

177

the portion of road over the Pass. The design standards adopted in the PRC Draft Feasibility Report (1987) for short tunnel approach roads are summarized at 2.3.5.

As further assistance to design considerations for an all-road access, Appendix H presents a narrative description of the current conditions of the road. In any subsequent studies of road design, safety considerations associated with a mountain road must be paramount.

5.2.2 Operations Safety Plan

An operations safety plan needs to incorporate components addressing the major and likely causes of accidents.

Vehicle Inspection

In order to reduce the possibility of fire or explosion, particularly in the tunnel, control load shifts leading to accidents or overturned vehicles, and help prevent breakdown, either in the tunnel or along curving access roads, vehicle inspection should be carried out. At each tunnel portal inspection of vehicle condition, loading and type of load can be accomplished along with collection of tolls by a portal inspector. Vehicle inspection on the roads leading from Ashret and from Dir is also recommended to: (1) avoid difficulty of unsafe vehicles arriving at a tunnel portal where there would be little opportunity to remedy the situation; (2) avoid vehicles traveling a long distance only to be confronted with a problem; and (3) reduce accident potential due to vehicle problems along the access roads.

For the last reason noted above, vehicle inspection is also recommended for an all-road access alternative.

Towing Service

Since a stalled, overturned or otherwise inoperative vehicle can become a major problem within the confines of a tunnel, towing service would be needed in order to remove vehicles safely and speedily. Within the tunnel, emergency telephones and monitoring would permit drivers to call for help. Towing service is also recommended for approach roads and/or the all-road access alternative. In order for this service to be effective, emergency telephones all along the route would be needed.

Paramedic/Ambulance Service

Accidents involving personal injury can be especially dangerous within the tunnel, particularly if victims are rendered unconscious or are unable to call for help. Emergency medical help could be provided from the south portal location, assuming that a permanent village would have been established and an emergency medical center provided during the construction period. If such were not the case, tunnel maintenance

172

workers should be trained as paramedics so that they can provide emergency care immediately and during transport to a hospital at Dir or Chitral.

Availability of paramedic/ambulance service is also recommended for tunnel approach roads or for all-road access. Obtaining help would depend on drivers' or passengers' ability to reach an emergency telephone or on passers-by who were able to call for help. Communication procedures with medical facilities in Dir or Chitral should be specified in the operations safety plan.

Speed Limits and Other Traffic Regulations

Enforcement of speed limits and prohibitions against passing in a tunnel and, as appropriate, along access roads would be critical in helping to reduce accidents. Enforcement would be physically easier within a tunnel, because of the monitoring capabilities associated with tunnel operation. Enforcement personnel need to be trained in the importance of implementing regulations and the risks of not doing so in order that a pattern and history of strict enforcement can be established.

Respect for speed limits and other traffic regulations along an all-road access or along tunnel approach roads would need to rely upon safety education and awareness and strict enforcement of infractions.

Snow Removal and De-Icing

Effective and adequate snow removal for tunnel approach roads or all-road access, as well as de-icing of a tunnel lining and road surface, would be required. In addition to snow removal equipment, attention needs to be paid to snow problems in roadway design in order to facilitate snow removal operations.

5.2.3 Spill Prevention, Clean-up and Control

A spill prevention, control and clean-up plan is required during operation and maintenance of a tunnel alternative or all-road access alternative, just as during construction (see 5.1.4).

Within the confines of a tunnel, procedures to clean-up spills promptly must be established in order to minimize the possibility of spill-induced accidents and to reduce risks of fire due to spills of flammable products. Prompt clean-up, specialized equipment and a specialized crew trained in clean-up procedures are recommended. Prevention of spills can be accomplished by attention during vehicle inspection to the condition of fuel tanks, drums and type of load. Installation of an oil and petrol separator on a tunnel waste water collector will help to reduce the ecological impacts of spills.

On tunnel approach roads or all-road access, spill prevention and control is important to avoid impacts on the surrounding environment. Vehicle inspection and enforcement of traffic laws would help to prevent spills due to vehicles in bad condition, improper transport of materials or accidents. Control and clean-up, however, would be difficult along isolated stretches of road and would need to rely upon emergency communication with clean-up crews in Dir or Chitral (in the case of all-road access) or at tunnel portals (in the case of a tunnel alternative). Acquisition of clean-up equipment, installation at appropriate locations, and training of a crew are recommended.

5.2.4 Natural Disaster Emergency Plan

Avalanche galleries and flood protection structures are included in the tunnel feasibility study and would also need to be incorporated into design of all-road access. Design measures to deal with the possibility of earthquakes and fault movement are considered a high priority.

In addition to design elements, a plan for handling natural disasters is recommended. Such a plan would include an assessment of risk-prone areas for avalanches, landslides, floods and earthquakes; identification of emergency procedures; locations of volunteer emergency personnel and emergency equipment; and establishment of procedures to mobilize manpower and equipment.

5.2.5 Training and Public Education

Training requirements are associated with effective implementation of an Operations Safety Plan, a Spill Prevention Control and Clean-up Plan and a Natural Disaster Emergency Plan. In particular, training of paramedics, vehicle inspectors, enforcers of rules associated with fire, explosions and spills), fire-fighters and clean-up crews is recommended.

In order to provide an operational staff comprised of members of the work force of Chitral or Dir District, specialized training could be offered to candidates from these areas.

A safety awareness program is recommended to educate drivers about the risks and precautions needed for driving in a tunnel or on a mountain road. Such a program could entail: specialized seminars for truck and bus drivers through the unions; educational pamphlets or verbal warnings given at time of vehicle inspection; pamphlets and signs describing emergency procedures, locations of emergency telephones and need for notification regarding accidents or spills; and well-posted speed limits and other traffic warnings.

A public education program is needed to foster awareness regarding dangers of forest and brush fires as a result of throwing lighted cigarettes or matches. In conjunc-

180

tion with such a program, a more general, anti-littering campaign could be introduced.

5.3 Mitigative Measures Associated with Secondary Impacts

Mitigative measures related to secondary impacts are proposed as a means of remedying existing problems, some of which can be exacerbatered by improved access and others of which will easily be considered a result of better access, even when that is not the case. These mitigative measures are summarized in Table 5-3.

5.3.1 Climate and Air Quality

No mitigative measures related to secondary impacts are likely to be necessary, unless mining or smelting activities were to occur (see 5.3.11).

5.3.2 Geology, Physiography and Soils

Mitigative measures appropriate to this topic are discussed below as pertinent to mining and forestry.

5.3.3 Water Resources

An increased amount of vehicle traffic would lead to increased risk of petroleum and oil spills, greater chances of pollution from improper petroleum product storage and additional disposal facilities for spent oil, solvents and vehicle maintenance products. While the initial volume of increased traffic is not great and all-season access would reduce the need for fuel storage over the winter shortage period, the situation should be controlled and monitored. Regulations regarding storage tanks, spill containment, clean-up and disposal should be developed by the Chitral District Council. While no high risk nor major pollution of surface waters is anticipated, the importance of spill prevention is heightened, because the effects of an untimely and major spill could be serious to the trout fishery and to tourism.

5.3.4 Terrestrial Ecology

Wildlife field studies, a wildlife plan and formulation of wildlife programs are recommended. Program components could include habitat enhancement to maintain wildlife populations and re-establishment of wildlife populations as the recommended means to deal with infringement on existing habitat and the consequences of continued deforestation. Improved access provides a mechanism to control wildlife poaching through establishment of a wildlife inspection and control station at Lowari Pass to regulate the transport of wildlife products. Further protection of wildlife can be gained by a training program for Chitral Wildlife Division personnel. An extension program would help to improve public awareness of the importance of habitat and wildlife and could provide education re-

181

garding the dangers of over-grazing and other man-induced pressures on wildlife. At Lowari Pass where a permanent, larger village could be expected, establishment of a protected area or park in conjunction with road or tunnel construction is recommended.

Although improved access per se is not expected to cause significant ecological impacts, a special set of mitigative measures related to terrestrial and aquatic ecology has been prepared. These measures respond to the presence of endangered species, the valley's remoteness, and the serious consequences of deforestation, overgrazing and erosion. Opportunities for bettering the existing situation are summarized in Table 5-4.

5.3.5 Aquatic Ecology

Mitigative measures are noted at 5.3.3, Water Resources.

5.3.6 Socio-economics, Land Use and Infrastructure

No impacts on population requiring mitigation are expected. Economic impacts, while not large, are mostly beneficial and no remediation is needed. Customs and traditions of the Kalash could be threatened by improved access, if tourism and secondary development were to occur to a much larger degree than predicted in this EA and Economic Feasibility analysis. A protective area, however, has already been proposed and could be pursued within the context of an improved access project.

Land use impacts are considered to be marginal and localized and no formal mitigation would be required. Nevertheless, a land use survey and plan are recommended in conjunction with environmental monitoring of improved access. Localized land use changes, if detrimental, could then be identified and mitigated through land use controls (see also Forestry).

Infrastructure needs, aside from those associated with construction and operation of improved access, would not arise from improved access, since few secondary impacts are anticipated. Attention should be given to investigating the relationship between improved access and infrastructure already planned in association with the IFAD/ADB project. For example, storage needs for fertilizer and agricultural chemicals could be less than planned, if improved access were assured.

In order to enhance the effectiveness of improved access to Chitral town, additional investigation of farm or village-to-market roads (beyond these planned by the IFAD/ADB project) is merited. A percentage of tolls collected could be utilized as incentive assistance to village populations for construction of upgraded local roads.

182

5.3.7 Agriculture and Livestock

Because no major changes in agriculture or livestock sectors aside from those associated with the IFAD/ADB project are projected, there is no need for mitigative measures. Support to training programs in use of fertilizer and agricultural chemicals is recommended in conjunction with the IFAD/ADB extension program.

5.3.8 Forestry

Since increased access could result in pressure to increase the allowable cut or encourage illegal tree felling in a situation where deforestation is already severe, strong mitigative measures in advance of such a problem are required. A set of mitigative measures should be devised as part of forestry planning and programming and would need to include field studies. Measures could include:

- Support for a revised forestry management plan that scientifically determines the allowable cut;

- Establishment and enforcement of strict sanctions against illicit cuttings in accordance with the allowable cut;

- Protection and enhancement of natural regeneration with under-planting in order to reduce continued deforestation and erosion;

- Terrain analysis to guide reforestation of mountain slopes;

- Provision of fuelwood by woodlot plantings in addition to those planned by the IFAD/ADB project, encouraged use of alternate fuel sources, and/or more efficient woodstoves.

5.3.9 Tourism

No impacts requiring mitigation are associated with tourism. If continued deforestation and attractions of parks and wildlife should diminish, tourism would likely decline. Efforts to enhance or maintain a forested landscape, as opposed to eroded slopes, are recommended.

5.3.10 Paleontology, Archaeology and Historic Resources

No mitigative measures are associated with cultural resources, other than those appropriate to increased mineral exploration or the possibility of more mining activity (see 5.3.11, below).

183

5.3.11 Mineral Resources

Mineral Exploration

Further exploration for mineral resources would occur (see 4.2.11 and Appendix K); the more this activity occurs, the greater the likelihood that one or some mineral prospects would be found exploitable.

A Mineral Exploration Plan with appropriate environmental regulations and safeguards should be required prior to mineral exploration. Among the elements of such a plan would be: guidance or restrictions regarding disturbance of vegetation and habitat; need for erosion control, including replanting, if appropriate; limits on release of sediments or other pollutants to surface waters; and restrictions on (or prohibition of) roads developed solely for exploration. Where reseeding is appropriate, indigenous plants should be specified.

Stricter limitations on mineral exploration in national parks or other protected areas would be needed to protect habitat of indigenous and endangered species. For example, exploration activities could be limited to the minimal amount of disturbance needed to test or prove extent of previously investigated nearby mineral resources. Certification of a Mineral Exploration Plan and monitoring by Chitral Wildlife Division or international wildlife agencies could be required.

Notification regarding intended exploration should be required and given to all appropriate authorities, including the Director of the Advisory Committee responsible for enforcement of the Antiquities Act.

Exploration drilling should be registered and supervised by the GOP. Drillings and/or borings should be backfilled and sealed, with particular restrictions on those which penetrate the water table. Monitoring by GOP is recommended in order to ensure compliance with the exploration plan regulations.

Blasting should be permitted only in accord with GOP laws and additional limitations should be established as needed to protect habitat. Limits on the size of charges should be established in order to permit only the minimum amount for a reasonable sampling plan or geo-physical program. In general, exploration and mining companies should be required to restore the landscape to pre-existing conditions. For each exploration activity, a specific environmental program is recommended.

Mineral Exploitation

Should mineral resources of sufficient quantity and value for exploitation be proved, an Environmental Assessment and Mitigation Plan for Mining activities would be necessary, as appropriate to the location of a deposit, its extent, type

of mining envisioned, kind of ore and by-products to be mined and transported, and needs for processing prior to transport. Since specific sets of environmental impacts would be generated by each mining activity, specific environmental reports or assessments accompanied by a mitigation plan should be required.

At a minimum, each Mineral Environmental Assessment and Mitigation Plan should cover: devegetation, erosion, siltation, contamination/pollution of surface and groundwater, aquatic and terrestrial impacts, air pollution, and impacts associated with the need for additional infrastructure. Attention to archaeology and historic resources noise and aesthetic conditions should also be required. Because the potential exists for mining of hazardous materials, such as mercury or arsenic or processing that entails use of hazardous chemicals, special preventative measures might be needed in these instances. While it is difficult to speculate about environmental impacts of unknown types and magnitudes of mineral exploitation, prudence dictates that mechanisms for environmental safeguards be established and enforced. While the probabilities of problems may be small or limited in geographic extent, the consequences of environmental impacts are high in the sensitive ecological setting of Chitral District.

5.3.12 Aesthetics

No mitigative measures are recommended, except in so far as minerals exploration, mining or increased deforestation would occur. In any of these cases, restoration of natural conditions to mitigate ecological impacts would be sufficient and desirable from an aesthetic standpoint.

5.3.13 Noise

No specific measures, unless associated with mineral exploration (blasting), mining or processing, are necessary.

5.4 Implementation Priorities for Mitigative Measures

Priorities for mitigative measures during construction should be placed on safety procedures, site planning/infrastructure for construction camps, sanctions against tree-cutting and, in the case of a tunnel, spoil disposal.

During operation of a tunnel and approach roads, highest priority should be given to an operations safety plan, including vehicle inspection, and educational programs for drivers. In the case of all-road access, a safe driving program and associated education are deemed to be most important.

With regard to secondary impacts, measures to reduce deforestation and procedures for environmentally-sound mineral exploration are considered to have highest priority.

5.5 Environmental Monitoring

5.5.1 Purpose

An environmental monitoring plan has been developed to measure changes in environmental quality during project construction and operation, to assess the degree to which such impacts are the result of the project and to identify the effectiveness of mitigative measures. The program would function as a feedback mechanism to indicate the level of accuracy of impact assessments made in this report, the adequacy of mitigative measures, and additional mitigative actions that would be appropriate. The information obtained would also assist in honing the predictive tools employed in future environmental, economic and social soundness assessments performed by USAID.

The monitoring plan outlines several programs, each of which would require detailed planning and design. Performance of baseline studies would be integral components of each program.

5.5.2 Training

Program planning and design for environmental monitoring should be performed in collaboration with GOP and would be an appropriate medium for technical training requisite to the implementation of monitoring programs, as would the collection of baseline data. Training requirements are associated with effective implementation of water supply, water quality, fault, wildlife and wildlife habitat, land use, forest resource and geomorphologic monitoring programs. Training in remote sensing, in particular, is recommended.

5.5.3 Short-Term Monitoring

Construction Accidents. A record should be made of each accident that occurs during project construction. Each record should include the time, character, location and cause of accident; extent and nature of injuries or damage; the cost, in time and money, of accident clearance and returning to normal construction activities.

Spoil Management. The use and disposal of spoil should be monitored throughout project construction to: (1) ensure that disposal operations are in accordance with the spoil disposal plan (see 5.1.3) and that impacts to the environment are minimized; and (2) to facilitate revision of the plan as construction proceeds.

Archaeological Resources. Records should be maintained of all artifacts encountered during project construction. Review of the records would assist in avoiding the unnecessary destruction of previously unidentified archaeological finds.

Logging. During project construction, increased pressure on forest resources are anticipated in the vicinity of construction camps (see 4.1.8). Firewood gathering and logging for light construction would also continue after project construction. A monitoring program to identify the location, extent and character of the extractions should be established to enable their control and should extend from project initiation to at least a few years after construction operations are completed. In this case, since sanctions or provision of fuel could limit deforestation, it is recommended that the monitoring program incorporate enforcement of sanctions and other aggressive measures to reduce tree cutting.

Water Supply. Upon initiation of tunnel construction, streamflow gauging should be initiated in Nirga Khwar and Trangar Gol to determine whether minimum streamflows will be adequate to simultaneously supply the water needs of tunnel construction and operation (drinking/sanitary use, fire fighting and cleaning) and provide baseline flows necessary to sustain aquatic communities. Streamflow gauging should be performed in concert with a program to monitor the seasonal composition of aquatic communities in the subject streams. Both monitoring programs should extend through the first five to ten years of tunnel operation.

Erosion and Sedimentation. Monitoring of erosion and sedimentation should be performed along project roadways and facilities to evaluate and, as appropriate, amend the soil erosion and sediment control plan (see 5.1.3). Monitoring should be initiated during project construction and extend to at least a few years after completion of construction operations.

5.5.4 Long-Term Monitoring

Avalanches and Landslides. During construction and throughout project life, records should be kept as to the date, location, extent, character, damage, duration of roadway obstruction and cost of each avalanche or landslide along project roadways. This data could be used to evaluate the effectiveness of protective measures and indicate locations requiring additional protection.

Faults. All faults passing through the tunnel corridor should be mapped using appropriate remote sensing and field investigation methods. Faults of particular concern should be monitored for slippage during construction and throughout the project life.

Water Quality. Surface and groundwater quality should be regularly monitored in the project vicinity and at strategic locations throughout Chitral and Dir Districts. Monitoring should be initiated during project construction to establish baseline conditions and should continue throughout project operation. Target components of this program should

181

include agriculture-related chemicals, petroleum and oil, in addition to conventional parameters.

Traffic. Periodic traffic counts should be taken along the project route and at strategic locations in Chitral and Dir Districts. Counts of traffic volumes and vehicle types should be initiated during project construction and extend throughout the life of the project.

Traffic Accidents, Fires and Spills. All traffic accidents, fires and spills occurring throughout project life within a tunnel or on project roadways should be recorded. Each record should include the time, character, location and cause of incident; extent and nature of injuries or damage; the cost, in time and money, of clearance, cleanup, and return to normal project operation. Through periodic review of data, causes of accidents, effectiveness of clean-up and recommendations for changes could be made.

Tourist Use. Periodic surveys of tunnel/roadway use by tourist should be performed. The survey should be designed to indicate changes in tourism in Chitral and to determine the value of the project as a recreational resource.

Wildlife and Wildlife Habitat. Periodic surveys of wildlife populations and habitat should be performed in strategic locations throughout Chitral and Dir Districts. The surveys would supplement those currently performed by the Chitral Wildlife Division and would specifically address anticipated and unforeseen project impacts. The monitoring program should be initiated upon project inception and should extend throughout project construction and operation. The World Wildlife Fund and other wildlife conservation organizations and individuals should be consulted during the design and implementation of the program. The transport of wildlife products between Chitral and Dir should be recorded at strategically located inspection stations.

Land Use. Remote sensing should be utilized to monitor land use change in Chitral and Dir Districts. The accumulated data could be used to evaluate project impacts and assist in future development planning efforts. The program should begin during project construction to establish baseline conditions and develop interpretation signatures. Monitoring should proceed on a periodic basis throughout project operation.

Mining Exploration. During project operation, all mining exploration activities in Chitral District and their impacts should be monitored. This program would be used to evaluate project impacts, assist in the enforcement of restrictions placed on mining exploration under the mineral exploration plan, assess the adequacy of the restrictions and aid in the development of a data base for site-specific environmental impact statements for proposed mining operations (see 5.3.11).

Forest Resources. Changes in the extent, composition and condition of forests throughout Chitral District should be monitored utilizing remote sensing and field investigations. This program should be initiated during project construction and extend throughout project operation. Monitoring of forest resources should be performed in concert with a program to determine the patterns of consumption within Chitral of local and imported forest products and of the export of forest products to other districts.

Geomorphological Terrain Analysis. A terrain analysis, utilizing remote sensing, should be performed to determine the geomorphological constraints to development within Chitral District. The analysis should be designed as a long-term monitoring program to facilitate the periodic updating of the product in response to changes in the status of geomorphologically dynamic features.

189

Table 5-1

MITIGATIVE MEASURES ASSOCIATED WITH CONSTRUCTION OF TUNNEL AND ALL-ROAD ALTERNATIVES

MITIGATIVE MEASURES	ALT.(1)	PURPOSE/NEED	EXECUTING AGENCY	COST (US Dollars)
Advance Site Planning and Infrastructure Plan				
Site planning of permanent construction camp.	T&R	Avoidance of potential impacts of constr. camp for workers, families and camp followers, with potential to remain after completion of construction.	AID/NHB	175,000-225,000
Multi-storied buildings at permanent constr. camps.	T&R	Minimize potential impacts of constr. camp for workers, families and camp followers, with potential to remain after completion of construction. Very little level land upon which to build.	AID/NHB	Costs to be determined during site and infrastructure plan development.
Food storage facility at north portal constr. camp.	T&R	Food shortage in Chitral District.	AID/NHB	Costs to be determined during site and infrastructure plan development.
Package sewage treatment facility.	T&R	Groundwater and surface water protection; protection of public health.	AID/NHB	Costs to be determined during site and infrastructure plan development.
Emergency medical center/infirmaries; emergency medical care and transport.	T&R	Insufficient medical services to handle influx of people and constr.-related accidents.	AID/NHB	Costs to be determined during site and infrastructure plan development.
Portable toilets or temporary latrines for mobile camps.	T&R	Groundwater and surface water protection; protection of public health.	AID/NHB	Costs to be determined during site and infrastructure plan development.
Demobilization plan.	T&R	Site clean-up; landscape protection.	AID/NHB	Costs to be determined during site and infrastructure plan development.
Water Needs				
Water supply development and protection plan.	T&R	Determine water supply requirements for project construction; protect water resources.	AID/NHB	30,000-50,000

Note: (1) Alternatives: T = Tunnel and Approach Roads; R = All-Road Access.

Analysis of surface water quality and supply at each permanent camp.	T&R	Protection of public health; determine if withdrawals of surface water for constr. and operation of tunnel will be detrimental to aquatic fauna.	AID/NHB	Costs to be determined during water supply development and protection plan formulation.
Groundwater exploration program.	T&R	To be executed if planned surface water withdrawals are determined to be potentially detrimental to aquatic fauna.	AID/NHB	Costs to be determined during water supply development and protection plan formulation.
Groundwater supply development.	T&R	To be executed if need is demonstrated and supply is available.	AID/NHB	Costs to be determined during water supply development and protection plan formulation.
Develop groundwater protc. program.	T&R	Groundwater protection; protection of public health.	AID/NHB	Costs to be determined during water supply development and protection plan formulation.
Soil Erosion and Sediment Control				
Soil erosion and sedimentation control plan, including measures such as stockpiling topsoil, landscaping and planting, terracing, etc.	T&R	Soil erosion and sedimentation: surface water, forestry, aesthetic, terrestrial and aquatic ecology impacts.	AID/NHB	30,000-50,000
Spoil disposal plan.	T&R	Disposal of excavated material; surface water, aesthetic, terrestrial and aquatic resource protection.	AID/NHB	35,000-60,000
Spills				
Spill prevention, clean-up and control plan.	T&R	Worker and public safety; protection of surface and groundwater resources.	AID/NHB	25,000-35,000
Spill prevention, clean-up and control equipment and personnel.	T&R	Worker and public safety; protection of surface and groundwater resources.	AID/NHB	Costs to be determined during spill prevention, clean-up and control plan development.
Forest and Habitat Protection/Enhancement				
Provision of fuel supply to camps.	T&R	Prevent deforestation.	AID/NHB	Costs to be determined during site and infrastructure plan development.
Plan to establish and enforce sanctions against cutting of trees for fuel or timber.	T&R	Prevent deforestation.	AID/NHB and NWFP Forest Dept.	20,000-25,000
Educational program development.	T&R	Foster greater awareness of and protect forest, range and wildlife resources.	AID/NHB and NWFP Forest Dept.	15,000-20,000

191

Re-establish soil and vegetate abandoned roadway sections.	T&R	Compensate for taking of terrestrial wildlife habitats.	AID/NHB	20,000 per hectare; area to be determined during project design.
Enhance proximate habitats.	T&R	Compensate for taking of terrestrial wildlife habitats.	AID/NHB	20,000 per hectare; area to be determined during project design.
Re-establish Trangar Gol as a natural, productive stream.	T	Diversion of Trangar Gol, under Alternative A0.	AID/NHB	Costs to be absorbed in cost of cut-and-fill operations.
Archaeologic and Historic Resources				
Briefing of construction managers.	T&R	Protection of currently unknown resources.	AID/NHB	Costs to be absorbed in cost of construction management.
Periodic inspection of cuts.	T&R	Protection of currently unknown resources.	AID/NHB	Costs to be absorbed in cost of construction management.
Air Quality and Noise				
Deflectors, baffles, mufflers, etc. on constr. machinery and protective equipment for workers.	T&R	Construction noise.	AID/NHB	Costs to be determined during design.
Constr. phase tunnel ventilation system and protective equipment for workers.	T	Air quality in tunnel.	AID/NHB	Costs to be determined during design.
Safety Measures				
Preparation of public safety awareness program.	T&R	Public safety (road accidents) during construction.	AID/NHB	15,000-20,000
Specialized driver training for constr. crew drivers.	T&R	Public safety (road accidents) during construction.	AID/NHB	Costs to be determined during design.
Specialized training in equipment use and safety measures; safety plan.	T&R	Public and worker safety during construction.	AID/NHB	Costs to be determined during design.
Explosives handling and transport plan.	T&R	Public and worker safety during construction.	AID/NHB	Costs to be determined during design.
Compensation				
Compensation for takings in accordance with Pakistan law and local custom.	T&R	Taking of property, including land, structures, cemeteries, etc.	AID/NHB	Costs to be determined during design.

192

Table 5-2

MITIGATIVE MEASURES ASSOCIATED WITH OPERATION AND MAINTENANCE OF TUNNEL AND ALL-ROAD ALTERNATIVES

MITIGATIVE MEASURES	ALT.(1)	PURPOSE/NEED	EXECUTING AGENCY	COST
Safety-Related Design Criteria and Standards				
Safety gallery. (2)	T	Fire, explosion, accidents, breakdowns, etc.	AID/NHB	Costs to be determined during final feasibility study or design.
Safety niches. (2,3)	T	Fire, explosion, accidents, breakdowns, etc.	AID/NHB	Costs to be determined during final feasibility study or design.
Emergency telephones. (2,3)	T&R	Fire, explosion, accidents, breakdowns, etc.	AID/NHB	Costs to be determined during final feasibility study or design.
Median barrier. (2)	T&R	Collisions.	AID/NHB	Costs to be determined during final feasibility study or design.
Sound-attenuating tunnel lining. (2)	T	Reduce noise in tunnel.	AID/NHB	Costs to be determined during final feasibility study or design.
More effective ventilation system. (2)	T	Air quality, fire and smoke safety.	AID/NHB	Costs to be determined during final feasibility study or design.
Emergency pull-off areas.	T&R	Lay-by areas along tunnel approach roads or road to reduce accident risk from inoperative vehicles blocking road.	AID/NHB	Costs to be determined during final feasibility study or design.
Safe Operations				
Tunnel operations safety plan.	T&R	Prevent combustion of flammable materials; control load shifts; prevent vehicular collisions.	AID/NHB	50,000-75,000
Vehicle inspection. (2)	T&R	Prevent combustion of flammable materials; control load shifts.	GOP,MMFP	Costs to be determined during tunnel operations safety plan development.

Notes: (1) Alternatives: T = Tunnel and Approach Roads; R = All-Road Access.
(2) Especially important for tunnel component.
(3) Included in PRC Draft Feasibility Report design recommendations for a tunnel cross-section.

Towing service. (2)	T&R	Remove stalled/inoperative vehicles.	AID/NHB	Costs to be determined during tunnel operations safety plan development.
Paramedic/Ambulance service. (2)	T&R	Treat and transport accident victims.	AID/NHB	Costs to be determined during tunnel operations safety plan development.
Traffic regulations enforcement.	T&R	Public safety.	GOP,NWFP	Costs to be determined during tunnel operations safety plan development.
Snow removal and de-icing.	T&R	Public safety.	AID/NHB	Costs to be determined during tunnel operations safety plan development.
Spills				
Spill prevention, clean-up and control plan.	T&R	Public safety; protection of surface and groundwater resources.	AID/NHB	25,000-35,000
Spill prevention, clean-up and control equipment and personnel.	T&R	Public safety; protection of surface and groundwater resources.	AID/NHB	Costs to be determined during spill prevention, clean-up and control plan development.
Natural Disasters				
Natural disaster emergency plan.	T&R	Landslides, avalanches, earthquakes and floods.	AID/NHB	75,000-100,000
Natural disaster emergency equipment and personnel.	T&R	Landslides, avalanches, earthquakes and floods.	AID/NHB	Costs to be determined during natural disaster emergency plan formulation.
Training/Public education				
Training programs for residents of Chitral and/or Dir.	T&R	Tunnel/Roadway operation and maint. positions.	AID/NHB	50,000-75,000
Prepare public education program.	T&R	Reduce risk of forest or brush fires and littering.	AID/NHB	15,000-20,000
Prepare driver awareness program.	T&R	Reduce accident risks on steep, mountain roads and, in case of tunnel, educate tunnel users regarding procedures for safe passage.	AID/NHB	20,000-25,000

Table 5-3

MITIGATIVE MEASURES ASSOCIATED WITH SECONDARY IMPACTS
OF ALL ALTERNATIVES

MITIGATIVE MEASURES	ALT.(1)	PURPOSE/NEED	EXECUTING AGENCY	COST
Water Resources				
Spill prevention, clean-up and control regulations.	All	Chemical, hazardous materials, etc. spills; protect water resources.	GOP, NWFP	20,000-25,000
Terrestrial Ecology				
Wildlife field studies, plan and program.	All	Protection of wildlife and wildlife habitat.	AID, NWFP Forest Dept./ Chitral Wildlife Div., WWF and IUCN.	400,000-500,000
Habitat enhancement.	All	Compensate for secondary impacts to wildlife and wildlife habitats.	AID and NWFP Forest Dept./ Chitral Wildlife Div.	20,000 per hectare; areas to be determined during wildlife field studies.
Re-establish wildlife populations.	All	Protection of wildlife and wildlife habitat.	NWFP Forest Dept./Chitral Wildlife Div., WWF and IUCN.	Costs to be determined during wildlife field studies plan development.
Establish wildlife inspection and control station at Lowari Pass to regulate the transport of wildlife goods.	All	Protection of wildlife under increased poaching pressures.	AID and NWFP Forest Dept./ Chitral Wildlife Div.	Costs to be determined during wildlife field studies plan development.
Training program for Chitral Wildlife Div. personnel.	All	Protection of wildlife and wildlife habitat.	AID, NWFP Forest Dept./ Chitral Wildlife Div., WWF and IUCN.	Costs to be determined during wildlife field studies plan development.
Wildlife extension program.	All	Protection of wildlife and wildlife habitat.	AID, NWFP Forest Dept./ Chitral Wildlife Div., WWF and IUCN.	Costs to be determined during wildlife field studies plan development.

Note: (1) Alternatives: T = Tunnel and Approach Roads; R = All-Road Access.

195

Establish protected area for wildlife conservation at Lowari Pass.	All	Protection of wildlife and wildlife habitat.	NWFP Forest Dept./Chitral Wildlife Div., WWF and IUCN.	Costs to be determined during wildlife field studies plan development.
Agriculture				
Support ADB training program and extension services in the use of agric. chemicals.	All	Increased use of agric. chemicals.	AID, IFAD, ADB, AKRSP, NWFP Agric. Dept.	20,000-25,000
Forestry				
Forestry field studies, plan and programming.	All	Protection of forest resources.	AID,IFAD,ADB, AKRSP, NWFP Forest Dept.	400,000-500,000
Determine allowable cut based on planned 1988 forest inventory.	All	Overcutting of forests.	NWFP Forest Dept.	Costs to be determined during forestry field studies.
Establish and enforce sanctions against illicit fellings and cuttings, in accordance with allowable cut.	All	Overcutting of forests.	NWFP Forest Dept.	Costs to be determined during forestry field studies.
Under-planting.	All	Reduce deforestation and erosion.	AID,IFAD,ADB, AKRSP, NWFP Forest Dept.	Costs to be determined during forestry field studies.
Terrain analysis.	All	Guide reforestation of mountain slopes.	AID,IFAD,ADB, AKRSP, NWFP Forest Dept.	Costs to be determined during forestry field studies.
Village firewood plantations.	All	Overcutting of forests.	AID, IFAD, ADB, AKRSP, NWFP Forest Dept.	20,000 per hectare; areas to be determined during forestry field studies.
Encourage use of alternate fuels and more efficient wood stoves.	All	Overcutting of forests.	AID, IFAD, ADB, AKRSP, NWFP Forest Dept.	Costs to be determined during forestry field studies.
Mineral Resources				
Establish envir. restrictions and guidelines for exploration, mining and smelting.	All	Environmental impacts of mineral exploration, mining and smelting.	Sarhad, Geological Survey of Pakistan, Chitral Wildlife Div., and PEPA when established.	100,000-150,000

196

Prepare site-specific minerals exploration plan with environmental regulations and safeguards.	All	Environmental impacts of mineral exploration.	Sarhad, Geological Survey of Pakistan, and PEPA when established.	Costs to be borne by mining interests.
Prepare EIA/EIS and mitigation plan for each proposed mine or smelter.	All	Environmental impacts of mineral exploration, mining and smelting.	Sarhad, Geological Survey of Pakistan, and PEPA when established.	Costs to be borne by mining interests.
Infrastructure				
Improve farm to market roads.	All	Upgrade roads currently not serviceable by trucks and thereby facilitate the of fruits and other cash crops. NOTE: The Chitral Area Development Project of IFAD and ADB provides for upgrading the Chitral-Booni road.	AID, IFAD, ADB, AKRSP and NWFP Communications and Works Dept.	6,400 per km. (estimated cost of access roads, per ADB 1987)

197

Table 5-4

CONCEPTS FOR MITIGATION OF IMPACTS
TO WILDLIFE AND WILDLIFE HABITATS

Establish protected area for wildlife at the Kalash Valleys.

Establish protected area for wildlife at Lowari Pass. Replant Lowari Pass area, upslope from and in the vicinity of the proposed portals. Establish as a recreational/wildlife area with hiking/trekking trail through pass. Establish limited and controlled parking facilities proximate to the portals.

Reforest mountain slopes. Technique currently being used in Chitral Valley should be investigated, as it has been successful. This technique involves irrigation, terracing, replanting and maintenance. For range habitats, seeding should be investigated. Irrigation will be necessary in most locations.

Perform carrying capacity estimates of range and other grazing habitats and control domestic livestock access to permit adequate utilization by wildlife.

Perform geomorphologic terrain analyses on areas under consideration for re-establishment of vegetation. This will help establish priorities for erosion control and application techniques.

Combine carrying capacity studies and geomorphic terrain analyses to function as a predictive model to indicate those areas which will most benefit from re-vegetation, range, forest and wildlife management.

Sediment traps in the streams and rivers to reduce their sediment loads and create wetlands and riverine/floodplain forest habitats. Vegetate.

Re-establish and manage indigenous predators.

Improve protection afforded to wildlife within existing protected areas.

Perform studies to determine the "greater ecosystem" of each existing protected area and the inherent management problems.

Expand existing protected areas.

Improve protection afforded to wildlife outside protected areas, especially proximate and conterminous with protected areas.

Create new protected areas.

Perform studies to locate wildlife populations that would most benefit from the creation of new protected areas.

Re-establish and manage native plant species of value to wildlife species.

195

Nesting boxes for indigenous bird species.

Re-establish and improve raptor populations.

Plant wildflowers, shrubs and trees, including fruit trees.

Stone erosion control/sediment retention walls on open slopes and in gullies on wildlife grazing lands. This technize is currently being used on domestic livestock grazing lands. Many of the existing structures, however, are in disrepair and sediments are passing through them. Mitigation should therefore include periodic maintenance, as is true of all structural techniques proposed. Combine this technique with windbreaks, hedgerows or other plantings of appropriate vegetation. Vegetative species should be indigenous, should be resistant to over-grazing and should be of value to wildlife, both mammals and birds. The birds will be of wildlife value themselves and will also facillitate the spread of the vegetation, by seeds and berries. Planted species should be grasses, wildflowers, shrubs and trees. Natural fibrous material, such as reeds, hay or hemp, should be placed on the uphill side of the stone walls to collect and retain moisture. This program and all vegetation planting schemes will probably require irrigation in many locations.

Plant vegetation of value to wildlife along irrigation ditches. Vegetation should not be phreatophytic and should not be susceptible to over-grazing by either wildlife or livestock.

Plant vegetation of value to wildlife on agricultural land. Vegetation should be chosen to be compatible with current and expected agricultural practices at each location.

Focused erosion control program in areas considered critical or likely to benefit most from controls.

Store snow-melt in ponds for later utilization as irrigation water for conservation plantings, habitat creations and reforestation schemes.

Earmark for local wildlife management projects and fisheries management projects all proceeds from the sale of hunting and fishing licenses and fines for violations of wildlife and fishing regulations.

Effectively ban the use of explosives and nets in all fisheries.

Introduce "new blood" to trout fishery, to improve genetic integrity.

Build new hatchery or restore existing, closed hatchery.

Perform aquatic habitat studies to determine suitability to various indigenous species. Establish aquatic communities that are not dependent on human inputs.

6. List of Preparers

6.1 TAMS Team Members

Name and Title	Project Responsibilities	Education
G. Barrie Heinzenknecht Senior Vice President	Senior Technical Advisor	Fairleigh Dickinson University, 1970, B.A. Sociology. New York University 1975, M.U.P. Urban Planning
Charlotte S. Bingham Principal Environmental Planner	Technical Advisor	Barnard College, 1965, AB, Natural Resources Conservation. University of California, Berkeley, 1967 MCP, City Planning.
John R. Andrews Terrestrial Ecologist	Team Leader	University of Toronto, 1948, BSCF, Forestry. Yale Univ., 1953, MF, Forest Management.
James Smith, Ph. D. Geologist	Geologist	Emory Univ. 1955, B.A., Geology. Emory Univ., 1959, M.S., Structural Geology. University of Tennessee, 1968, Ph. D., Geology and Pedalogy.

200

Michael Fritzsche, P.E. Chief Field Engineer	Transportation Planner	Technical University of Berlin, 1958-59 Engineering Studies; Mining College of Austria, 1959-60. Newark College of Engineering, 1967, B.S.C.E.
Victor P. Frankenthaler Environmental Planner	Ecologist	Rutgers University, 1981, B.S., Environmental Planning and Design. Rutgers University, 1981-date, M.S. candidate in Geography.
Frank Peacock Economist	Transportation Economist	University of Essex, 1972, B.A., Economics. University of London, 1973, M. Sc., Economics.
James J. Coyle Prinicipal Environmental Engineer	Air Quality Specialist	Columbia Univ., 1968, B.S., Chemical Engineering. Hunter College, 1972, M.A., Urban Studies. New York Univ., 1973, M.S., Applied Math.
Kit Y. Eng Environmental Engineer	Air Quality Specialist	The Cooper Union, School of Engineering, 1984, B. Ch. E., Chemical Engineering.

.70

Elizabeth Sanford Assistant Planner	Technical Assistant	Colgate Univ., 1984, B.A., Urban Studies. Haute Univ. de Geneve, 1983, research in International Dev.

6.2 USAID Personnel

Sheridan Plunkett Anthropologist U.S.A.I.D.	Social Anthropologist	Unversity of Chicago, 1960, A.B., Social Anthropology. University of Chicago, 1964, A.M., Social Anthropology. University of California, Berkeley, 1972, Ph.D., Social Anthropology.

6.3 Pakistan Team Members

Name	Firm	Project Responsibility
Jehanzeb Khattak Prinicipal Engineer, B.E. M.I.E.C. (Pak.)	Associated Consulting Engineers ACE (Private) Ltd. 1-C/2, M.M. Alam Road Gulberg, III, Lahore II Pakistan	Team Leader
Anis Ahmed Chaudhry	ACE (Private) Ltd. (same as above)	Agronomy/Land Use
Moinul Islam	ACE (Private) Ltd.	Geology
Irshad Ahmed	ACE (Private) Ltd.	Transport Economics
A.D. Nasir	ACE (Private) Ltd.	Legal Expertise
Shabbir Ahmed	ACE (Private) Ltd.	Forestry
M. Mumtaz Malik	ACE (Private) Ltd.	Wildlife
Farzand Ali Durrani	ACE (Private) Ltd.	Archeology
S.B. Hasan	ACE (Private) Ltd. (Lahore)	Project Coordination
Col. A.H. Riaz	ACE (Private) Ltd. (Islamabad)	Project Coordination

202

S.A.H. Zaidi	ACE (Private) Ltd. (Karachi)	Project Coordination
Aman Khan	ACE (Private) Ltd. (Peshawar)	Project Coordination

203

Appendix A
Bibliography

Ahmad, Z., S. Ghulam, R.N. Khan, A. Hussain, A. Khan, B.A. Saleemi, R. Khan, S. Ahmad, and S.A. Quereshi. 1974. Investigation of Placer Mineral Deposits in the Indus, Gilgit and Chitral Rivers of Pakistan. Geological Survey of Pakistan 35:25p.

Alaudin, M., S.M. Akhtar, and A.H. Khan. 1972. A Note on Sirvik Gol Pegmatites. Science and Industry 9 (1 and 2).

Aleem, A. 1976. Markhor in Chitral Gol. Pakistan Journal of Forestry 26 (2): 117-128.

Aleem, A. 1977. Ecological Impact of Domestic Stock on Chitral Gol Sanctuary. Tigerpaper 4(3): 26-29.

Aleem, A. and M.M. Malik. 1977. Litter Size in Markhor. Pakistan Journal of Forestry: 203-206.

Ali, S. Ikramuddin. 1951. Alluvial Gold in Chitral State. Geological Survey of Pakistan, report unpublished, File No., 262(2), 11p.

Ali, S. Ikramuddin. 1951. Alluvial Gold in Chitral, North West Frontier Province. Geological Survey of Pakistan, report unpublished, File No. 549(1), 25p.

Ali, S. Ikramuddin. 1953. Report on Iron Ore Deposit of Chitral. Geological Survey of Pakistan, report unpublished, File No. 549(3), 21p.

Ali, S. Ikramuddin. 1955. A Note on Orpiment. Geological Survey of Pakistan, report unpublished, File No. 6.

Ali, Salim and S. Dillon Ripley. 1969. Handbook of the Birds of India and Pakistan. Vol2: 225-434. Oxford University Press. Bombay, London, New York.

American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE). 1987 HVAC Systems and Applications, Chapter 29, Enclosed Vehicular Facilities. p.29.1-29.6.

Asian Development Bank. 1984. Identification Mission, Malakand Area Development Project.

Asian Development Bank. 1987. Appraisal of the Chitral Area Development Project in Pakistan, report unpublished, File No. PAK: Ap-73.

204

Asrarullah. 1957. Interim Report on Research of Radioactive Mineral in Chitral State. Geological Survey of Pakistan, report unpublished, File No. 556(6), 5p.

Asrarullah. 1972. Non-Glamorous Economic Mineral Resources of North West Frontier Province. Geological Survey of Pakistan. Geonews 2(2): 47-55.

Asrarullah. 1976. Iron Ores in Pakistan. Geological Survey of Pakistan, Information Release No. 108,33p.

Asrarullah, and S. Ghazanfor Abbas. 1979. Ophiolites in Pakistan, in Geodynamics of Pakistans, Geological Survey of Pakistan, Monography: 181-182.

Asrarullah and S. Tayyah Ali. 1963. Dammar Nisar Iron Ore Deposit of Chitral State, West Pakistan. CENTO Symposium on Iron Ore, Isphanan, CENTO publication: 113-116.

Asrarullah and S. Flasan Gauhar. 1984. Economic Mineral Resources of the North West Frontier Province: Geological Survey of Pakistan.

Asrarullah and Ahmad Hussain. 1985. Marble Deposits of the North West Frontier Province, Pakistan. Geological Survey of Pakistan, Inforamtion Release No. 128, 23p.

Asrarullah and H. Rehman. 1955. On the Prospects of Finding Radioactive Mineral Deposits in Pakistan. Geological Survey of Pakistan, report unpublished, File No. 556 (14), 5p.

Austrominerals, Vienna/Austria. 1978. Feasibility Study (Final Report), Mineral Exploration and Mineral Development in Chitral District. Submitted to Sarhad Development Authority, Peshawar Pakistan 291, p.38.

Bakv, Abu M. 1965. Thermal Springs of Pakistan: Pakistan Geological Survey 16 (3), 3p.

Bakv, Abu M. 1965. Florsbar Deposits of Pakistan: Geological Survey of Pakistan 16(2). 6p.

Beg, A. 1975. Wildlife Habitats of Pakistan. Botany Branch, Pakistan Forestry Institution, Peshawar, Bull. 556pp.

Buchroithner, M.F. 1984. Geologic Map of the Tirich Mir, scale 1:50,000.

Bureau of Statistics, Planning and Development Department, North West Frontier Province, 1985. North West Frontier Province Development Statistics, pp. 794.

Bureau of Statistics, Planning and Development Department, North West Frontier Province. 1987. Important District wise SocioEconomic Indicators for N.W.F.P., pp. 40

Butt, M. H. 1976. Gravity Survey of Lead-Antimony Ore in Shoghor Area, Chitral, Pakistan. Geological Survey of Pakistan, Information Release No. 96, 9p.

Calkins, James A., S. Jamil-ud-din, Kamaluddin Bhuyan and Ahmad Hussain. 1981. Geology and Mineral Resources of the Chitral-Pakistan Area, Hindu Kush Range, Northern Pakistan: U.S. Geological Survey Professional Paper 716-C, 33p.

Chairman District Council, Chitral. 1983. Five Year Development Program and Plan of Action through Community Participation (1983-84 - 1987-88) pp.105.

Champion, H.G., S.K. Seth, and G.M. Khattak. 1965. Forest types of Pakistan, Pakistan Forestry Institute, Peshawar. 238pp.

Chaudhry, M.N., and Abdul Ghafoor. 1974. Geology of Khagram Area, Dir District. Punjab University, Geology Bulletin 11:21-43.

Chaudhry, Kausar, Allah Bakhsh and S.A.K. Lodhi. 1974. The Orthoamphibolites and the Paramphibolites of Dir District, North West Frontier Province. Punjab University, Geology Bulletin 11:53-73

Coward, M.P., M.Q. Jan, D. Rex, J. Tarney, M. Thirlwall, and B.F. Windley. 1982. Structural Evolution of a Crustal Section in the Western Himalaya. Nature 295 (5844): 22-24.

Crookshank, H.C. 1949. A Note on a Visit to Chitral. Geological Survey of Pakistan, report unpublished, File No. 540(1), 14p.

Dames and Moore. 1987. Evaluation of Gold and Tungsten Prospects near Shaghore and Garam Chasma, Chitral District, N.W.F.P., Pakistan; San Francisco, California, U.S.A.

Dames & Moore and United Consultants (1987). Mineral Sector Development Study, Northwest Frontier Province, Pakistan: Government of Pakistan Ministry of Planning and Development, 15p.

Danziger, N.H. and W.D. Kennedy. 1982. Longitudinal Ventilation Analysis for the Glenwood Canyon Tunnels. Fourth International Symposium on the Aerodynamics & Ventilation of Vehicle Tunnels, March 23-25, 1982. p. 169-186. (Held at the University of York, Heslington, York, U.K.).

Department of Agriculture, North West Frontier Province. 1986. Agricultural Statistics of North West Frontier Province for 1985-86, pp. 107.

Desio, Ardito. 1966. The Devonian Sequence in Mastuj Valley (Central Northwest Pakistan), Review Italiana Paleontologia 72(2): 293-320.

Desio, Ardito. 1975. Some Geological Notes and Problems on the Chitral Valley: Rend. Accademia Nazianale dei Lincei. Series 8, Vol. 58, Fasc. 4, p.611-617.

Division of Planning and Investigation, Lahore. 1964. Reconnaissance Report Kabul-Swat. Chitral Basins, West Pakistan Water and Power Development Authority, pp.71

Fletcher, C.J.N. 1985. Gold, Antimony and Tungsten Mineralization in the Chitral District, NWFP, Pakistan: British Geological Survey Report, 82p.

Frontier Works Organization. 1973. Engineering Feasibility Report, Lowari Tunnel, pp.62

Gauhar, S.H., M.A. Mirza, S. Jamiladdin, and W. Ahmed. 1985. Map showing status and strategy of Geological Mapping in Pakistan. Geological Survey of Pakistan, NGC Special Map Series Vol. 2, No. 1, scale 1:2,000,000.

Gee, E.R., and Abdul Hai Kidwai. 1957. Note on the Geology of the Lowari Pass Road Section, Dir and Chitral States. Geological Survey of Pakistan, report unpublished, No. 536(13). 2p.

Government of Pakistan. March, 1986. Tourism Growth in Pakistan: Annual Growth - 1985. Planning Development and Research Wing, Tourism Division, Islamabad

Government of Pakistan. 1970. Draft Report of the Wildlife Enquiry Committee. Islamabad.

Hayden, H.H. 1915. Notes on the Geology of Chitral, Gilgit and the Pamirs. Geological Survey of India 45(4): 271-335.

Hayden, R.L. 1981. Natural Tunnel Ventilation. Report No. CDOTT-DTP-R-81-3. Colorado Department of Highways, pp.16

Highway Research Board. 1966. Rock Mechanics. Highway Research Record No. 135, Four Reports. National Academy of Science, Washington, D.C. Publication 1379, pp. 17.

Hopper, R.C., T.A. Lang, and A.A. Mathews. 1974. Construction of Straight Creek Tunnel. Colorado RETC Proceedings 1(28): 501-537.

Hudson, W.G. 1945. Conveyors and Related Equipment, 2nd Edition. John Wiley & Sons, pg. 240-249.

IFAD (International Fund for Agricultural Development). 1986. Draft Report on Pakistan Chitral Area Development Project, unpublished.

IFAD and ADB. 1987. Report and Accommodations of the President to the Executive Board on a proposed loan to the Islamic Republic of Pakistan for the Chitral Area Development Project, pp.24.

Institute of Development Studies. North West Frontier Province University. 1986. Malakand Area Development Project Agro-Socio-Economic Study of Chitral District for International Fund for Agricultural Development, Rome, pp.484.

Ivanc, J.F., D.M. Traves, and D. Kung. 1956. Report on the Alluvial Gold Deposits of Mastuj and Chitral Rivers in Chitral State, Pakistan. Geological Survey of Pakistan, unpublished, File No. 762 (4).

Kazmi, A.H. 1979. Active Fault System in Pakistan in Geodynamics of Pakistan (Farah and DeJong, editors) Geological Survey of Pakistan, Monograph, pp. 282-294.

Kazmi, A.H. and R.A. Rana. 1982. Tectonic Map of Pakistan. Geological Survey of Pakistan, Quetta, scale: 2,000,000.

Khan, Abdul Hai. 1951. A Short Note on the Gahirat Gol Weir Site, Chitral. Geological Survey of Pakistan, report unpublished, File No. 535 (5). 8p.

Khan, A. and M. Aslam. 1981. Interim Report on Magnetile Occurrence in Bunj Zom Area, Chitral District, North West Frontier Province, Pakistan, Information Release No. 111, 15p.

Khan, Abdul Rauf. 1974. Lowari Rope-way Dir-Chitral, pp.20

Khan, M.A., T. Karim, and S. Iqbal. 1986. Preliminary Bibliography and Index to the Geology of Northwest Frontier Province, Pakistan. Geological Survey of Pakistan 77. 233p.

Khan, Yar Mohammd and Mumtaz Khan. 1981. Integrated Land Resource Survey Report of Chitral Sub-Project (Chitral District), Northwest Frontier Province Forest Pre-Investment Centre, Peshawar, 81 p.

Kidwai, A.H. and S. Iman. 1958. Magnetile Deposits of Dammer Nisar, Chitral State, West Pakistan. Geological Survey of Pakistan, Information Release No. 7, 13p.

Lillie, Robert J. 1985. Interpretation of seismic reflection data across the Himalayan fareland thrust belt in Pakistan (abstract).

Malik, Mohammad Muntaz. 1987. Management Plan for Wild Artiodactyls in North West Frontier Province, Pakistan. M.S. thesis, University of Montana, Missoula.

Mirzaw, Mohammad Ali. 1971. Magnetic Survey Over the Magnetite Deposits of Dammer Nisar Area, Chitral. Geological Survey of Pakistan, Information Release No. 42, report No. 1.

Mirza, Mohammad Ali. 1983. Seismic Risk Evaluation in Pakistan. Geological Survey of Pakistan. Record volume 56, 6p.

Mirza, M.A., S.A. Gauher, S. Vamiluddin, and W. Ahmad. 1985. Map Showing Status and Strategy of Geological Mapping in Pakistan: N.G.C. Special Map Series Vol. 2, No. 1.

Montreal Engineering Company, Ltd. (date?) Hydroelectric Inventory Ranking and Feasibility Studies for Pakistan, Montreal, Canada

National Engineering Services (Pakistan) Limited. 1983. A Write-up on Lowari Tunnel, Government of Pakistan, Planning and Development Div., 21p.

National Transport Research Centre. 1985. A Study of Design Standards for Surface Width and Design Speed on Tertiary Rural Roads, GOP Planning Commission. John Smith ODA, UK. NTRC-82 pp.69.

National Transport Research Centre. 1983. Manual of Rural Construction, GOP Planning Commission. NTRC-DS-1 pp.69.

National Transport Commission. 1976. Effect of Highway Design Elements on the Capacity of 2-lane roads, GOP Planning Commission NTRC-8. pp. 26.

National Training Research Centre. 1987. Achievements, GOP Planning Commission pp.15.

North West Frontier Province. August 1, 1975. Government Gazette, Extraordinary. Law Department, Peshawar.

Pakistan Agricultural Research Council. 1981. Agricultural Experts Committee Report in Chitral, pp.79.

P & I, WAPDA, Lowari Tunnel Project, Geological Report, Lahore, Pakistan.

PRC Engineering, Inc. October 1987. Lowari Tunnel Draft Feasibility Report. Prepared for National Highways Board, Islamabad, Pakistan.

Qaiser, M.A. et al. 1986. (PCSIR Lab, Peshawar, Pakistan.) Mineralogy and Chemistry of Limestone Resources of Khyber Agency, N.W.F.P. Pakistan Journal of Seiomet Industrial Research 29 (4): 249-254. Sketch map.

Quittmey, Richard C: Lamont-Doberty Geological Observatory and Department of Geological Sciences, Columbia University, Palisades, New York U.S.A.

Quittmeyer, R.C., A. Farah and K.H. Jacob. 1979. The Seismicity of Pakistan and Its Relation to Surface Faults: in Geodynamics of Pakistan (Farah and DeJong, editors) Geological Survey of Pakistan, Monograph, pp. 271-284.

Rahman (1987). "The Impact of Lowari Tunnel on the Exploration and Exploitation of Mineral Potentials at Chitral," unpublished notes for Chitral District officials and TAMS meeting.

Rahman, A.Y.M.H. 1955. Report on Drosh District, Chitral State. Geological Survey of Pakistan, Report unpublished, File No. 439 (1), 21 p.

Reed, F.R.C. 1911. Devonian Fossils from Chitral, Persia, Afghanistan and the Himalayas. Geological Survey of India 41(2): 86-114.

Reed, F.R.C. 1925. Upper Carboniferous Fossils from Chitral and the Pamirs. Geological Survey of India, Palaeontologica Indica New Series, Memoir 6(4): 134p.

Rehman, Faiz-Ur. 1976. A Short Note on Landslide of AMLUKNAR, Dir district, N.W.F.P., Pakistan. Geological Survey of Pakistan. Information Release No. 123.

Sarhad Development Authority, Government of N.W.F.P. (Date?) "S.D.A. Minerals and Mineral Products for Sale and Export"

Sarhad Development Authority, Peshawar. (Date?) "Report on Mineral Activities of S.D.A in N.W.F.P."

Searle, M.P., B.F. Windley, N.P. Coward, D.J.W. Cooper, A.J. Rex, D. Rex, L. Tingdong, X. Xuchang, M.O. Jan, V.C. Thakur, S. Kumar. 1987. The Closing of Tethys and the Tectonics of the Himalaya. Geological Society of American Bulletin. 98:678-701.

Shuja, Taugeer Ahmad. 1983. A Study of Thermal Springs of Northern Pakistan. Geological Survey of Pakistan, Information Release No. 179.

Stauffer, Karl, W. 1969. Denonian Laterite in Chitral State, West Pakistan. Geological Society 64(4): 252-254.

Stauffer, Karl W. 1971. Reconnaissance Geology of the Central Mastuj Valley, Chitral State, Pakistan. United Sates Geological Survey/Geological Survey of Pakistan, (IR) PK-24, 44p.

Tahirkheli, R.A.K. 1964. Alluvial Gold Prospects in the Northwest and West Pakistan, University of Peshawar, NWFP, Information Release No. 7, 48p.

Tipper, G.H. 1921. Orpiment Mines in Chitral: Geological Survey of India: 16-17.

U.S. Department of Commerce. NTIS. July 1975. PB-259-333-T. Tunnel Manual Department of Transportation, Washington, D.C.

United States Department of State. 1987. Pakistan Background Notes, pp.10.

U.S. Fish and Wildlife Service. April 10, 1987. Endangered & Threatened Wildlife and Plants, 50 CFR 17.11 and 17.12. U.S. Department of the Interior, Washington, D.C.

Vogeltanz, R. 1969. Recepteculites Neptuni (Defrance) from Devonian of Owir An, Chitral, West Pakistan Geological Survey of Pakistan, Record Volume 19, 4p.

211

West, A., Pursall, B.R. 1982. The Environmental Impact of a Longitudinally Ventilated Tunnel. Fourth International Symposium on the Aerodynamics and Ventilation of Vehicle Tunnels, March 23-25, 1982. p. 245-260. (Held at the University of York, Heslington, York, U.K.)

White, Max. G. 1975. Copper, Lead, Zinc, Antimony and Arsenic in West Pakistan: United States Geological Survey. Open File Report 75-162, 39p.

Yar Mohammad Kan and Mohammad Tufail. 1980. Integrated Land Resource Survey Report at Dir Sub-Project, NWFP Forestry Pre-Investment Centre, Peshawar, Series 2, pp.61

Yar Mohammad Khan and Numtaz Khan. 1981. Integrated Land Resource Survey Report of Chitral Sub-Project, NWFP Forestry Pre-investment Centre, Peshawar Series 1, pp.81

Yar Mohammad Khan. 1976. A Comprehensive Report on Wildlife Resources (Wildlife Population Census) of Chitral, Department of Forests and Wildlife NWFP, Peshawar, pp. 11

212

Appendix B
List of Persons Contacted

The following List of Persons Contacted was transcribed from handwritten field notes of the EA team and may contain errors in spelling. We apologize for any misspelling and welcome corrections for the final Environmental, Economic and Social Soundness Assessment.

APPENDIX B - LIST OF PERSONS CONTACTED

CONTACT	DATE(S) CONTACTED
Mohammad Afzal Assistant Director of Fisheries Chitral District Fisheries Department Chitral	9/7/87; 9/10/87
Afzal Ahmad Assistant Director Geological Survey of Pakistan Quetta	Week of 9/27/87
Naseer Ahmad Owner Naseer Marble Mine Gunner, Swat	9/28/87
Riaz Ahmad Assistant Professer Institute of Geology Punjab University Lahore	Week of 9/27/87
Saeed Ahmad MPA Chitral	9/17/87
Sharif Ahmad Deputy Commissioner Chitral	9/5/87
Waleed Ahmad General Manager, Exploration Sarhad Development Authority Mineral Wing Peshawar	9/15/87
Zaheer Ahmad 8-B, Bath Island Karachi	9/1/87
Zudfigar Ahmad Director Center of Excellence in Minerology Baluchistan University Quetta	Week of 9/27/87
Zafter Ahmed MPA Chitral	9/17/87

215

CONTACT	DATE(S) CONTACTED
Engn Syed Hamid Ali Project Manager, Khanpur Dam Associated Consulting Engineers (ACE)	8/27/87
S. Monawar Ali President Associated Consulting Engineers (ACE)	8/27/87; 8/30/87
Sardar Ali Deputy Director Office of Director General of Agriculture Peshawar	9/15/87
Amanullah Divisional Forest Officer - Management and Planning NWFP Forest Department Forestry Pre-Investment Center Pakistan Forest Institute Peshawar	9/16/87
Raja Rehan Arshad Project Engineer U.S. AID	8/23/87
Zaki Ahmad Asrarullah Former Head of Pakistan Geological Survey U.S. AID Islamabad	9/2/87
Muhammad Aslam Deputy Director Geological Survey of Pakistan Peshwawar	Contacted 9/8/87 in Chitral District
Ir. J. Van den Berg Associate Vice President PRC Engineering Inc.	8/20/87
Peter S. Bridges Geologist Robertson Research International, Ltd. Llandudno, Gwnedd United Kingdom	10/4/87
Aftab Ahmad Butt Associate Professor Institute of Geology Punjab University Lahore	Week of 9/27/87

CONTACT	DATE(S) CONTACTED
Hafeez Butt Geophysist Geological Survey of Pakistan Quetta	Week of 9/27/87
Sagib Butt PCSIR Laboratories Lahore	Week of 9/27/87
Abdul Chafoor Librarian Centre of Excellence in Minerology B.U. Quetta	Week of 9/27/87
Dr. Abdul Aleem Chaudhry Technical Consultant World Wildlife Fund - Pakistan P.O. Box 1513, Nishatabad Faisalabad	9/1/87; 9/30/87
Air Marshal Zafar A. Chaudhry Director, Development World Wildlife Fund - Pakistan Ali Industrial Technical Institute Ferozeuper Road, P.O. Box 1312 Lahore	9/1/87; 9/30/87
Ken Davis Liason Office U.S. AID Peshawar	9/2/87; 9/9/87
Dr. Karzand Ali Durrani Chairman Department of Archeology Peshawar, University Peshawar	9/24/87
Muhammad Ahmad Farougui Lecturer Dept. of Geology Balachistan University Quetta	Week of 9/27/87
Roger I. Gale Senior Economist Asian Development Bank Manila, Philippines	10/5/87

-217

CONTACT	DATE(S) CONTACTED
Gene V. George Chief Office of Engineering U.S. AID Islamabad	9/15/87
Soleman Ghani Secretary Commerce and Work Northwest Frontier Province (NWFP)	9/14/87
Roy G. Hafforson Office of Engineering U.S. AID Islamabad	8/23/87
Dr. Hiamiduddin Centre of Excellence in Geology Peshawar University Peshawar	Week of 9/27/87
S. Hussain Hundal Deputy Chief National Transport Research Centre Islambad	9/28/87
S. Yed Manzer Husain Technical Director/Highways and Structures Associated Consulting Engineers (ACE)	8/27/87
Ahmad Hussain Deputy Director (Geo-Chemical Lab) Geological Survey of Pakistan Peshawar	9/15/87
Chulam Hussain Senior Geological NESPAK, WAPDA HOUSE Lahore	Week of 9/27/87
Imtiaz Hussain Range Forest Officer - Wildlife Chitral Wildlife Division NWFP Forest Department Chitral	9/5/87; 9/17/87; 9/20/87; 9/26/87
Dr. Iqbal Hussain Programme Livestock Officer Anga Khan Rural Support Programme Angna Khan Foundation Chitral	9/27/87

CONTACT	DATE(S) CONTACTED
Shabir Hussain Divisional Forest Officer Chitral Subdivision NWFP Forest Department Chitral	9/9/87; 9/17/87; 9/26/87
Gullawar Ingegan Sawmill Owner Chitral	9/23/87
Mr. Jalaluddin Mining Engineer Sarhad Development Authority Chitral	Week of 9/27/87
Saifullah Jan Official Representative of Kalash Rumber Valley P.O. Box Ayun, Chitral District NWFP, Pakistan	9/22/87
Tahir Karim Deputy Director (Publications) Geological Survey of Pakistan Quetta	Week of 9/27/87
Aban Kabraji Project Representative International Union for Conservation of Nature and Natural Resources - IUCN No. 1 Bath Island Road Karachi 4	10/1/87
Abdullah Khan Deputy Director Directorate of Industries and Mineral Development Peshawar	9/15/87
Abid Khan Director (Minerals)/Chief Geologist Sarhad Development Authority Gemstone Corporation of Pakistan Peshawar	Week of 9/27/87
Adam Khan Chief Engineer Commerce and Works North West Frontier Province (NWFP)	9/15/87
Dr. Ahmad Nabi Khan Director General of Archeology and Museums Government of Pakistan	8/29/87

219

CONTACT	DATE(S) CONTACTED
Ali Akbar Khan Conservator of Forests Pakistan Forest Institute Peshawar	9/29/87
Aman Khan Area Manager - Peshawar Associated Consulting Engineers (ACE)	9/12/87; 9/17/87
Amanullah Khan Resident Director Associated Consulting Engineer (ACE), Ltd. Peshawar	Week of 9/27/87
Bahrawar Khan General Manager Sarhad Development Authority Peshawar	9/8/87
Ejaz A. Khan Junior Geologist P & I WAPDA Sunnyview, Lahore	Week of 9/27/87
Dr. Mirza HaKim Khan Deputy Director (Technical) Pakistan Forest Insitute Peshawar	9/15/87
Raza Mohammad Khan Pakistan Mineral Development Corporation Peshawar	9/15/87
Riaz Ahmed Khan Unit Manager PTOC Chinar Inn Gilgit	9/11/87
Sharif Khan Deputy District Commissioner North West Frontier Province Chitral	9/5/87
Dr. Tahir Khei, R.A. Khan Centre of Excellence in Geology Peshawar University Peshawar	Week of 9/27/87

220

CONTACT	DATE(S) CONTACTED
Yar Mohammad Khan Chief Conservator of Forests NWFP Forest Department Shami Road Peshawar	9/14/87; 9/15/87
Zahid Karim Khan Assistant Professor Institute of Geology Punjab University Lahore	Week of 9/27/87
Ziarat Khan Engineer Sarhad Development Authority Chitral	9/21/87
Dr. Taj Mohammad Khattack Medical Doctor Headquarters, Chitral Scouts Drosh	8/25/87; 9/12/87
Abdul Latif Leghari Assistant Director Geological Survey of Pakistan Islamabad	9/2/87
Jared Majid Chief Special Development Plan Section Planning and Development Department	9/14/87
Laurier Mailloux POM U.S. AID Islamabad	8/23/87
Mumtaz Malik Conservation of Wildlife North West Frontier Province	9/14/87
Shabbir Malik Divisional Forest Officer Chitral	9/24/87
Tarig Masood Deputy Director Geological Survey of Pakistan Lahore	Week of 9/27/87
Mike McGovern Office of Engineering U.S. AID Peshawar	8/23/87

221

CONTACT	DATE(S) CONTACTED
Don Melville Regional Affairs Officer U.S. AID Peshawar	9/10/87
M.W. Mirza Director-Engineering Coordination Engineering Consultants Karachi	8/28/87
Abdul Majid Mohmand Secretary Commerce and Works North West Frontier Province	9/15/87; 9/17/87
Taleh Mohammad Director of Tourism	10/5/87
Matanat Mohsin 29 F.C.C., Gulberg Lahore	9/1/87
John R. Morgan Office of Energy and Environment U.S. AID Islamabad	8/24/87; 8/26/87
Babu Muhammad Former Laborer Astromineral Company Chitral	9/10/87; 9/11/87
Paul Mulligan Economist USAID Islamabad	8/26/87
Major K.A. Mulk Pakistan Army, Retired Ayun Chitral District North West Frontier Province	9/24/87
Masood-UL-Mulk Chitral	9/20/87
Muhammad Mushtaq Project Director National Highways Board	9/15/87; 9/16/87

CONTACT	DATE(S) CONTACTED
M. Nawaz Associate Professor (Minerology) Institute of Geology Punjab University Lahore	Week of 9/27/87
Edward Noble Geologist U.S. Geological Survey Islamabad	8/9/87; 9/2/87
Zahid Noor Office of Engineering U.S. AID	8/26/87
L.N.L. Van Noort Senior Civil Engineer PRC Engineering Inc. The Hague, Netherlands	8/24/87
William Outerbridge Geologist U.S. Geological Survey Reston, Virginia	8/9/87
Jeeva Perumalpillai Project Officer Asian Development Bank Manila, Philippines	10/5/87
Rashid Pervaiz Geo. Physicist Geological Survey of Pakistan Quetta	Week of 9/27/87
R.D. Porter Senior Project Engineer PRC Engineering Inc. The Hague, Netherlands	8/24/87
Said Raheem Assistant Director (Library) Geological Survey of Pakistan Peshawar	Week of 9/27/87
Jalil-Ur-Rahman Project Manager Sarhad Development Authority Chitral	9/7/87; 9/8/87; 9/10/87; 9/22/87; 9/29/87; 9/30/87

CONTACT	DATE(S) CONTACTED
Abdul Latif Rao Conservator of Wildlife National Council for Conservation of Wildlife Ministry of Food, Agriculture and Cooperatives Government of Pakistan House No. 485, Street No. 84, G-6/4 Islamabad	9/30/87
Harif Raza Subdirector of Tourism	10/5/87
Sifur Rehman Executive Engineer C/N Chitral	9/22/87
Mohammad Riaz Dames and Moore Representative Geology Department University of Peshawar Peshawar	9/8/87
Bagar Mehdi Rizvi General Manager Mining Pakistan Steel Bin Qasim Karachi	10/11/87
Walrus Ruhman Advocate Chitral	9/17/87
Akhfar Saleemi Lecturer Institute of Geology Punjab University Lahore	Week of 9/27/87
Mohmmad Sarway Liason Officer Associated Consulting Engineer (ACE) Islamabad	8/25/87
Dr. George B. Schaller Animal Research and Conservation Center New York Zoological Society Bronx Zoo Bronx, New York 10460	10/21/87/phone
Jal R. Setna Managing Director Rabka Services Ltd.	9/1/87

224

CONTACT	DATE(S) CONTACTED
Allalique Jafar Ali Shah Former Owner of Onpiment Mines Chitral	9/20/87
Altaf Ali Shah Deputy Ranger - Wildlife Chitral Wildlife Division NWFP Forest Department Chitral	9/20/87
Haider Ali Shah Owner Mountain Inn Chitral	9/10/87
S. Iqmail Hussain Shah Divisional Forest Officer - Wildlife Deputy Conservator of Wildlife NWFP Forest Department Peshawar	9/29/87
Muhammad Sharif Chief Librarian Geological Survey of Pakistan Quetta	Week of 9/27/87
M.I. Sheikh Director General Pakistan Forest Institute Peshawar	9/15/87
F.K. Siddiqui Principle Geclogist Kalabagh Consultants Lahore	Week of 9/27/87
Zafar H. Siddiqui Director Engineering Consultants Karachi	8/28/87; 8/29/87
H.F. Sijtsma Head, Estimating and Planning Department PRC Engineering Inc. The Hague, Netherlands	8/24/87
Fred Simon Geologist U.S. Geologist Survey Reston, Virginia	8/9/87

225

CONTACT	DATE(S) CONTACTED
Pieter M. Smidt Project Engineer Asian Development Bank Manila, Philippines	10/7/87
E. Zell Steever Ecologist World Bank Washington, D.C.	10/7/87
Bell Stiver Consultant World Bank (Army Corps of Engineers) Washington,. D.C.	10/7/87
Chulam Qadir Sumaroo Research Officer Geological Survey of Pakistan Quetta	Week of 9/27/87
M. Sadiq Swati Chief National Transport Research Centre Islamabad, Pakistan	9/28/87
Richard Terman Geologist U.S. Geological Survey Reston, Virginia	8/5/87
Glen Whaley Environmental Officer U.S. AID Islamabad	10/1/87
Mohammad Yusut Manager of Operation Development and Corporation Swat	9/26/87
Sah Zaidi Manager Business Development Associated Consulting Engineers (ACE) Karachi	10/3/87
M.F.W. Zijsvelt Senior Agronomist Asian Development Bank Manila, Phillipines	10/6/87

Appendix C
Record of Scoping Sessions

C.1 Introduction

In accordance with USAID requirements to obtain advance input from all parties involved in a proposed action, Scoping Sessions were held in conjunction with the Chitral Access Project.

The first, held on September 14, 1987 in Peshawar, was chaired by Mr. Suleman Ghani, Secretary of the Planning and Development Department, Northwest Frontier Province. Participants at the meeting included officials from the Ministry Departments of the Northwest Frontier Province. The second scoping session was held on September 17, 1987 in Chitral and was chaired by Mr. Sharif Ahmad, Deputy Commissioner of Chitral. This meeting was organized by district level officials and was attended by over 100 interested citizens of Chitral.

The objectives of the Scoping Sessions, as defined by its organizers, included the following:

1. A determination of the scope and significance of issues to be analyzed in the Environmental Assessment, including direct and indirect effects of the project on the environment;

2. Identification and elimination from detailed study of the issues that are not significant or have been covered by approved design considerations, narrowing the discussion of these issues to a brief presentation of why they will not have a significant effect on the environment;

3. A description of (a) variations required in the format of the Environmental Assessment and (b) the tentative planning and decision making schedule; and

4. A description of how the analysis will be finalized.

C.2 Scoping Session: Government of Northwest Frontier Province, Peshawar, September 14, 1987

The Northwest Frontier Province Scoping Session was conducted as a roundtable discussion. Many environmental concerns were expressed during the meeting, as were concerns about

-227

the project's social impacts. The 26 participants in this session included officials from most agencies of the provincial government. The following paragraphs summarize the issues discussed at the meeting. Please note that the tape of meeting proceedings was garbled and therefore, some information may have been lost.

Chief Conservator, Forests

In a descriptive overview of development in Pakistan, the Conservator outlined the current status of environmental resources in Pakistan. The Chief Conservator stated that laws have now been completed for industrial waste disposal but there is still a need for "anti-pollution" laws, zoning laws, and public training/education to foster environmental awareness. The Conservator was clear in saying that the economic benefits of improved access to Chitral will compensate for the environmental losses. He cited the immediate environmental impacts on the forest, ecology and wildlife of the area that will result from blasting. He stated the need to insure safeguards to protect the trees and wildlife species, such as the markhor and ibex.

Secretary, Commerce and Works Department

Long-term environmental impacts were projected for the forest as a result of tourism (specifically littering and forest fires), increased traffic and increased settlement as people in Chitral cut trees for fuel in the winter months. The Chief concluded his comments by arguing that the cutting of trees will cease as the tunnel lessens pressure on the forest by bringing in alternate fuel sources.

Secretary of Physical Planning and Housing

The Secretary began his comments by stating that the Lowari Tunnel is a basic necessity. He projected minimal adverse impacts resulting from construction and cited long-term impacts on forestry, wildlife, land-use and mining as unavoidable.

Mitigative measures were suggested such as a land-use plan to guide the location of economic activity in NWFP and a Regional Development Plan to mitigate the projected increase in settlement. He spoke of the environmental assessment as the means by which to identify project goals and impacts addressable by mitigation.

Secretary, Health

The Secretary's statements clearly stressed that improved access to Chitral will have only positive effects on public health care.

-228

His comments carried a sentiment that the positive impacts of the proposed project will far outweigh the negative. He spoke of the great psychological impact of greater mobility and economic development. Additionally, he described the current public health problems associated with transport of medical supplies and people needing emergency transport during the winter months.

His closing statement indicated that "only good can come" from improved access to the area.

Secretary, Minerals

The Chairman informed the group of the absence of the Secretary from the Mineral Department and issued his regret of this situation in light of Chitral's rich reserves of minerals.

Secretary, Agriculture

The Secretary's comments focused on the positive market effects of improved access. He projected that local agricultural production would increase due to better transport alternatives and the opening of additional markets.

He also cited environmental impacts to forestry and wildlife as important considerations.

Secretary, Finance Department

The speaker, Mr. Salim, stated that the financing of Lowari Tunnel would have an immediate impact on Chitral.

He voiced a belief that the major environmental issues associated with the project had been identified by previous speakers. His comments then focused on the changes that opening the sector would bring to the human environment. He described most Chitralis as having no contact with the world beyond Lowari Pass and he questioned the effects that improved access would have on the social and ethnic fabric of the Kalash.

He spoke of the subsistence economy and restricted agriculture, as land is limited. His argument pointed out that people in Chitral grow certain crops because they must provide all food for themselves. In addition, crops such as strawberries and grapes, which are well-suited to the district have no access to the market.

Further comments on the issue of population migration pointed out that an influx of people to the region was probable as was increased internal migration within the district. He projected that people would move to the more developable part of Chitral, near the road. He stated that these

population, shifts, from rural to road corridor would be perceptible. In addition, he argued that Chitralis would now remain in the district, as opposed to the current trends of out-migration. This forecast was based on the hypothesis that year-round access would spur tremendous growth in housing/commercial investment in Chitral and Drosh. The need for a development plan was then stressed, as was heavy involvement of the Planning and Development Bureau of Chitral.

Another mitigative measure was suggested to curtail soil erosion in the forests, which are already limited and pressured. Here, the Secretary spoke of the need for a stronger law and an alternate energy source to slow deforestation.

Conservator, Wildlife

The Conservator's comments focused on the complex environmental impacts and the need for mitigation of these effects of the Tunnel.

His concerns centered on habitat destruction and the potential extinction of vulnerable species. Specifically, the increase in traffic resulting from a better road and the transport of huge machinery were cited as important issues. In addition, the Conservator stated that revenue for wildlife protection would be available, but he feared that hunters would see the sale of furs, etc. as a money-making proposition in an expanded market.

His concerns also included impacts on fisheries because trout fishing would be under heavy pressure with increased population.

On a positive note, the Conservator offered his belief that population growth would improve public perception of land-use planning and spur an increase in community participation.

Deputy Director, Population

This representative began his comments by building the following economic scenario for Chitral: Income capacity will go up and create excess, thus creating a market for durable goods and imported consumer items; people will buy and therefore, the rate of savings in Chitral will go down. His point was that noone will become affluent in Chitral as a result of the proposed project. He continued by stating that electricity would come to Chitral with the road, and living conditions will be unavoidably affected. Cultural ecology would change. Education and literacy rates would increase, and Chitral's women would be exposed to different lifestyles, thereby spurring household changes.

Finally, he stated that demands on the government for improved public services would increase as people were exposed to differing lifestyles.

Chief, Planning and Evaluation

The Regional Planner opened his remarks by speaking about the need for a livestock artificial insemination program and a similar program's previous failure due to lack of access. He also asserted that use of pesticides would increase, and both factors would create environmental impacts. He then commented on the abundance of minerals in Chitral.

He then spoke of the energy situation in Chitral and the high price of electricity. He suggested that the region is capable of generating hydroelectric surpluses. This energy potential prompted a request that tunnel design allow for high tension electric wires to run from portal to portal.

The representative listed other issues to consider, such as community growth and improved housing, relocation of people, air quality, scenic resources and increased traffic. He also cited social and cultural consideration of the Kalash.

The speaker finally urged the consultant geologist to intently study the rock of Lowari Pass. He spoke of layers and strips of igneous, metamorphic and morphic-inclusive rock and vocalized his knowledge that explosions can travel the length of these strips, shattering them and resulting in landslides many miles away. He issued a warning concerning the formation of screes and loss of vegetation during construction of the tunnel.

TAMS Consultants, Inc.

The meeting concluded with comments by the consultant team who requested the opportunity to pursue some of these issues in more depth with the officials present. They stated their preliminary findings to include the need to upgrade access roads and implement mitigative measures and they thanked the participants for their remarks.

C.3 Scoping Session: Government of Chitral District, Chitral, September 17, 1987

This Scoping Session was attended by concerned citizens in the Chitral District and was held at the Government College of Commerce in Chitral. Speakers included Mr. Sharif Ahmad, Deputy Commissioner of Chitral, Mr. Zaffar Ahmad, MPA Chitral and Mr. Saeed Ahmad, MPA Chitral and Advisor to the Chief Minister, NWFP Government. In addition, the TAMS team was present as were representatives from the ACE counterpart team.

The large audience consisted of a cross section of people from Chitral District; council members, union council, chairmen from district councils and union councils, lawyers, landlords, agriculturists, shopkeepers, civil contractors, bank

employees, representatives from different district-level departments in Chitral and students and educators. The audience numbered 123.

Due to the large size of the meeting, it was conducted like a public hearing with each speaker offering his/her comments from the platform. The Deputy Commissioner, in his opening remarks, explained to the representatives and people of Chitral the purpose of the scoping session. He said that a foreign consultant (TAMS), engaged by USAID, had come to Chitral to study the construction of Lowari Tunnel and approach roads so that Chitral might be connected with other parts of the country throughout the year. He informed the audience that the consultant had almost completed the work and that a report to this effect would be submitted to the Government of the United States and the Government of Pakistan.

At this time, local representatives were invited to express their feelings and sentiments about construction of Lowari Tunnel and subsequent development in Chitral which might result from improved access.

Eight speakers were invited to the platform. Their remarks coincided with the Chairman's stated objective: the expression of their sentiments and feelings about improved access to Chitral. In general, the local representatives spoke of poverty and misery in Chitral District due to lack of a communication system. Proposed construction of Lowari Tunnel was extremely "pleasant" news to the local people. The United States Government was thanked for financing the project. Additionally comments focused on the benefits of improved access in Chitral.

Each official rendered a descriptive account of the difficulties associated with underdevelopment in Chitral. This underdevelopment was repeatedly attributed to poor communication and isolation of the district during the winter months. Additional concerns were centered on the geopolitical position of Chitral, with Afghanistan and Russia to the west. The cost of essential commodities during the winter months was cited as a central factor causing distress to Chitral residents. Lowari Tunnel was attributed with the potential to greatly improve the lives of the people in Chitral.

The general tone of the meeting can be summed up by the comments of Qaja Saeed, member of the District Council of Ashriat Town. He said that whatever are the positive or negative points to be faced, Lowari Tunnel would have a tremendous impact on improving the lives of Chitralis. He questioned the importance of environmental concerns, stating that the impacts on forests, wildlife, etc., were negligible given the situation of people in Chitral. He claimed that Chitralis were deprived of the very basic necessities of life due to Lowari Pass and he petitioned the USA Government not to create hindrances, political or otherwise.

A description of the proposed project were rendered by Mr. Zahid Noor, engineering programming manager, USAID, Islamabad and Mr. John Andrews, team leader of TAMS Consultants. Mr. Noor requested that representatives tell the consultants about any negative impact that could result from Lowari Tunnel. James Smith, geologist from TAMS, spoke of his findings of minerals and requested that the local people inform him of any other mineral locations which he might not have seen thus far.

However, the meeting proceeded with the same emotional fervor which preceded their comments. As a result, substantial environmental concerns were not brought forth.

The meeting concluded with remarks from the Deputy Commissioner of Chitral. He thanked the consultants and representatives, inviting the consultants to a tea party given in their honor by the local representatives.

IV. Results of Scoping Sessions

The concerns expressed during the scoping sessions with respect to environmental issues, particularly wildlife and forestry and the need for mitigative measures have been given special attention in the EA. Remarks regarding the social-psychological and symbolic aspects of improved access are addressed in the Social Soundness Analysis (Appendix G).

Many of the comments made at both scoping sessions are directed to improved tunnel access, since an all-road access had historically not been defined. Localized impacts at Lowari Pass aside, access to Chitral Valley via a tunnel and improved approach roads or via an all-road access would not differ. Comments in the scoping session have thus been assumed to apply to both alternatives, except for tunnel specific components such as blasting.

The general tenor of comments suggests that better access to the Chitral Valley will lead to increased population, expanded economic development, the opening up of mining, more tourism, and improved social services. Certain comments regarding the nature and magnitude of environmental impacts and other comments expressing the opinion that benefits far outweigh negative environmental effects are all based on the belief that improved access will generate positive economic benefits. The EA reveals that symbolic and social-psychological benefits of improved access and service delivery are significant; however, as a result of improved access, economic benefits in tourism, mining or other sectors and the likelihood of population increases are not projected to be great. Thus, both the possibilities for major economic improvement and, by the same token, adverse environmental effects as analyzed in the EA are much reduced in importance compared to statements in the scoping session. It should be noted that expressions of sentiment in the scoping sessions have not been ignored, but did need to be tempered by the results of the EA analysis.

- 232

As indicated in the introduction to Chapter 5, improved access is a necessary but not a sufficient condition for development in the Chitral Valley. Indeed, the IFAD/ADB development project states that the Lowari Tunnel is a complementary project. Certainly improved access will benefit the population, particularly in the long-term, as access to educational opportunities outside the valley become easier, as government communication and coordination with bureaus in Chitral improves and the frustrations of severe constraints due to lack of contact with the outside world during winter are diminished.

Appendix D
Proforma Environmental Assessment

Appendix D
Pro Forma for Environmental Impact Assessment

Types of Information

1. General

1.1 Name of the Project:

Chitral Access Project

1.2 Official address at which correspondence can be made:

U.S. Agency for International Development
18-Sixth Avenue
Ramna 5
Islamabad, Pakistan
Attention: Mr. Gene George,
Chief Office of Engineering

1.3 Name and address of consultant appointed, if any:

TAMS Consultants, Inc.
655 Third Avenue
New York, New York 10017
U.S.A.

1.4 Name, designation, and address of official authorized to deal with this Questionaire/Proforma:

Muhammad Mushtaq
Project Manager
National Highway Board
Islamabad, Pakistan

1.5 Date on which letter of intent was issued:

NA[1]

2. Process Details

See EA[2], Chapter 2 Discussion of the Proposed Action and Alternatives. More detailed specifications can be found in the Lowari Tunnel Draft Feasibility Report prepared for the National Highways Board (PRC Engineering, Inc., October 1987).[3]

---

[1]NA = Not Applicable
[2]EA = Environmental, Economic and Social Soundness Assessment
[3]Cited hereafter as PRC Draft Feasibility Report

-236

2.1 Production Schedule:

For schedule, see EA 2.3.6, 2.4, 2.5 and PRC Draft Feasibility Report, Sections 4 and 6.

2.1.1 List of main products proposed to be produced with designed daily production or capacity:

Not a production facility, but see EA Chapter 2 and PRC Draft Feasibility Report.

2.1.2 List of by-products produced with designed daily product capacity:

Not a production facility, but see EA Chapter 4, Environmental Impacts of Proposed Project and Alternatives.

2.1.3 Time phasing for achieving full production capacity:

See EA 2.3.5, Construction Scenario and PRC Draft Feasibility Report, Section 6.3.

2.2 Raw Materials Consumption:

See EA Chapter 4 and PRC Draft Feasibility Report, Section 6.

2.2.1 List all raw materials with daily consumption at full production capacity:

See PRC Draft Feasibility Report, Sections 6.2 and 6.4.

2.2.2 List all process chemicals/materials consumed with approximate quantities:

NA

2.2.3 Is any recycled material from the waste of your project or any other project used in the process? If so, please specify quantities and source.

See EA 4.1.2 regarding spoil disposal.

2.2.4 Is any material salvaged from your waste stream reusable economically for any other?

See EA 4.1.2 regarding spoil disposal.

2.3 Manufacturing Process:

NA

2.3.1 Source of process know-how:

NA

2.3.2 **Give a brief description of the process technology utilized with a flow-chart. (Flow-chart of the process should be attached).**

NA

2.3.3 **Have you any foreign collaboration?**

Not applicable with respect to manufacturing process. See Chapter 6, List of Preparers and Appendix B, List of Persons Contacted for persons consulted in Environmental Assessment preparation.

2.4 **Energy Consumption:**

See EA Chapter 2 and PRC Draft Feasibility Report, Sections 4.4 and 6.3.5.

2.4.1 **Source of energy:**

a) **In-plant generation.**

See EA Chapter 2 and PRC Draft Feasibility Report, Sections 4.4 and 6.3.5.

b) **Public supply.**

See EA Chapter 2 and PRC Draft Feasibility Report, Sections 4.4 and 6.3.5.

2.4.2 **If energy is generated in plant, type and quantity of fuel daily consumed:**

See response to 2.4.1

3. **General Environment (Site climate settlement):**

3.1 **Site:**

Lowari Pass, Dir and Chitral Districts.

3.1.1 **Where is the plant proposed to be sited? (Attach map showing topographical features of the area.)**

See Figures 1, 2, 3 and 4 and EA Chapter 3 - Affected Environment. See also PRC Draft Feasibility Report, Volume II (Drawings).

3.1.2 **Elevation above mean sea level:**

See EA Chapter 2 regarding tunnel elevations and 1.1 for study area.

3.1.3 Area of land proposed to be acquired:

See EA 4.1.6.

3.1.4 Area proposed to be built up or developed:

See EA 4.1.6 and 4.2.6, Socio-economics, Land Use and Infrastructure.

3.1.5 Present use of the land: (agriculture/forest/grazing/settlement/fallow)

See EA 3.6.2, Land Use and Land Tenure and 4.1.6.

3.1.6 Indicate the nature of topography near the site: (plains/valley/hilly)

See EA 3.2.

3.1.7 Specify site character: (river basin/coastal/estuarine/land-locked)

See EA 1.1, Study Area and 3.2, Geology, Physiography and Soils.

3.1.8 Is the land situated within any municipal or corporation jurisdiction?

No

3.1.9 Is the land situated in an approved industrial zone or estate? If so, please specify.

No

3.1.10 What, of the following features, exist within 30 km of the site?

a) **Human settlements: specify population.**

See EA 3.6.1, Population and Demographics and 3.6.2, Land Use and Land Tenure.

b) **Agricultural land: specify crops.**

See EA 3.7, Agriculture and Livestock.

c) **Grazing land:**

See EA 3.6.2, Land Use and Land Tenure.

d) **Fisheries:**

See EA 3.5, Aquatic Ecology.

e) **Forest/sanctuary/natural park:**

See EA 3.6.2, Land Use and Land Tenure; 3.4.5, Protected Areas; 3.8, Forestry; and 3.9, Tourism.

f) **Nullahs/streams/rivers:**

See EA 3.3, Water Resources.

g) **Ponds/lakes/dams:**

See EA 3.3, Water Resources.

h) **Estuary/sea:**

NA

i) **Hills/mountains:**

See EA 3.2, Geology, Physiography, and Soils.

j) **Archaeological/Historic/Cultural/Scenic sites/Scientific Institutions/Hospitals/Sanatoria/Religious importance:**

See EA 3.6.4, Infrastructure; 3.9, Tourism; 3.10, Paleontological, Archaeological and Historical Resources and Appendix G, Social Soundness Assessment.

3.1.11 Type of flora and fauna, especially wildlife, endangered species:

See EA 3.4, Terrestrial Ecology.

3.1.12 Present employment or occupational pattern in the area:

See EA 3.6.3, Employment and Economic Activity.

3.1.13 Prominent Endemic Disease (Fluorosis, Malaria, Filaria, Malnutrition, etc).

See Appendix G, Social Soundness Assessment.

3.1.14 Mortality rates: (Crude, Infant, Maternal):

See EA 3.6.1, Population and Demographics and 4.2.6.

3.1.15 Any other observation regarding state of the environment?

See Chapter 3, passim.

3.2 Climate:

3.2.1 Indicate the climatic conditions at the site (e.g., arid, semi-arid, etc.).

See EA 3.1.1, Climate and Meteorology.

3.2.2 Rainfall yearly average. Range:

See EA 3.1.1, Climate and Meteorology.

3.2.3 Temperature seasonal. Ranges:

See EA 3.1.1, Climate and Meteorology.

3.2.4 Provide information on speed and direction of wind.

See PRC Draft Feasibility Report, Table 3.9.

3.3. Settlement:

See EA 3.6.1, Population and Demographics and 3.6.2, Land Use and Land Tenure.

3.3.1 Total number of persons proposed to be employed:

(a) During construction:

See EA Chapter 2, Proposed Action and Alternatives and 4.1.6, Socioeconomics, Land Use and Infrastructure.

(b) After completion:

See EA Chapter 2, Proposed Action and Alternatives and 4.1.6, Socioeconomics, Land Use and Infrastructure.

3.3.2 Do you propose to build a township/housing quarters for your employees?

See EA 4.1.6 and 5.1.1.

3.3.3 Area allocated for above:

See EA 4.1.6 and 5.1.1.

3.3.4 Population to be accommodated:

See EA 4.1.6 and 5.1.1.

3.3.5 Distance from township to plant site:

See EA 4.1.6 and 5.1.1.

241

3.3.6 Services provided in township:

a) Water - daily consumption:

See EA 3.6.4, Infrastructure, 4.1.3, Water Resources and Chapter 5, Mitigative Measures.

b) Sewer system:

See EA 3.6.4, 4.1.3 and Chapter 5.

c) Sewage treatment:

See EA 3.6.4, 4.1.3 and Chapter 5.

d) Garbage disposal:

See EA 3.6.4, Infrastructure.

e) Drainage:

See EA, 3.3 Water Resources, 4.1.3, Water Resources and Chapter 5.

f) Any other:

NA

4. <u>Water Requirements</u>:

4.1 What treatment is given before use, if any?

See EA, 4.1.3 and Chapter 5 and PRC Draft Feasibility Study, Section 4.4.4.

4.2 Average daily quantities and characteristics of water consumed:

a) Process and wash:

See PRC Draft Feasibillity Report, Sections 5.4 and 4.4.4.

b) Cooling:

See PRC Draft Feasibility Report, Sections 6.1.4 and 5.4.

c) Sanitary:

See EA 4.1.3 and Chapter 5 and PRC Draft Feasibility Report, Section 6.3.

d) **Total:**

NA

4.3 Are adequate quantities of water available?

a) **At present:**

See EA 4.1.3, 5.1.2 and 5.3.3.

b) **For future expansion:**

See EA 4.1.3, 5.1.2 and 5.3.3.

5. <u>Wastewater Discharges</u>:

5.1 Total quantity of wastewater discharged from the project per day:

See EA 4.1.3, Water Resources and Chapter 5, Mitigative Measures and PRC Draft Feasibility Report, Section 4.4.4.

5.2 Wastewater discharges per day from:

a) **Process and wash (with break up, where possible):**

See EA 4.1.3, Water Resources and Chapter 5, Mitigative Measures and PRC Draft Feasibility Report, Section 4.4.4

b) **Cooling:**

See EA 4.1.3, Water Resources and Chapter 5, Mitigative Measures and PRC Draft Feasibility Report, Section 4.4.4.

c) **Sanitary:**

See EA 4.1.3, Water Resources and Chapter 5, Mitigative Measures and PRC Draft Feasibility Report, Section 4.4.4.

d) **Total:**

See EA 4.1.3, Water Resources and Chapter 5, Mitigative Measures and PRC Draft Feasibility Report, Section 4.4.4.

243

5.3 **How do you propose to discharge the wastewater?**

a) **Separate streams/combined:**

See EA 4.1.3, Water Resources and Chapter 5, Mitigative Measures and PRC Draft Feasibility Report, Section 4.4.4.

b) **Continuous/intermittent:**

See EA 4.1.3, Water Resources and Chapter 5, Mitigative Measures and PRC Draft Feasibility Report, Section 4.4.4.

5.4 **Type of treatment proposed to be adopted: Give details and flow chart.**

See EA 5.2.3, Spill Prevention, Control and Clean-up.

5.5 **What standards for treatment effluent do you propose to adopt?**

Not yet known. See PRC Final Feasibility and Design Reports.

Does it conform to standards prescribed by State/Central Water Pollution Board, Local Authority, or other statutory authority?

Not yet known.

5.6 **Mode of final discharge:**
(open channel/pipeline/covered drains)

Not yet known. See PRC Final Feasibility Report and Design Report.

5.7 **Point of final discharge:**
(fallow land/agricultural land/sewer/river/lake bay/estuary/sea.)
Give details of outfall design.

Not yet known. See PRC Final Feasibility Report and Design Report.

5.8 **Is any portion of the wastewater proposed to be recycled? If so, give details.**

Not yet known. See PRC Final Feasibility Report and Design Report

244

5.9 **What methods do you propose to adopt for handling and disposal of sludge from treatment plants?**

Not yet known. See PRC Final Feasibility Report and Design Report

5.10 **Indicate available information on wastewater characteristics before treatment as below.**

a) **Physical Parameters:**
(Temperature, pH, colour, turbidity, odour, total solids, total suspended solids, and total volatile solids.)

Not yet known. See PRC Final Feasibility Report and Design.

b) **Chemical Parameters:**
(Acidity, total, and pH; Alkalanity, total and pH; Hardness, total; BOD; COD; Oil and Grease; total N; Phosphates, total; Chlorides; Sulphates; Sodium; Potassium; Calcium; and Magnesium.)

Not yet known. See PRC Final Feasibility Report and Design

5.11 **What other specific toxic substances are discharged? Please specify nature and concentration:**
(inorganics, organics, including pesticides and organic chlorine compounds, phenols, lignin, mercaptans, heavy metals, and radio-active substances).

See EA 5.1.4, 5.2.3 and 5.3.3 and PRC Final Feasibility Report and Design.

6. **Solid Wastes: Process and Treatment Plants**

6.1 **Total quantity of solid wastes in tons per day:**

See EA 4.1.2, Geology, Physiography and Soils and PRC Draft Feasibility Report, Section 6.

6.2 **Nature of Wastes:**
(Lumps/Granules/Dust/Slurry/Sludge)

See EA 4.1.2, Geology, Physiography and Soils and PRC Draft Feasibility Report, Section 6.

6.3 **Type of waste**
(organic, inorganic, ash, glass, natal, etc.)

See EA 4.1.2, Geology, Physiography and Soils and PRC Draft Feasibility Report, Section 6.

245

6.4 **Method proposed for disposal, including treatment plant: (Landfill/dumping/sea/lagoon/marsh/composting/incineration/sold)**

See EA 4.1.2, Geology, Physiography and Soils and PRC Draft Feasibility Report, Section 6.

6.4.1 **If landfill, possibility of leaching of toxic compounds into soil, groundwater, or surface water:**

See EA 4.1.2, Geology, Physiography and Soils and PRC Draft Feasibility Report, Section 6.

6.4.2 **If incinerated, details of incineration plant and procedures:**

NA

6.5 **Do you anticipate any problems regarding collection, handling, and transport of solid wastes?**

Not known. See PRC Final Feasibility and Design Reports.

6.6 **Are there any problems of subsequent pollution of air, water, or soil likely at the place of disposal of solid wastes?**

Not known.

7. <u>Atmospheric Emissions</u>

7.1 **Emission from fuel burning:**

See EA 4.1.1 and 4.2.1, Air Resources, 5.1.7, 5.2.1 and 5.3.1 and PRC Draft Feasibility Report, Sections 4.2, 4.4 and 6.3.5.

7.1.1 **Anticipated quantity of stack emissions:**

See EA 4.1.1 and 4.2.1, Air Resources, 5.1.7, 5.2.1 and 5.3.1 and PRC Draft Feasibility Report, Sections 4.2, 4.4 and 6.3.5.

7.1.2 **Temperature of emission:**

See EA 4.1.1 and 4.2.1, Air Resources, 5.1.7, 5.2.1 and 5.3.1 and PRC Draft Feasibility Report, Sections 4.2, 4.4 and 6.3.5.

7.1.3 **Composition of emission:**

a) **Particulates and smoke nature and quantity:**

See EA 4.1.1 and 4.2.1, Air Resources, 5.1.7, 5.2.1 and 5.3.1 and PRC Draft Feasibility Report, Sections 4.2, 4.4 and 6.3.5.

b) **Gases:**
(Sulphur dioxide, Nitrogen oxides, Hydrocarbons, Carbon monoxide, Moisture, Other, specify.)

See EA 4.1.1 and 4.2.1, Air Resources, 5.1.7, 5.2.1 and 5.3.1 and PRC Draft Feasibility Report, Sections 4.2, 4.4 and 6.3.5.

7.2 **Emissions from process:**

7.2.1 **Anticipated emissions, quantity:**

See EA 4.1.1 and 4.2.1, Air Resources, 5.1.7, 5.2.1 and 5.3.1 and PRC Draft Feasibility Report, Sections 4.2, 4.4 and 6.3.5.

7.2.2 **Temperature:**

See EA 4.1.1 and 4.2.1, Air Resources, 5.1.7, 5.2.1 and 5.3.1 and PRC Draft Feasibility Report, Sections 4.2, 4.4 and 6.3.5.

7.2.3 **Composition of emissions:**

a) **Particulates, nature and quantity:**

See EA 4.1.1 and 4.2.1, Air Resources, 5.1.7, 5.2.1 and 5.3.1 and PRC Draft Feasibility Report, Sections 4.2, 4.4 and 6.3.5.

b) **Gases:**
(Sulphur dioxide, Nitrogen oxides, Carbon monoxide, Ammonia, Acid Mists, Halogens, Hydrocarbons, Mercaptans, Others, specify:)

See EA 4.1.1 and 4.2.1, Air Resources, 5.1.7, 5.2.1 and 5.3.1 and PRC Draft Feasibility Report, Sections 4.2, 4.4 and 6.3.5.

7.3 **Height of stack(s), for atmospheric emissions:**

See EA 4.1.1 and 4.2.1, Air Resources, 5.1.7, 5.2.1 and 5.3.1 and PRC Draft Feasibility Report, Sections 4.2, 4.4 and 6.3.5.

7.4 **Proposed air pollution control system:**

See EA 4.1.1 and 4.2.1, Air Resources, 5.1.7, 5.2.1 and 5.3.1 and PRC Draft Feasibility Report, Sections 4.2, 4.4 and 6.3.5.

7.5 **Proposed method of handling and disposal of wastes trapped by pollution arresting equipment:**

See EA 4.1.1 and 4.2.1, Air Resources, 5.1.7, 5.2.1 and 5.3.1 and PRC Draft Feasibility Report, Sections 4.2, 4.4 and 6.3.5.

7.6 **Are any standards of emission prescribed for or adopted by your industry?**

See EA 4.1.1 and 4.2.1, Air Resources, 5.1.7, 5.2.1 and 5.3.1 and PRC Draft Feasibility Report, Sections 4.2, 4.4 and 6.3.5.

8. **Other Types of Pollution:**

8.1 **Is your project industry likely to cause noise pollution?**

See Ea 4.1.13, 4.2.13 and 5.1.7.

8.2 **Is your project industry likely to cause any odour pollution?**

No

8.3 **Is your project industry likely to cause any thermal pollution?**

NA

If yes, what measures are proposed to be taken?

8.4 **Is your project industry likely to cause radioactive pollution?**

NA

If yes, what measures are proposed to be taken?

8.5 Describe the nature and extent of pollution nuisance caused during construction phases and measures taken to contain the same.

See EA 4.1 and 5.1.

8.6 Work Environment Hygiene and Housekeeping:

8.6.1 What major health/safety hazards are likely in the working environment in your factors?

See EA 5.1.4, 5.1.8 and all of 5.2.

8.6.2 Describe the industrial hygiene measures you propose to adopt.

See EA 5.1.4, 5.1.8 and all of 5.2.

8.6.3 What provision have you made to confirm to health and safety requirements as per Factories Act?

See EA 5.1.4, 5.1.8 and all of 5.2.

9. Management of Pollution Control:

9.1 Give details of the organizational set-up propose to have for pollution control.

See all of EA Chapter 5, Mitigative Measures and Monitoring.

9.2 What is the level of expertise of the person in charge of pollution control?

See all of EA Chapter 5, Mitigative Measures and Monitoring.

9.3 Do you propose to monitor the pollution from your industry?

If yes, give details.

See EA 5.5, Environmental Monitoring.

9.4 What laboratory facilities do you propose to have for the above?

See EA 5.5, Environmental Monitoring.

9.5 Give details of operation and maintenance of facilities you propose to have for treatment plants and pollution monitoring and control equipment.

See EA 5.5, Environmental Monitoring.

10. **Cost of Pollution Control:**

10.1 **Total expenditure proposed for pollution monitoring and control:**
Type of expenditure:
Capital, Recurring including monitoring):

See EA Chapter 5.

11.0 **Environmental and Social Soundness Assessment**

11.1 **Climate and Air Quality:**

a) **Will the project modify the local wind behavior?**

See EA 3.1, 4.1.1 and 4.2.1, Air Resources.

b) **Will the project have an impact upon the local precipitation/humidity pattern?**

See EA 3.1, 4.1.1 and 4.2.1, Air Resources.

c) **Will the project have an impact upon the local temperature pattern?**

See EA 3.1, 4.1.1 and 4.2.1, Air Resources.

d) **Will the project generate and disperse atmospheric pollutants?**

See EA 3.1, 4.1.1 and 4.2.1, Air Resources.

e) **Will the project generate any intense odours?**

See EA 3.1, 4.1.1 and 4.2.1, Air Resources.

11.2 **Water:**

a) **Will the project alter the hydrological balance?**

See EA 3.3, 4.1.3 and 4.2.3, Water Resources.

b) **Will the project effect the groundwater required in terms of quality/quantity, depth, and direction of flow?**

See EA 3.3, 4.1.3 and 4.2.3, Water Resources.

c) **Will dewatering methods be necessary to undertake excavation?**

See EA 3.3, 4.1.3 and 4.2.3, Water Resources and PRC Draft Feasibility Report, Sections 4 and 6.

d) **Will the project induce a major sediment influx into area water bodies?**

See EA 3.3, 4.1.3 and 4.2.3, Water Resources.

e) **Will the project impede the natural drainage pattern and/or induce alteration of channel form?**

See EA 3.3, 4.1.3 and 4.2.3, Water Resources.

f) **Will the project impair existing surface waters through filling, dredging, water extraction, or other detrimental practices?**

See EA 3.3, 4.1.3 and 4.2.3, Aquatic Ecology.

g) **Will recreation or aesthetic values be endangered?**

See EA 3.12, 4.1.12 and 4.2.12 Aesthetics; 3.4.5, Protected Areas; 4.1.4 and 4.2.4, Terrestrial Ecology

11.3 Geotechnical:

a) **Is there risk of damage or loss resulting from tectonic/seismic activity and/or volcanic activity?**

See EA 3.2 and 4.1.2, Geology, Physiography and Soils and PRC Draft Feasibility Report Section 3.5.

b) **Are there mineral resources of potential value close to the project?**

See EA 3.11 and 4.1.11 and 4.2.11, Mineral Resources.

c) **Will there be an increase in rock deposition/degradation as a result of the project?**

See EA 3.2, 4.1.2, 4.2.2, 3.2.11, 4.1.11 and 4.2.11 and PRC Draft Feasibility Report.

d) **Are there potential dangers related to slow failure or falling rock?**

See EA 5.2.4 and PRC Draft Feasibility Report Sections 4.5 and 4.6.

e) **Is there risk of major ground subsidence associated with the project?**

See EA 5.2.4 and PRC Draft Feasibility Report Section 4.5 and 4.6.

11.4 Soil:

a) **Will there be a substantial loss of soil due to construction or operational practices?**

See EA 3.2, 4.1.2 and 4.2.2.

b) **Will there be a risk of losses due to instability?**

See EA 3.2, 4.1.2 and 4.2.2 and PRC Draft Feasibility Report, Sections 3 and 6.

c) **Will project cause or be exposed to liquefaction of soils in slopes or foundations?**

See EA 3.2, 4.1.2 and 4.2.2 and PRC Draft Feasibility Report, Sections 3 and 6.

d) **In case of settlement/heave, will there be a risk of damage of structure or services?**

See EA 3.2, 4.1.2 and 4.2.2 and PRC Draft Feasibility Report, Sections 3 and 6.

e) **Will the project modify the property of impacted soil?**

See EA 3.2, 4.1.2 and 4.2.2 and PRC Draft Feasibility Report, Sections 3 and 6.

11.5 Ecology:

a) **Are there rare/endangered species which require protection?**

See EA 3.4, 4.1.4 and 4.2.4, Terrestrial Ecology; 3.5, 4.1.5 and 4.2.5, Aquatic Ecology; and 5.1.5, 5.3.4 and 5.5.

b) **Are there species which are particularly susceptible to human activities?**

See EA 3.4, 4.1.4 and 4.2.4, Terrestrial Ecology; 3.5, 4.1.5 and 4.2.5, Aquatic Ecology; and 5.1.5, 5.3.4 and 5.5.

c) **Would the loss of certain plants species deny food or habitat to wildlife species?**

See EA 3.4, 4.1.4 and 4.2.4, Terrestrial Ecology; 3.5, 4.1.5 and 4.2.5, Aquatic Ecology; and 5.1.5, 5.3.4 and 5.5.

d) **Are there any unusual population communities of plants that may be of scientific value?**

See EA 3.4, 4.1.4 and 4.2.4, Terrestrial Ecology; 3.5, 4.1.5 and 4.2.5, Aquatic Ecology; and 5.1.5, 5.3.4 and 5.5.

e) **Will project activities impair natural productivity?**

See EA 3.4, 4.1.4 and 4.2.4, Terrestrial Ecology; 3.5, 4.1.5 and 4.2.5, Aquatic Ecology, and 5.1.5, 5.3.4 and 5.5.

11.6 Land Use and Land Capability:

a) **Will the project conflict with existing or proposed land use?**

See EA 3.6, Socioeconomics, Land Use and Infrastructure.

b) **Will the project degrade land capability types?**

See EA 3.6, Socioeconomics, Land Use and Infrastructure.

11.7 Noise and Vibration:

a) **Will the internal noise level present a potential risk to the hearing of workers?**

See EA 3.13, 4.13, 4.2.13, Noise and 5.1.7, 5.1.8, 5.2.5 and 5.3.13.

b) **Will the safe operation of the project be affected?**

See EA 3.13, 4.13, 4.2.13, Noise and 5.1.7, 5.1.8, 5.2.5 and 5.3.13.

c) **Will the project create noise levels which will cause annoyance or discomfort to nearby properties?**

See EA 3.13, 4.13, 4.2.13, Noise and 5.1.7, 5.1.8, 5.2.5 and 5.3.13.

d) **Will the project cause damage to structures, both natural and manmade, due to vibration?**

See EA 5.1.8 and PRC Draft Feasibility Report, Section 6.

e) **Will the vibration levels within the plant be such that there is a risk to employees safety?**

See EA 5.1.8 and PRC Draft Feasibility Report Section 6.

11.8 Visual Quality:

a) **Will the content of the scene perceived by the residents of the surrounding area be adversely affected by the project?**

See EA 3.12, 4.1.12 and 4.2.12, Aesthetics.

b) **Will the coherence of the surrounding areas be impaired by the project?**

See EA 3.12, 4.1.12 and 4.2.12, Aesthetics.

Appendix E
Pakistan Laws and Regulations Pertinent to Tunnel and Highway Improvement

E.1 Background

1) Dir and Chitral Districts are, inter alia, Provincially Administered Tribal Area notified as such by the Government of West Pakistan as adopted by NWFP Province. Unlike other settled area, some of the Central Acts/Ordinances, Regulations/Orders extended to Dir, Chitral and Swat, inclusive of Kalam and Malakand Protected Areas. These are transcribed as under:

1. The Pakistan Penal Code of 1860
2. The Canal & Drainage Act VIII of 1873
3. The Transfer of Property Act of 1882
4. The Explosives Act of 1882
5. The Land Acquisition Act of 1894
6. The Code of Criminal Procedure of 1898
7. The Code of Civil Procedure of 1908
8. The Explosives Subsurface Act of 1908
9. The Punjab Forest Act of 1913
10. The Mines Act of 1923
11. The Forest Act of 1927
12. The Central Excise & Salt Act of 1944
13. The Regulation of Mines, Oil Fields & Mineral Development (Government Control), Act of 1948
14. The NWFP Protection of Trees & Brushwood etc., 1949
15. The West Pakistan Highways Ordinance of 1959
16. The West Pakistan Wildlife Protection Ordinance of 1959
17. The Mineral (Acquisition & Transfer) order of 1961

255

18. The West Pakistan Tolls on Roads & Bridges Ordinance of 1962

19. The West Pakistan Land Revenue Act of 1967

E.2 State Property

According to the Government of NWFP and Tribal Affairs and Local Government Department order notified on 15/9/1972, besides property specified in Col. 2 of the Schedule; amongst others:

- All Road and Forests (in Dir District) shall be treated as State Property.

Similarly, order notified and issued on 31/7/1975 by the Government of NWFP Home & Tribal Affairs Department, enables the Provincial Government of NWFP to own the State Property of the former state of Chitral, inter alia, as under:

- All public Rest Houses, public recreation grounds
- All public buildings and lands; and
- All forests except trees standing on cultivated lands, chiragahs, shikaragahs, waste lands, and mines and minerals subject to such concessions to the public which the Government may determine and specially subject to the following concessions to the public;
- Obtain firewood from forests (dry only)
- Obtain timber for private use under a permit.
- Grazing of cattle to be regulated by Government.
- All office buildings and forts which were used by Shahzadas in their official capacity as governors.
- All rivers, river beds, rivulets and nullahs.
- All public roads, paths, tracks, bridges and culvers.
- All mountains

E.3 Laws Pertinent to Highways and Tunnels

E.3.1 West Pakistan Highways Ordinance XXXII of 1959

The Highway Authority is authorized to perform the following:

256

- "Widen, alter the level of, improve or repair any existing highway under its control" (Section 3).

- Depression of road level through construction of tunnel is also governed by the law (Section 8).

- "A Highway Authority may acquire any land situated between a building line and the highway to which it relates, if in his opinion, such acquisition is necessary for the construction or improvement of the Highway. If the purchase cannot be effected by agreement, the Highway Authority may certify that the land is required for the construction or, as the case may be, the improvement of a highway, and thereafter acquisition may be effected under the Land Acquisition Act, 1894" (Section 18).

- "In addition to any specific provision made elsewhere in the ordinance, any contravention of the provisions of Sections 6, 7, 8 and 17(1) shall be the offenses which will be cognisable" (Section 24).

- Contravention of any provisions of law is punishable with a fine of Rs. 500 or with imprisonment of 3 months or both under Sections 25(1) and (2).

E.3.2 The Explosives Act (IV) of 1884

As defined in Section 4(1): (a) "Explosive means gun-powder, nitroglycerine dynamite, blasting powder, fulminate of mercury, or of other metal, coloured fires and every other substance, whether similar to those above-mentioned or not, used or manufactured with a view to produce a practical effect by explosion or a pyrotechnic effect; and (b) includes for signals, fireworks, rockets, percussion caps, and every adaptation or preparation of an explosive as above defined".

Under Section 5(1): "The appropriate Government may for any part of Pakistan make rules consistent with the Act to regulate or prohibit, except under and in accordance with the conditions of a license granted as provided by those rules, the manufacture, possession, use, sale, transport and importation of explosive or any specified class of explosives".

Rule 84 of the Explosives Rules, 1940 sets out a procedure for application for license. Rule 85 controls the grant of license. Rule 92 empowers the licensing authority to refuse license, whereas Rule 93 allows the same to cancel license. Rule 106 empowers the officers named below to search and seize the license:

251

	Officers	Areas
1)	The Chief Inspector, Inspector and Assistant Inspector of Explosives.	All parts of Pakistan.
2)	All District Magistrates	Their respective Districts
3)	All Stipendiary Magistrates Subordinate to Distt. Magistrates.	Their respective jurisdictions.
4)	All police officers of rank not less that that of sub-inspectors.	The respective areas over which authority extends

Rules 87, 88, 89, 90, 91 of these rules governs the issue of license.

E.3.3 The NWFP Canal & Drainage (Amendment) Act VIII of 1948

As defined in Section 3(1) "Canal" includes:

- "all canals, channels and reservoirs constructed, maintained or controlled by Government for the supply or storage of water;
- All works, embankments, structures, supply and escape channels connected with such canals, channels or reservoirs;
- all water courses as defined in the 2nd clause of this Section;

any part of a river stream, lake or natural collection of water or natural drainage channel to which the Local Government has applied the provisions of Part II of this Act."

According to Section 5 of the Act: "At any time after the day so named, any canal officer (as defined in Sec. 3(7) of the Act) acting under the orders of the Local Government in this behalf may enter on any land and remove any obstructions and may close any channels, and do any other thing necessary for such application or use of the said water".

Pursuant to Section 14: "Any Canal Officer or other person acting under the general or special order of a Canal Officer may enter upon any lands adjacent to any canal or through which any canal is proposed to be made and undertake surveys of levels thereon; and dig and bore into the subsoil; and make and set up suitable land marks and water gauges; and do all other acts for the Proper Prosecution of any enquiry relating to any existing or projected canal under the said

Canal Officer. [The Act provides] power to clear land .... fence or jungle; power to inspect and regulate water supply ....; and compensation for damage caused by entry.

E.3.4 Land Acquisition Act 1 of 1894

Part II, Section 4 ("Publication of preliminary notification) specifies that: (1) "Wherever it appears to the Provincial Government that land in any locality is needed or is likely to be needed for any public purpose, a notification to that effect shall be published in the official gazette, and the Collector shall cause public notice of the substance of such notification to be given at convenient places in the said locality. (2) Thereupon it shall be lawful for any officer, either generally or specially authorized by such Government in this behalf, and for his servants and workmen,

- to enter upon and survey and take levels of land in such locality;

- to dig or bore in the sub-soil;

- to do all other acts necessary to ascertain whether the land is adapted for such purposes; to set out boundaries of the land proposed to be taken and the intended line of the work (if any) proposed to be made thereon:

- to mark such levels, boundaries and line by placing marks and cutting trenches; and, when otherwise the survey cannot be completed and the levels taken and the boundaries and lines marked, to cut down and clear away any part of any standing crop, fence or jungle:

- Provided that no person shall enter into any building or upon any enclosed court or garden attached to a dwelling house unless with the consent of the occupier thereof without previously giving such occupier at least seven days' notice in writing of his intention to do so".

According to Section 5A (Hearing of Objections):

- "Any person interested in any land.... may, within thirty days after the issue of the notification, object to the acquisition of the land or any land in the locality as the case may be.

- Every objection shall be made... in writing ... the Collector shall give the objector an opportunity of being heard and ..... submit the case for the decision... The decision of the Provisional Government on the objections shall be final.

257

- For the purpose of the section, a person shall be deemed to be interested in land who would be entitled to claim an interest in compensation if the land were acquired under this Act".

Section 6 pertains to the declaration that the land is required for a public purpose. This Section states that:

- "Subject to Part VII of this (Act) when the Provincial Government is satisfied after considering the report, if any, made under Sec. 5(A), ... a declaration shall be made to that effect under the signature of a Secretary to such Government or of some officer duly authorized to certify its orders;

- Provided ..... authority the declaration shall be published in Official Gazette .... the place where such plan shall be inspected.

- The said declaration shall be conclusive evidence that the land is needed for a case may be; and, after making such declaration, the Provincial Government may acquire the land in manner hereinafter appearing".

After the declaration is made the Collector proceeds to acquire land, prepares a plan, issues notices to the persons interested, and completes award as to:

- the true area of the land;
- the compensation; and
- the apportionment of the said compensation.

E.3.5 <u>The Antiquities Act VII of 1975</u>

Under Section 5, the Director of Archaeology of the Government of Pakistan can take steps to preserve and protect antiquity. He can also take in to custody, preserve and protect the antiquity, in case the owner is not traceable.

Under Section 6, the Director may, after giving reasonable notice, enter into, inspect and examine any premises, place or area or the sub soil of which he may have reason to believe, to be, or to contain an antiquity.....

According to Section 7: "If the Federal Government has reasonable grounds to believe that any land contains any antiquity, it may direct the Provincial Government to acquire such land or any part thereof; and the Provincial Government shall thereupon acquire such land or part under the Land Acquisition Act of 1894, as for a public purpose."

Pursuant to Section 15: If the Federal Government apprehends that a protected immovable property is in danger of being destroyed, injured or allowed to fall in to decay, it may

260

direct the Provincial Government to acquire such autiquity or any part thereof; and the Provincial Government shall thereupon acquire such antiquity or part thereof under the Land Acquisition Act 1894 as for a public purpose. The power of compulsory acquisition shall not be exercised in the case of:

- any antiquity which or any part of which is periodically used for religious observances; or

- any antiquity which is the subject of a subsisting agreement under Sec. 12".

E.3.6 Local Government Ordinance 1979

Section 93 regarding Environmental Pollution states:

- "An urban local council for the prevention of the pollution of air by gases, dust or other substances exhausted or emitted by automobile engines, factories, brick or lime kilns, crushing machines for grain, stone, salt or other materials and such other sources of air pollution as the by-laws may provide.

- An urban local council may prepare and implement schemes for the prevention of the pollution of water or land from such sources and in such manner as the by-laws may provide."

E.3.7 West Pakistan Land Revenue Act XVII of 1967

Section 49 (Rights of Government in Mines and Minerals) specifies that:

"Notwithstanding anything to the contrary in any other law, or in any order or degree of court or other authority, or in any rule of custom or usage, or in any contract, instruments, deed or other documents, all mines and minerals shall be and shall always be deemed to have been the property of Government and Government shall have all powers necessary for the proper enjoyment of its rights thereto".

Section 50 concerns Presumption as to Ownership of Forests, Quarries and Waste lands:

- When in any record of rights completed on or before 18/11/1871 ..... it is not expressly provided that any forest or quarry or any unclaimed, unoccupied or wasteland or nay spontaneous produce or other necessary interest in land belongs to the land owners, it shall be presumed to belong to Government.

-261

- Until the presumption is so rebutted, the forest, land, produce or interest shall be held to belong to Government".

Section 51 deals with compensation for infringement of right of third party or parties in exercise of right of Government. This section states:

- "Whenever in the exercise of any right of Government referred to in Sections 49 and 50, the rights of any person are infringed by the occupation or disturbance of the surface of any land, Government shall pay, or cause to be paid, to that person compensation for the infringement.

- The compensation shall be determined as nearly as may be in accordance with the provisions of the Land Acquisition Act, 1894 (Act I of 1894)"

E.3.8 Local Government Ordinance 1979 (as applicable to NWFP)

This ordinance contains Section 108 (2) regarding Burial or Burning Places. It states:

"The Government may by notification in the official gazette declare that any burial or burning place which is open to public for burial vest in an urban local council and thereupon such burial or burning place shall vest in the urban local council and the urban local council shall take all measures necessary for the proper maintenance and administration thereof .....".

Note: There is no such law applicable to a graveyard along road side.

E.3.9 Enforcement Acts

The Pakistan Penal Code (P.P.C.), the Code of Criminal Procedure (Cr.P.C.) and the Code of Civil Procedure (C.P.C.) are the three major Acts introduced in Pakistan which help in implementation of the Supporting Acts mentioned at E.3.1 to E.3.8 above.

E.4 Conclusions

After having dealt with the laws identified as applicable in general and the details of the laws extended in particulars, the conclusions noted below have been reached.

In views of all rivers, rivulets, bridges, culverts and all mountains declared as state property by the Provincial Government of N.W.F.P. on directions from the President of

262

Pakistan, no question of infringement of civil rights of a third party is involved.

Compensation under Section 51 of the West Pakistan Land Revenue Act of 1967 in accordance with the Provision of the Land Acquisition Act of 1894 can meet with the infringement of the rights of the third party, if any.

West Pakistan Highways Ordinance of 1959 and Explosives Act of 1884, read with West Pakistan Land Revenue Act of 1967 and the Land Acquisition Act of 1984, control the widening of the right-of-way.

The Highway Authority via Executive Engineer, Highways Division is empowered to widen the Highways and acquire land, if necessary, in this regard. He is also authorized to excavate a tunnel by depressing the road level.

In the same manner, the Canal Officer is authorized to enter upon any land or channel and do any other thing necessary for such application or use of the said water in lieu of Powers conferred under Section 5 & 14 of the Canal & Drainage Act VIII of 1873 as amended and modified in 1948.

Where necessary, Sectiions 4 to 6 of the Land Acquisition Act of 1894 can be made use of in acquisition of land.

With regard to blasting, the Chief Inspector, Explosives is authorized to issue license for gun powder, and dynamite with detonator etc., whereas the Deputy Commissioner is empowered to issue license as per powers delegated under the Explosives Act of 1884 in the respective district to any firms or contractor who can fulfill the formalities prescribed under the Explosives Rules of 1940.

There is no special law enacted to control environmental pollution. However, Section 93 of the Local Government Ordinance of 1979 authorizes the District Council to prevent pollution of air.

The Director of Archaeology is authorized to preserve, protect and compulsarily acquire land or any part thereof, dealing with antiquity, under Land Acquisition Act of 1894.

Depending on the nature of a graveyard, i.e. registered with any Local Council and recognized as such by the Government of NWFP, land required for widening of highways can be acquired under the Land Acquisition Act I of 1894 in order to make way for traffic. In regard to an un-registered graveyard, there are no rights attached except sentiments and passions of the public which too can be satisfied by a suitable compensation at the level of District/Local Council. Removal of cemeteries is thus not a problem in the eyes of law.

Appendix F
Economic Feasibility Study

Appendix F
Economic and Financial Feasibility

F.1 Methodology

F.1.1 Definition and Objective

The project considers improved road access between the Chitral Valley and the rest of Pakistan. At present, access is via a road that crosses the Lowari Pass at a height of 10,500 feet and is closed by snow for six or seven months of the year. The project looks at means of upgrading this access so that year-round road transport, upto and including loaded 70-ton semi-trailers, is possible.

There are a number of alternatives to be examined as a means of achieving this improved access; these include the rebuilding of the road to a standard that would enable it to be utilized year-round; the construction of a tunnel; or the setting up of a cableway over the Lowari Pass. All of the alternatives utilize some project components in common, these are: an upgrading of 21 Km. of road from Dir to the South of Lowari Pass and the rebuilding of 7 Km. of road from Ashret to the North side of the Lowari Pass. Each of the alternatives analyzed herein treats the improvement of the transport system between Dir and Ashret as the project, but differences in the definition of alternatives apply to the means of access over or under the pass.

F.1.2 Analysis

The conventional transport economics approach of examining transport costs and volume with, and without, the project would seem to be adequate for a consideration of the alternatives.[1] However, the project has dimensions beyond that of reducing transport time and costs between the Chitral Valley and the rest of Pakistan. At present, access to the Valley is difficult between the months of June and December along both the existing road and via the air link with Peshawar. Between December and May the road is closed and weather conditions can cause the flight service to close down for up to fifteen days at time. This degree of isolation is bound to have impacts upon the valley and the people living in it. In justifying the project it is generally asserted that the development of the area has been held back by this enforced isolation, and that agriculture, industry and tourism would all benefit from improved all-season access. In order to ensure

---

1 The methodology to be used for this analysis being that laid down in "Adler,H.A. Economic Appraisal of Transport Projects. EDI Series in Economic Development; Published for the World Bank by the Johns Hopkins University Press. 1987.

265

that all the possible benefits of the project are captured, in accordance with the Aid Handbook 3 Appendix 3E-1, a broader analysis than that encompassed in a purely transport economics approach is necessary. A two-stage analysis was therefore carried out: the transport economic analysis was adopted in order to compare the alternative ways of providing all-season access to the Chitral Valley. The most attractive of these alternatives (in economic terms) was then subject to a broader cost benefit analysis encompassing all possible benefits in each of the sectors for the Chitral Valley. This analysis utilized the standard World Bank methodology for the analysis of development projects.[1]

F.1.3 Financial Analysis

At this stage with project financing not determined and the responsibility of the project components between the GOP Agencies not clear[2], any financial analysis can only be limited in scope. It will, for the present, be confined to the financing of maintenance, cost recovery and tolls.

F.2 The Project

F.2.1 General

The Chitral valley includes some 1.5 million hectares of land. It is rugged, with high mountain ranges bordering narrow valleys and ravines. The slopes on the valley sides are severe and the mountains high with many peaks above the 6,000 meter mark. The steep topography, combined with the semi-arid climate and serious erosion, limits the cultivated land to a little more than one percent of the area, the one percent where both surface water and topsoil are available.

Temperature and precipitation both vary with altitude. In the lower part of the valley, which is in the south, hot summers and cold winters are the rule. The northern part of the valley, with its higher altitudes, has very cold winters and warm summers.

1

This of ssentiart Pthe ctshod gy laid down in es iire, Lyn and van der Tak, Herman. The Economic Analysis of Projects. The Johns Hopkins University Press for ssisWorld Bank, 1975."

2

In August and September 1987 when the TAMS team were in Pakistan, the GOP has assumed that the Tunnel was the only way to improve access. Responsibility for the Tunnel was assigned to thhlBational Highways Board, but road access to the tunnel was not being addressed, with existing roads being the responsibility of the Frontier Works Organization working for the NWFP Government. There are some obvious advantages, regardless of which project option is chosen, to assigning the entire project to one agency.

266

Much of the precipitation falls as snow with precipitation rates varying from 650 mm to an estimated 200 mm. This is insufficient to sustain cropping in the valley without irrigation.

The principal river in the project area is the Chitral which is largely fed from glacial run-off and snow melt through its numerous tributaries. Total catchment area for the river is around 11,500 sq. km. It has a peak discharge in the summer of 640 cumecs with its low being in the winter when it drops as low as 85 cumecs. The tributaries of the Chitral that are not fed by snow melt are generally clear, indeed a few of them contain trout, but the river itself is heavily sedimented with loads of between 2 to 3,000 parts per million during high flow.

The population living within the Chitral valley are thought to number around 250,000 as of 1987. Table 1 giving this population by age and sex shows some 45 percent of the population are under the age of fourteen. The population are mainly of the Khow tribe, their language, which is confined to the Chitral valley, Khower (also known as Chitrali). The people live in some 570 villages scattered throughout the valley which serve as the centers for communal activity especially that related to agriculture such as the building and maintenance of the irrigation systems.[1]

Education within the valley, as in most of Pakistan, suffers from a serious lack of resources with only about 8 percent of the school age population enrolled. The literacy rate has been estimated by IFAD to be 14 percent[2], but this is probably on the high side. The rates of hospital beds per head of population is 2:620 which is a bit better than the average for the NWFP, but doctors are not always available in the four hospitals within the area.

F.2.2 Agriculture

The Chitral valley has a cultivated area of 18,000 hectares and a cropped area of 25,000 hectares which is the result of a 140 percent cropping intensity. During the winter the intensity is 75 percent with the major crop being wheat, in the summer 85 percent of the land is planted with rice and maize as the main crops. Minor crops include barley, fodder, potatoes, pulses, vegetables and fruit, with fruit-growing being a major source of cash income for many farmers. With the low precipitation levels within the valley and lack of topsoil, resulting from erosion, farming conditions are difficult but

---

1 The information in this paragraph was collected by the Peshawar Agricultural University on behalf of The Asian Development Bank in a survey conducted in 1986; it has been updated for this report.

2 IFAD EB 87/31/R.47 dated 3 August 1987.

267

the farmers of the Chitral Valley are skilled agricultura with a good understanding of irrigation. Perrenial streams been tapped and the water moved, with great ingenuity skill, for distances of up to 8 km., to the fields. construction, management and maintenance of these irrig systems is communally organised and resourced with Gover generally playing no part. The Provincial Governments Ir tion department are represented in Chitral but, over the y have been responsible for bringing only 400 hectares irrigation.

Given the meager endowment of topsoil and adverse conditions, the farmers of Chitral do well to a yields that average 1.25 and 1.65 tons per hectare for crops, (Table 2). In spite of their efforts there is a s fall in cereal production for the area of around 15,000 per year. The primary reason for this is the small average size with more than eighty percent of farm families wo holdings of less than 0.5 hectares. Even with land owne in the hands of the farmer and tenancy rare, this is clearly insufficient to provide for the needs of a family.

There is virtually no mechanized farming in the project area. The small plots and prevalence of boulders within the planted areas would not encourage the use of tractors even if they were made available to farmers. Land preparation is by the use of bullock power with double and triple ploughing being carried out prior to sowing. Weeding and harvesting are carried out by hand, with threshing carried out by hand or with the assistance of bullock power; a few mechanical threshers are in use in the area of Chitral town.

Pesticide is commonly used on fruit trees, less commonly used on grain crops, but the use of fertilizer, both chemical and manure, is common and appears to be well understood. Application of fertilizer would appear to be sub-optimum but there are no experimental plots within the valley at present that would enable the optimal applications to be determined under local conditions.

Within the valley, livestock ownership is widespread with a total herd approaching 95,000 cattle, 133,000 sheep and 220,000 goats.[1] This herd provides milk, draught power, meat, wool and hides but meets neither the need for meat nor milk for the valley with imports of both coming from outside.

F.2.3 Forestry

As recently as fifty years ago, many of the valley slopes within the Chitral District were wooded. Today the bare eroded hillsides stand as testimony to the damage that can be done by indiscriminate deforestation. The forest that remains

---

1 Asian Development Bank. Appraisal of the Chitral Area Development Project. July 1987. Appendix 3.

768

covers 4 percent, or 41,000 hectares of the land, mostly in the southern portion of the valley. This situation has resulted from unregulated commercial extraction of timber, felling by locals for building material and fuel wood and the grazing of land once it is clear of trees which prevents regeneration. A management plan is now in place with a cut of 500,000 cubic feet a year from the remaining forest. This cut substains some twenty small saw mills within the valley. The estimated value of the forestry industry to the area is PRs. 40 million in 1986.

F.2.4 Industry

F.2.4.1 Construction

Most buildings in the Chitral Valley are constructed of field stone walls with earthen roofs supported by tree trunks. The technique of building 50 cm. to 80 cm. wide walls by laying up stones without mortar is well developed within the valley and presumably is of long historical tradition. Concrete construction is the exception rather than the rule and it is not likely that many construction workers are familiar with building forms, installing reinforcing bars and pouring concrete. A government housing project presently underway in Chitral is using both field stone for walls and concrete for slabs and roof. The contractor for this project represents probably the most sophisticated expertise available in the area at present.

F.2.4.2 Manufacturing

There is little or no manufacturing within the valley at present. A small mill in the outskirts of Chitral produces woolen fibre from local yarn and some villages produce mud brick that they use for construction. Horseshoes, picks and shovels are produced by local blacksmiths but, other than this, all manufactured goods are imported from outside of the valley.

F.2.4.3 Tourism

Chitral has an established tourist industry with fifteen hotels located in the valley, mostly on and around Chitral town. Between them, these hotels sold just above 4,000 room nights in 1986. Most of these rooms went to domestic tourists but 1,400 were sold to foreigners. (Table 3)

The season in Chitral is from May to October. Based upon this season, the occupancy rate is a low 21 percent. The value of the industry is of the order of PRs. 0.5 million for the hotels and perhaps another PRs. 0.25 million for the local economy from the provision of services such as car rental.

F.2.4.4 Mining and Quarrying

There are around fifty sites within the Chitral Valley where minerals are extracted on an intermittent basis

together with one mine that is in continuous operation producing antimony oxide. None of these operations is large, little more than a scraping away at the surface of the ground with a pick and shovel. Outputs are low with gold and precious stones not rising above a few ounces a year. Approximate outputs for the various operations are shown in Table 4.

F.2.5 Transport

The Chitral valley presently has a limited transportation system which consists of footpaths, jeepable trails and roads suitable for medium size trucks (6-8 ton capacity). No navigable rivers or railroads exist. There is a twice daily air service between Chitral and Peshawar using a Fokker F-27, subject to frequent cancellation in the winter months due to problems of visibility at the Chitral air field.

The extent of the roads suitable for trucks is limited to the one between the Lowari Pass and Chitral. A little more than 60 Km. of this road is paved, it forms the link between the valley and the rest of Pakistan. The only other link between the Chitral Valley and other areas of the country is a jeep trail that crosses the Shandur pass and runs eventually to Gilgit, but from Chitral to Gilgit by this route is a long two-day journey that can only be made by short wheel base jeeps. There are a number of other jeepable trails that extend throughout parts of the valley. Their limitations are narrow passages along cliffs with height restrictions caused by overhangs and bridges that are only wide enough to permit the crossing of jeeps. In total there are about 250 km. of jeepable trails and road. It should be noted that a considerable percentage of transportation within the valley is accomplished using donkeys, mules and horses.

Vehicle registration in Chitral number just over 700, details are in Table 5. These registrations underestimate the actual transport availability as most of the trucks running goods into the valley originate, and are registered, in Dir.

F.2.6 Income Levels and Cost of Living

Per capita income levels are low, even by Pakistani standards, at around $102 per annum, this $102 being made up of $52 worth of farm output that is retained for home consumption and a cash income of $50.[1] Most of this cash income comes from wage labor with one or two males in each family typically seeking wage-paying employment, frequently outside of the valley, to supplement farm income. Production on most farms does not meet family consumption requirements and the amount of agricultural output that is marketed is small.

---

1 N.W.F.P. Agricultural University Peshawar. Malakand Area Development Project: Agro-Social-Economic Study of Chitral District.

In order to make up the food deficit, and improve living standards, the GOP subsidizes wheat, sugar and petroleum products that it trucks into the valley. These subsidies run to some PRs. 20 million, or $1.5 million, a year. Goods that do not receive subsidies are priced higher in Chitral than outside of the valley, (Table 6). Some part of this higher price can be attributed to the high transport cost involved in bringing goods into the valley. But in the winter, real supply shortages occur as stocks are run down and only a limited amount of goods trickles into the valley on the backs of porters. Then the supply constraint forces prices up further enabling the retailers to operate with higher profit margins.

Generally the cost of commonly purchased items are considerably higher in Chitral than the same items would be in Peshawar. This acts to further reduce the already low incomes in Chitral by cutting the purchasing power of the rupee.

F.3 The Project Impact

The authorities of both Chitral District and the NWFP Government in Peshawar seem to think that upgraded road access into the Chitral Valley will lead to an economic transformation. When examined sector by sector this is not self evident. The present situation is one where transport costs are high as a result of difficult access and where shortages occur in the winter. The reduction in transport costs and the alleviation of shortages that will occur when there is easier and year-round road access will be a benefit to the people of Chitral. In terms of impact, there is no reason to believe that this improvement it will generate an investment boom.

The Chitral Valley is a poor area not because of inadequate access. It is poor because it is an agricultural community with a severe shortage of cultivatable land. Improved access is not going to change this.

As far as exports out of the valley are concerned, the potential is generally held to be in the area of mineral exploitation. This is dealt with in more detail below, but it should be borne in mind that Chitral is not the only place in the NWFP that has minerals. Other areas that have existing good access to highways also hold potentially exportable mineral deposits that have, to date, not been mined.

F.3.1 Agriculture

The project will do nothing to remove the major constraints on agriculture - that of a limited area of topsoil within the Chitral Valley as the result of severe erosion. Nor is it likely that the pattern of agriculture within the valley, that of grain producing subsistence, will change greatly as the result of improved communication. Subsistence farmers do not easily change to cash cropping and evidence in Pakistan, along the Karakouram highway, does not suggest that the farmers of the NWFP are any different from the norm.

271

There will, however, with or without this project, be some changes within the Valley. These will result from the IFAD/ADB $40 million Chitral Area Development Project[1]. This project aims to introduce a comprehensive agricultural development program to the Chitral Valley with a research and input package that should lead to an increase in agricultural production. The increase will result from both an expansion of the cultivated area and an increased yield from the area currently under cultivation. Some 3,400 hectares of presently unirrigated land will be brought under irrigation. This would appear to represent the limit to the expansion of cropped land within the valley. Overall the production increases over the life of the project are 18,000 tons of cereal and 5,500 tons of fruit, as well as increases in milk and poultry production.

Although the above project will not be the result of the construction of all weather access, it is evident that such access would benefit the development. In the case of fruit where marketing problems already occur as the result of poor communications, improved access will be an essential precondition for the benefits of the IFAD/ADB project to be realized. The projected increase in fruit production cannot be marketed within the valley, and at present, cannot be economically transported out of the valley as fresh fruit. This is not a problem for apricots, which are dried, nor for nuts, but both apples and pomegrenates need to be transported as fresh fruits out to markets such as Peshawar. The construction of good all-season access will allow such marketing to take place. The result of this will be a higher fruit price for the farmer and this should serve to stimulate fruit production.

F.3.2 Forestry

There is no potential within the project area for any expansion of commercial forestry, indeed such an expansion would be disastrous for the small amount of forest remaining in the Chitral Valley. The construction phase of the project will generate an increased demand for timber and care will need to be taken to ensure that the present cut is not exceeded, once the construction is finished. The improved acess will not, of itself, generate a great demand for timber from Chitral. What it will do is reduce the transport cost for the existing loggers who may be tempted to capitalize on this as a windfall gain and increase their rate of extraction. Economically this would mean trading short term gains for the long term viability of the Chitral Forestry industry, as the current rate of

---

1

Asian Development Bank. Appraisal of the Chitral Area Development Project. July 1987.

IFAD. President's report on the Proposed Loan to the Islamic Republic of Pakistan for the Chitral Area Development Project. 3 August 1987.

212

extraction is the maximum that can be substained over the long run.

F.3.3 Industry

F.3.3.1 Construction

The project will generate a boom in the local construction industry as the local contractors sub-contract some of the road work. New skills will almost certainly be developed; but with the completion of the project, the outlet for these skills will be outside of the valley. Better access is not likely, in itself, to promote a construction boom within the valley.

F.3.3.2 Manufacturing

Improved access to the Chitral Valley is not likely to have any positive impact on the small amount of manufacturing presently carried out. Indeed an inflow of cheaper goods into the valley might have an adverse impact on the small amount of industry already present.

F.3.3.3 Tourism

Due to the low occupancy rates at present, any increase in tourism can be accomodated without the construction of new hotel rooms. In any event the Valley has a somewhat limited tourist appeal and has reasonable air access during the season. At present 60 percent of tourists choose to come by air. Chitral has to compete for tourists with other areas of Pakistan, such as Gilgit and Hunza, which offer very similar topography and attractions but have a better infrastructure. The wildlife sanctuaries and parks might seem to be an attraction, but they are not, in the main, easily accessible from Chitral and do not, in any case, offer the tourist any high probability of seeing a great deal of wildlife. They can, in fact, be more appropriately thought of as wildlife sanctuaries than as parks.

All of this would tend to point to no major increase in foreign tourism as the result of improved road access. The ability to arrive by bus, rather than jeep, should give some spur to Pakistani tourism with perhaps a ten to fifteen percent increase being generated by the project.

F.3.3.4 Mining and Quarrying

The Chitral Valley, in common with much of the rest of the NWFP, contains a variety of minerals. The difficulty of access has discouraged the mounting of a full-blown exploration program, so that the extent and quantities in these various mineral deposits is not at present known with any degree of certainty. The project, by improving access, may well act as a spur to a more intensive exploration program; the program might find mineral deposits in commercially exploitable quantities;

if it does, it may be possible to start mining some of these minerals, but that will depend upon a large number of factors including the cost of extraction and the selling price of the output. In short, any mining will need to be conditional upon a feasibility study being carried out prior to investment being committed.

At present the most attractive possibility for mining appears to be a deposit of iron ore near Drosh that is probably some four million tons. What makes this appear attractive is the fact that Pakistan has an integrated steel mill near Karachi, but has to import most of its iron. No feasibility study has been carried out for the mining of this iron ore, but capitalisation costs would be up to $25 a ton, and extraction costs for an efficient operation generally run at around $21 a ton[1]. The four million tons would make for a fairly small mine by world standards and it is not obvious that it could be run to a standard of efficiency that would keep costs down. On top of the costs of mining, the transport costs from Drosh to Karachi will add considerably to the per ton price, with improved access out of the valley being only the first of the hurdles to be overcome.

The World Bank projections for iron ore prices are as follows:

US $ Ton

1987	1988	1989	1990	1995	2000
18.5	18.2	16.9	16.1	16.4	15.8

At these prices, with a world over-supply of ore, a number of existing mines will close. Only the most efficient large mines will be able to operate. The cost of extraction at Drosh will almost certainly be above the world price for ore. It therefore seems unlikely that a mine will be operating there within the foreseeable future.

Quarrying, however will be stimulated by the project. Access will generate a need for road metal and this will be extracted locally; however, this is not likely to continue once the construction phase is over, given the ready availability of rock throughout the entire region. Local marble, which is already quarried, could find some small increase in the market outside of the valley with improved access, although there is no reason to believe that this marble is markedly different from marble quarried elsewhere in Pakistan, or to assume that the increased market will be that large.

---

[1]U.S. Bureau of Mines, Minerals Availability Division, Denver, Colorado. Personal communication with Bob Davidoff, 9-25-87.

274

F.3.4 Transport

Improved access to the Chitral Valley will be most beneficial to those people living in or close to Chitral Town or along the Chitral-Lowari road. Much of the population of the valley lives two or more hours away from the town along poorly surfaced jeep tracks or many hours away on trails that are not suitable for motor vehicles. For these people the impact will be marginal at best. The IFAD/ADB project will upgrade the Chitral-Booni road from jeepable to truckable and will also be extending the jeep tracks within the valley. Even with such improvements, the valley will be a long way away from having an adequate transport system.

It is not only the inadequate roads and difficult terrain that is a problem. Low income levels and a very low incidence of vehicle ownership (less than 800 vehicles registered for a population of 250,000) will not change as the result of the road building. The low income subsistence agriculture of the valley cannot support a good public transport system without extensive government subsidy.

F.3.5 Income and Subsidies

With improved all-weather access to the Chitral Valley, transport costs will be reduced. However Chitral will remain some 2,000 km. from Karachi, 400 Km. from Peshawar and over 100 Km. from Dir. Costs of items in Chitral will remain above those in Peshawar or Dir, and items imported through or manufactured in Karachi will continue to carry a substantial transport cost. What will happen is a reduction in transport costs at the margin and this will feed through into some reduction in prices. A more important impact on prices will occur in the winter where, at present, the lack of transport into the valley causes shortages of imported goods and high prices. With year-round access, the shortages should not occur and the opportunity for the retailers to make excess profit will disappear.

Insofar as prices are reduced, the consumers in the Chitral Valley will be better off; the purchasing power of each rupee will be increased. The impact of this will however be limited in a subsisdence economy with cash incomes of only $54 per capita. A ten or twenty percent reduction in prices will translate into an increase in purchasing power of only $5.40 to $10.80 per person, per year.

For Government, the year-round access will mean less need to provide large amounts of storage for grain and petroleum products. There will be some savings here, but the objective of the GOP is to keep grain and oil prices in Chitral at the same level as they are outside of the valley, so a subsidy will continue to be necessary although storage costs and, to an extent, transport costs, will now be lower.

275

F.4 Consideration Of Alternatives

Four alternatives to improve access to the Chitral Valley have been analyzed. These are:

(i) No-Action

(ii) An all weather road over Lowari Top

(iii) A Tunnel

(iv) A cableway over Lowari Top

Cost estimates for alternatives ii - iv are given in Table 7. The tunnel is by far the most expensive of the options at a financial cost of $174 million or PRs.3,307 million[1], and this cost may in fact be too low. The roadway over the top could be reconstructed to all-weather standards for $39 million (PRs. 702 million) and a cableway built for $34 million (PRs. 640 million). Both the tunnel and cableway also involve substantial running costs.

Table 7 gives economic as well as financial costs, these differ in that the foreign exchange component is shadow-priced by use of a conversion factor of 1.19 and the unskilled labor component is given a shadow wage rate by use of a conversion factor of 0.75. Both of these conversion factors are currently used by the World Bank for projects in Pakistan.

Benefits are computed in Tables 8 through 12 in terms of vehicle operating costs (VOC). Any of the alternatives will reduce VOC's by a significant savings in fuel, tire wear, maintenance and depreciation. The savings can be as high as 20 to 40 percent on some of these items, a reflection of the steepness, roughness and poor alignment of the existing road. Time saved is not costed and taxes are netted out of the financial costs in order to derive the economic VOC's. Taxes are a very substantial item in running a vehicle in Pakistan, so economic costs are considerably lower than financial.

The road over Lowari Top gives the lowest savings on VOC's, involving, as it does , no reduction in the length of the journey. But the improved road will make for a much easier, faster journey with savings in fuel, tires, maintenance and depreciation. Both the tunnel and the cableway reduce the distance to be travelled by road (Dir to Ashret), the tunnel cutting the length of the journey from 50 Km. to 36 Km, the cableway cutting the distance to 41 Km with the difference being made up by the cable.

---

1 This figure is based upon the lowest cost PRC option for the tunnel plus the cost of access roads.

When savings in VOC are compared to project cost, the rates of return (IRR) are as follows: For the tunnel, a rate that is negative at minus 4 percent, for the cableway, the IRR is 7 percent and for the road, it is 6 percent.[1]

The ordering is not surprising, the cost of the tunnel outweighs all possible benefits; there is no way, with reasonable figures for vehicle operating cost saving that a positive rate of return will be attained. The fact that the cableway looks relatively good results from its ability to generate most of the vehicle cost saving without the expenses of the tunnel. However, incurred by the cableway and not included in the analysis is the reorganisation of the present trucking system. At present the system is based upon, and run from, Dir. A reorganization will involve part of it running from Chitral to the North portal while the rest will continue to run out of Dir as far as the South portal. These runs will need to be coordinated so that goods and passengers loaded onto the ropeway at either end are met by vehicles when they are unloaded.

The major problem of the cableway, however, will be the need to break loads down into weights that the cableway can carry; there will be no question of it carrying weights of 30 tons and up as a single load. As such it does not meet project purposes.

The road remains as the most obviously viable alternative. It gives a positive, though not a high, rate of return and has the advantage of being the least difficult of the options to maintain and operate.

The economic feasibility of the No-Action Alternative has not been analysed. This would produce no costs and no benefits. No Action cannot be considered a viable alternative if road access to the Chitral Valley is going to be maintained. At present, Pakistan is consuming its capital as far as this road is concerned. Insufficient funds (3,000 PRs per Km) are allocated for maintenance, so the road is in a state of progressive deterioration. At some point, probably less than 5 to 7 years from now, it will cease to be truckable and access to the valley will be by jeep only. Such an event will have a major impact on the carriage of goods. If the road continued to deteriorate beyond this point it would be accessible by foot only within a couple of years. It is clear that no-action, defined as present levels of upkeep and maintenance, cannot be considered an acceptable alternative.

The above analysis is based upon the PRC Draft Feasibility Report figures (Table 3.8) for daily traffic. These may be too high. To indicate how sensitive the analysis is to a change in these figures, the analysis was rerun with the lower figures given in Table 3.6 of the PRC Draft Feasibility Report. The rates of return obtained were minus 8 percent

---

[1]PRC, in their study, find an IRR for the tunnel of around 10%.

for the tunnel and a positive IRR of 1 percent for both the cableway and road. If the figures given by the 1987 May to August traffic count are correct, one would expect the flow on a 365-day, daily basis, with access for 12 months of the year instead of 6, to be lower as there would not be the urgency to stockpile goods during the summer.

F.5 Financial Analysis

At this stage, with the financing of the project not having even been discussed and the GOP agencies who will ultimately be responsible for the project unclear, the financial analysis can only be limited in scope and will be confined to a consideration of maintenance, cost recovery and tolls.

F.5.1 Maintenance

Currently the maintenance of the road over Lowari Top is the Provincial Government's responsibility. They allocate road maintenance funds through the Province by formula but absorb a large part of the maintenance funds for payment of "establishment charges". Any of the alternatives will require more maintenance than the present road, with the tunnel and ropeway requiring substantial operating costs beyond those of maintenance. It is not clear that the Provincial Government is the best authority to provide the maintenance and operation of this project. The World Bank is putting great store by the National Highways Board for their Fourth Highways Project[1] and the NHB already have the proposed tunnel as one of their responsibilities. It might make sense for the Board to handle the project, regardless of the alternative chosen, with maintenance to be provided under the same conditions as outlined by the World Bank for the National Highways.

An alternative would be to set up an autonomous body to run the project and provide maintenance, collecting the necessary funds in the way of tolls. The disadvantage of this approach is that Pakistani experience would indicate that the body would end up utilising a disproportionate share of any monies collected for administering itself.

F.5.2 Cost Recovery and Tolls

The project, regardless of which alternative is chosen (other than no-action) will need to pay for itself, if it is to be considered viable. Each of the alternatives in fact generates sufficient savings in vehicle operating costs to cover maintenance and operations.

---

1 The World Bank, Appraisal of the Fourth Highways Project. July 1987.

In year ten of the project, the following VOC savings are generated (Financial costs).

Road over Lowari Top	PRs	85,712,000	($4.9m)
Tunnel	PRs	112,760,000	($6.5m)
Cableway	PRs	83,643,000	($4.8m)

Maintenance and operating costs will be:

Road over Lowari Top	PRs	1,980,000	($115,000)
Tunnel	PRs	22,000 000	($1.26m)
Cableway	PRs	3,530,000	($200,000)

In every case, these very real savings in vehicle operating costs are sufficient for a toll to be charged to cover maintenance and operating costs while at the same time allowing the vehicle operator to retain some of the saving.

There are two problems. At present the few tolls that are collected in Pakistan, mostly on bridges, go to the Provincial Governments as general revenue. If a toll is to be collected for the maintenance of the project, a structure and accounting system needs to be set up that would earmark the tolls for that purpose. Secondly, the legal basis for doing this restructuring at present is not clear. However, it is understood that laws are currently being drafted that would enable tolls to be collected for appropriate sections of National Highways with these revenues being utilised for the maintenance of that highway. It is not known whether the laws will be drafted in such a way that they could cover this project which is not part of a National Highway.

F.6 A Broader Cost Benefit Approach

It might be argued that a pure transport project approach to the project ignores the broader development aspects of the project. This section looks at these broader aspects in terms of tourism, forestry, agriculture and mining and quantifies the benefits in each sector. A cost/benefit analysis is then carried out utilising these benefits.

F.6.1 The Benefits

F.6.1.1 Mining and Quarrying

Based upon the findings of the Environmental Assessment, the only mineral that is almost certain to be exploited with the advent of improved access is the local marble which can be quarried at low cost and transported out of the valley for domestic consumption. The total value of this quarrying will not be high, probably no more than Rs.500,000 per annum.

F.6.1.2 Tourism

Improved access will increase tourism slightly, perhaps by 10-15 percent. There will also be some slight increase with or without improved access. The value of tourism, with improved access will rise from todays figure of Rs.0.75 million to Rs.0.90 million (in constant Rs) by year 10 of the project.

F.6.1.3 Agriculture

Improved access, in connection with the IFAD/ADB Chitral Valley Project will increase fruit-growing substantially, eventually leading to a near doubling of production. This cannot happen without the improved access provided by the project.

F.6.1.4 Other Benefits

The cost of winter storage of grain, fertilisers and petroleum products at present estimated to cost Rs.5 million a year will no longer be necessary with year round access.

F.6.2 The "Without Project" Situation

Without the project, the present level of maintenance and repairs of the road is such that within 5-7 years it will no longer be truckable and within 7-10 years will not be usable as a traffic path at all. This has a number of adverse consequences on all economic sectors within the Chitral Valley.

Tourism would suffer as it would lose the 40 percent of tourists who presently rely on road access.

Forestry would virtually cease as a commercial activity as it would no longer be able to truck timber out of the valley where the markets are.

Agriculture would suffer in two ways; grain yields would fall as it would become impossible to supply chemical fertilisers. Even with the increased acreage to be brought under cultivation by the Chitral Valley Project, it is unlikely that grain output could reach 50,000 tons as compared to the 60,000 tons a year projected. For fruit-growing the impact would also be severe with a loss of markets and an immediate impact on income.

The "without project" impact substantially increases the net benefit in Table 9, 1.1 through 1.4.

The cost/benefit analysis in Table 10 is for the road over the Top and shows an IRR of 5.5%. This is lower than obtained using the VOC approach but still positive.

780

F.7 Conclusion.

The reconstruction of the road over Lowari Top gives a positive, though not a high, rate of return, however we analyse it. If we were to include non-quantifiable benefits such as the reduction of isolation of the area then a good case could be made for proceeding with it. Of the alternatives considered, the road is the only one that does meet the need for access, can be constructed at a reasonable cost and gives a reasonable rate of return.

281

Table 1

POPULATION -CHITRAL DISTRICT

		%	Cum %
Age 0-5	52,560	21	21
Age 6-14	60,100	24	45
Adult Female	67,560	27	72
Adult Male	70,080	28	100

Sources: IFAD EB 87/31/R.47 of 3 August 1987
and
District Council Development
Program 1983-1988, June 83.

282

Table 2

ACREAGES AND YIELDS

Crop	Acreage Ha	Output Tons	Yields Tons/Ha
Wheat	7,090.00	8,862.00	1.25
Maize	6,995.00	11,684.00	1.67
Rice	2,835.00	4,549.00	1.61
Barley	400.00	500.00	1.25
Fodder	240.00	1,995.00	8.31
Potato	320.00	2,560.00	8.01
Pulses	242.00	135.00	5.58
Vegetables	206.00	1,440.00	6.99
Fruit	302.00	3,714.00	12.32

Source: Dept of Agriculture, Chitral

Table 3

Hotels. Room Nights and expenditure
Chitral District-1986

Location	Hotels	Rooms	Availability [1]	Occupancy Pak	Occupancy Foreign	Expenditure PRs.
Chitral	9.00	75.00	13,800.00	1,720.00	1,223.00	416,933.00
Bomburet	3.00	20.00	3,680.00	692.00	100.00	19,800.00
Rambor	1.00	7.00	1,288.00	242.00	35.00	6,925.00
Garum Chashma	1.00	7.00	1,288.00	242.00	35.00	6,925.00
Birir	1.00	7.00	1,288.00	242.00	35.00	6,925.00
District total	15.00	116.00	21,344.00	3,138.00	1,428.00	457,508.00

[1] Based upon an 184 day season May to October

Source: TAMS figure based on Tourist Board and survey of hotels.

TABLE - 4

MINERAL EXTRACTION

Mineral	Number	Production
METALLIC		
-Antimony Oxide	1	5 tons
-Gold	3	LT 16 oz
-Arsenic	1	Inactive
NON METALLIC		
-Road Stone	3	1,000 Tons
-Sand - Gravel	3-5	LT 5,000 Tons
-Slate - Building Stone	10-15	LT 500 Tons
-Marble	1	3-5 Tons
-Lime	3	3-5 Tons
-Mica	2	250 lbs
-Beryl	1	5 lbs
-Aquamarine	1	LT 1 lb
-Tourmaline	1	LT 1 lb
-Garnet	1	50-100 lbs
-Fluorite	1	10 lbs
-Mudbrick - clay	10-15	5-10 Tons

Source: Collected by TAMS - Various sources.

Note: LT ... Less than.

TABLE - 5

VEHICLE REGISTRATIONS IN CHITRAL

Jeeps	425
Pick-ups	88
Farm Tractors	37
Trucks	12
Station Wagons	6
Public Bus	1
Motor Cars	22
Motorcycles	138
Total Vehicles	729

TABLE - 6

RETAIL PRICES OF COMMON ITEMS

Commodity	Quantity Imported to Chitral During 1986-87 (Tons)	Sale Price at Peshawar (Rs)	Sale Price in Chitral (Rs)
Meat	500	14 to 16/kg	18 to 35/kg
Salt	3000	25 to 50/kg	55 to 50/kg
Tea	5000 chests of 45 kg	70/kg	80/kg
Pulses	500 tons	8/kg	12/kg
Rice	200 tons	6/kg	12/kg
Fruits			
-Watermelon)		2/kg	6/kg
-Melon)	1000 tons	2/kg	6/kg
-Banana)		6/dozen	14/dozen
-Oranges)		4/dozen	14/dozen
-Mango)		10/kg	20/kg
Soap			
Washing	500 tons	3/cake	5/cake
Bathing	100 tons	8/ckae	12/cake

Source: Food Department Chitral.

287

Table 7

COST ESTIMATES [1]
PRs million

	FINANCIAL	ECONOMIC [2]
TUNNEL		
Road Dir-Sp	252.00	241.92
Tunnelling	2,971.00	3,409.10
NP-Ashret	84.00	87.50
TOTAL	3,307.00	3,738.52
ROADWAY		
Road Dir-SP	252.00	241.92
SP-Lowari	120.00	125.00
Lowari-NP	216.00	225.00
NP-Ashret	84.00	87.50
Snow Rem. Eqp	19.14	22.77
TOTAL	691.14	702.19
CABLEWAY		
Road Dir-SP	252.00	241.92
Cableway	257.52	306.57
Power Gen.	3.50	4.20
NP-Ashrey	84.00	87.50
TOTAL	597.02	640.19

[1] Estimates have been made for the purpose of the Enviromental Assessment only. They are very approximate figures that do not have the benefit of any engineering study or design. Tunnel figure is the lowest cost option in the PRC report.

[2] Economic cost calculations are based upon the following:

For the road a 50 percent Foreign Exchange component is estimated and the skilled/unskilled labor mix is estimated at 20/80.

For the tunnel a 75 percent Foreign Exchange component is estimated and the skilled/unskilled labor mix is estimated at 80/20.

A Foreign Exchange conversion rate of 1.19 is used. This

255

rate has been used in recent World Bank appraisals.

A conversion rate of 0.75 is used to convert the unskilled labor cost to the SWR.

Table 8

VEHICLE OPERATING COSTS [1]
PRs/Km

	FINANCIAL			ECONOMIC		
PRESENT ROAD	Jeep/pickup	Bus	Truck	Jeep/pickup	Bus	Truck
Fuel and Oil	1.14	2.57	3.68	0.89	2.02	2.89
Tire Wear	0.26	1.15	0.28	0.16	0.72	0.16
Depreciation	0.86	1.71	1.76	0.28	1.04	1.18
Interest	0.50	0.93	1.31	0.17	0.55	0.88
Maintenance	2.31	3.11	2.99	0.82	2.07	2.15
Wages	1.10	4.50	3.97	0.80	3.33	2.98
TOTAL	6.17	13.97	13.99	3.12	9.73	10.24
IMPROVED ROAD						
Fuel and Oil	0.80	1.95	2.94	0.63	1.53	2.19
Tire Wear	0.03	0.11	0.15	0.02	0.07	0.18
Depreciation	0.54	1.13	1.17	0.19	0.69	0.78
Interest	0.33	0.69	0.87	0.12	0.37	0.58
Maintenance	0.30	0.62	0.56	0.19	0.45	0.44
Wages	0.53	2.22	2.00	0.40	1.67	1.50
TOTAL	2.53	6.72	7.69	1.55	4.78	5.67

[1] Based upon figures frim The National Transport Research Center "Vehicle Operations Cost" 1985. Extensively modified to take account of roughness, gradient, and curvature of the road.

Table 9

VEHICLE OPERATING COSTS
ALTERNATIVES(per journey)

	FINANCIAL			ECONOMIC		
	Jeep/pickup	Bus	Truck	Jeep/pickup	Bus	Truck
AT PRESENT						
Fuel and Oil	57.00	128.50	184.00	44.50	101.00	144.50
Tire Wear	13.00	57.50	14.00	8.00	36.00	8.00
Depreciation	43.00	85.50	88.00	14.00	52.00	59.00
Interest	25.00	46.50	65.50	8.50	27.50	44.00
Maintenance	115.50	155.50	149.50	41.00	103.50	107.50
Wages	55.00	225.00	198.50	40.00	166.50	149.00
TOTAL	308.50	698.50	699.50	156.00	486.50	512.00
WITH TUNNEL						
Fuel and Oil	28.80	70.20	105.84	22.68	55.08	78.84
Tire Wear	1.08	3.96	5.40	0.72	2.52	6.48
Depreciation	19.44	40.68	42.12	6.84	24.84	28.08
Interest	11.88	24.84	31.32	4.32	13.32	20.88
Maintenance	10.80	22.32	20.16	6.84	16.20	15.84
Wages	19.08	79.92	72.00	14.40	60.12	54.00
TOTAL	91.08	241.92	276.84	55.80	172.08	204.12

WITH CABLEWAY						
Fuel and Oil	22.40	54.60	82.32	17.64	42.84	61.32
Tire Wear	0.84	3.08	4.20	0.56	1.96	5.04
Depreciation	15.12	31.64	32.76	5.32	19.32	21.84
Interest	9.24	19.32	24.36	3.36	10.36	16.24
Maintenance	8.40	17.36	15.68	5.32	12.60	12.32
Wages	48.48	163.07	269.99	36.36	122.30	202.49
TOTAL	104.48	289.07	429.31	68.56	209.38	319.25
NEW ROAD						
Fuel and Oil	40.00	97.50	147.00	31.50	76.50	109.50
Tire Wear	1.50	5.50	7.50	1.00	3.50	9.00
Depreciation	27.00	56.50	58.50	9.50	34.50	39.00
Interest	16.50	34.50	43.50	6.00	18.50	29.00
Maintenance	15.00	31.00	28.00	9.50	22.50	22.00
Wages	26.50	111.00	100.00	20.00	83.50	75.00
TOTAL	126.50	336.00	384.50	77.50	239.00	283.50

Table 10

DAILY TRAFFIC PROJECTIONS

	Jeeps	Bus	Trucks	TOTAL
1985	301.00	18.00	142.00	461.00
1986	331.10	19.80	156.20	507.10
1987	364.21	21.78	171.82	557.81
1988	400.63	23.96	189.00	613.59
1989	440.69	26.35	207.90	674.95
1990	484.76	28.99	228.69	742.45
1991	533.24	31.89	251.56	816.69
1992	559.90	33.48	264.14	857.52
1993	587.90	35.16	277.35	900.40
1994	617.29	36.91	291.21	945.42
1995	648.16	38.76	305.77	992.69
1996	680.56	40.70	321.06	1,042.33
1997	714.59	42.73	337.12	1,094.44
1998	750.32	44.87	353.97	1,149.16
1999	787.84	47.11	371.67	1,206.62
2000	827.23	49.47	390.25	1,266.95
2001	868.59	52.00	409.77	1,330.36
2002	903.34	52.00	426.16	1,381.49
2003	939.47	52.00	443.20	1,434.67
2004	977.05	52.00	460.93	1,489.98
2005	1,016.13	52.00	479.37	1,547.50
2006	1,056.77	52.00	498.54	1,607.32
2007	1,099.05	52.00	518.49	1,669.53
2008	1,143.01	52.00	539.23	1,734.23
2009	1,188.73	52.00	560.80	1,801.52
2010	1,236.28	52.00	583.23	1,871.50
2011	1,285.73	52.00	606.56	1,944.28
2012	1,324.30	52.00	624.75	2,001.05
2013	1,364.03	52.00	643.50	2,059.52
2014	1,404.95	52.00	662.80	2,119.75
2015	1,447.10	52.00	682.68	2,181.78
2016	1,490.51	52.00	703.16	2,245.68
2017	1,535.23	52.00	724.26	2,311.49

Notes: These figures are derived from the PRC base figures in table 3.8 of their report, extrapolated by the growth rates given in table 3.7. Table 3.8 appears to contain arithmatic errors.

-292

Table 11

TOTAL ANNUAL VOC
PRs ,000

PRESENT ROAD	Jeeps	Bus	Trucks	TOTAL
1987	20,738.12	3,863.55	32,109.72	56,711.39
1988	22,811.93	4,249.91	35,320.69	62,382.53
1989	25,093.12	4,674.90	38,852.76	68,620.79
1990	27,602.43	5,142.39	42,738.04	75,482.86
1991	30,362.68	5,656.63	47,011.84	83,031.15
1992	31,880.81	5,939.46	49,362.44	87,182.71
1993	33,474.85	6,236.43	51,830.56	91,541.84
1994	35,148.59	6,548.26	54,422.09	96,118.94
1995	36,906.02	6,875.67	57,143.19	100,924.88
1996	38,751.33	7,219.45	60,000.35	105,971.13
1997	40,688.89	7,580.42	63,000.37	111,269.68
1998	42,723.34	7,959.45	66,150.38	116,833.17
1999	44,859.50	8,357.42	69,457.90	122,674.83
2000	47,102.48	8,775.29	72,930.80	128,808.57
2001	49,457.60	9,224.28	76,577.34	135,259.22
2002	51,435.91	9,224.28	79,640.43	140,300.62
2003	53,493.34	9,224.28	82,826.05	145,543.67
2004	55,633.08	9,224.28	86,139.09	150,996.45
2005	57,858.40	9,224.28	89,584.66	156,667.34
2006	60,172.74	9,224.28	93,168.04	162,565.06
2007	62,579.65	9,224.28	96,894.76	168,698.69
2008	65,082.83	9,224.28	100,770.55	175,077.66
2009	67,686.14	9,224.28	104,801.38	181,711.80
2010	70,393.59	9,224.28	108,993.43	188,611.30
2011	73,209.33	9,224.28	113,353.17	195,786.78
2012	75,405.61	9,224.28	116,753.76	201,383.66
2013	77,667.78	9,224.28	120,256.38	207,148.44
2014	79,997.82	9,224.28	123,864.07	213,086.16
2015	82,397.75	9,224.28	127,579.99	219,202.02
2016	84,869.68	9,224.28	131,407.39	225,501.35
2017	87,415.77	9,224.28	135,349.61	231,989.66

294

WITH TUNNEL

1987	7,311.52	1,367.35	12,806.26	21,485.12
1988	8,042.67	1,504.08	14,086.89	23,633.64
1989	8,846.93	1,654.49	15,495.57	25,997.00
1990	9,731.63	1,819.94	17,045.13	28,596.70
1991	10,704.79	2,001.93	18,749.65	31,456.37
1992	11,240.03	2,102.03	19,687.13	33,029.19
1993	11,802.03	2,207.13	20,671.48	34,680.65
1994	12,392.13	2,317.49	21,705.06	36,414.68
1995	13,011.74	2,433.36	22,790.31	38,235.41
1996	13,662.33	2,555.03	23,929.83	40,147.19
1997	14,345.44	2,682.78	25,126.32	42,154.54
1998	15,062.71	2,816.92	26,382.63	44,262.27
1999	15,815.85	2,957.77	27,701.77	46,475.39
2000	16,606.64	3,105.66	29,086.85	48,799.15
2001	17,436.98	3,264.56	30,541.20	51,242.73
2002	18,134.45	3,264.56	31,762.84	53,161.86
2003	18,859.83	3,264.56	33,033.36	55,157.75
2004	19,614.23	3,264.56	34,354.69	57,233.48
2005	20,398.79	3,264.56	35,728.88	59,392.24
2006	21,214.75	3,264.56	37,158.04	61,637.34
2007	22,063.34	3,264.56	38,644.36	63,972.25
2008	22,945.87	3,264.56	40,190.13	66,400.56
2009	23,863.70	3,264.56	41,797.74	68,926.00
2010	24,818.25	3,264.56	43,469.65	71,552.46
2011	25,810.98	3,264.56	45,208.43	74,283.97
2012	26,585.31	3,264.56	46,564.68	76,414.56
2013	27,382.87	3,264.56	47,961.63	78,609.06
2014	28,204.36	3,264.56	49,400.47	80,869.39
2015	29,050.49	3,264.56	50,882.49	83,197.54
2016	29,922.00	3,264.56	52,408.96	85,595.53
2017	30,819.66	3,264.56	53,981.23	88,065.46

29

WITH CABLEWAY

1987	9,114.14	1,664.51	20,021.54	30,800.19
1988	10,025.55	1,830.96	22,023.69	33,880.20
1989	11,028.11	2,014.05	24,226.06	37,268.22
1990	12,130.92	2,215.46	26,648.67	40,995.05
1991	13,344.01	2,437.01	29,313.54	45,094.55
1992	14,011.21	2,558.86	30,779.21	47,349.28
1993	14,711.77	2,686.80	32,318.17	49,716.74
1994	15,447.36	2,821.14	33,934.08	52,202.58
1995	16,219.72	2,962.20	35,630.79	54,812.71
1996	17,030.71	3,110.31	37,412.33	57,553.34
1997	17,882.25	3,265.82	39,282.94	60,431.01
1998	18,776.36	3,429.11	41,247.09	63,452.56
1999	19,715.18	3,600.57	43,309.44	66,625.19
2000	20,700.94	3,780.60	45,474.92	69,956.45
2001	21,735.98	3,974.03	47,748.66	73,458.68
2002	22,605.42	3,974.03	49,658.61	76,238.06
2003	23,509.64	3,974.03	51,644.95	79,128.62
2004	24,450.02	3,974.03	53,710.75	82,134.81
2005	25,428.02	3,974.03	55,859.18	85,261.24
2006	26,445.15	3,974.03	58,093.55	88,512.73
2007	27,502.95	3,974.03	60,417.29	91,894.28
2008	28,603.07	3,974.03	62,833.98	95,411.09
2009	29,747.19	3,974.03	65,347.34	99,068.57
2010	30,937.08	3,974.03	67,961.24	102,872.35
2011	32,174.56	3,974.03	70,679.69	106,828.28
2012	33,139.80	3,974.03	72,800.08	109,913.91
2013	34,133.99	3,974.03	74,984.08	113,092.11
2014	35,158.01	3,974.03	77,233.60	116,365.65
2015	36,212.75	3,974.03	79,550.61	119,737.40
2016	37,299.14	3,974.03	81,937.13	123,210.30
2017	38,418.11	3,974.03	84,395.24	126,787.38

IMPROVED ROAD

1987	10,302.59	1,899.98	17,779.50	29,982.07
1988	11,332.85	2,089.98	19,557.45	32,980.28
1989	12,466.13	2,298.97	21,513.20	36,278.31
1990	13,712.75	2,528.87	23,664.52	39,906.14
1991	15,084.02	2,781.76	26,030.97	43,896.75
1992	15,838.22	2,920.85	27,332.52	46,091.59
1993	16,630.13	3,066.89	28,699.15	48,396.17
1994	17,461.64	3,220.23	30,134.10	50,815.98
1995	18,334.72	3,381.24	31,640.81	53,356.78
1996	19,251.46	3,550.31	33,222.85	56,024.62
1997	20,214.03	3,727.82	34,883.99	58,825.85
1998	21,224.73	3,914.21	36,628.19	61,767.14
1999	22,285.97	4,109.92	38,459.60	64,855.50
2000	23,400.27	4,315.42	40,382.58	68,098.27
2001	24,570.28	4,536.22	42,401.71	71,508.21
2002	25,553.09	4,536.22	44,097.78	74,187.09
2003	26,575.22	4,536.22	45,861.69	76,973.13
2004	27,638.23	4,536.22	47,696.16	79,870.60
2005	28,743.76	4,536.22	49,604.00	82,883.98
2006	29,893.51	4,536.22	51,588.16	86,017.89
2007	31,089.25	4,536.22	53,651.69	89,277.16
2008	32,332.82	4,536.22	55,797.76	92,666.79
2009	33,626.13	4,536.22	58,029.67	96,192.02
2010	34,971.17	4,536.22	60,350.86	99,858.25
2011	36,370.02	4,536.22	62,764.89	103,671.13
2012	37,461.12	4,536.22	64,647.84	106,645.18
2013	38,584.96	4,536.22	66,587.27	109,708.45
2014	39,742.50	4,536.22	68,584.89	112,863.61
2015	40,934.78	4,536.22	70,642.44	116,113.44
2016	42,162.82	4,536.22	72,761.71	119,460.75
2017	43,427.71	4,536.22	74,944.56	122,908.49

Table 12

COSTS AND BENEFITS
PRs ,000

TUNNEL	Costs	Benefits	Net benefits
1988	411,520.00		(411,520.00)
1989	998,000.00		(998,000.00)
1990	997,000.00		(997,000.00)
1991	922,000.00		(922,000.00)
1992	410,000.00		(410,000.00)
1993	22,000.00	56,861.20	34,861.20
1994	22,000.00	59,704.26	37,704.26
1995	22,000.00	62,689.47	40,689.47
1996	22,000.00	65,823.94	43,823.94
1997	22,000.00	69,115.14	47,115.14
1998	22,000.00	72,570.90	50,570.90
1999	22,000.00	76,199.44	54,199.44
2000	61,600.00	80,009.41	18,409.41
2001	22,000.00	84,016.49	62,016.49
2002	22,000.00	87,138.76	65,138.76
2003	22,000.00	90,385.92	68,385.92
2004	22,000.00	93,762.97	71,762.97
2005	22,000.00	97,275.10	75,275.10
2006	22,000.00	100,927.72	78,927.72
2007	22,000.00	104,726.44	82,726.44
2008	22,000.00	108,677.10	86,677.10
2009	22,000.00	112,785.80	90,785.80
2010	22,000.00	117,058.84	95,058.84
2011	22,000.00	121,502.81	99,502.81
2012	22,000.00	124,969.10	102,969.10
2013	22,000.00	128,539.38	106,539.38
2014	22,000.00	132,216.77	110,216.77
2015	22,000.00	136,004.48	114,004.48
2016	22,000.00	139,905.83	117,905.83
2017	22,000.00	143,924.21	121,924.21

IRR (0.04)

CABLEWAY

1988	128,000.00		(128,000.00)
1989	320,000.00		(320,000.00)
1990	192,000.00		(192,000.00)
1991	3,530.00	37,936.60	34,406.60
1992	3,530.00	39,833.43	36,303.43
1993	3,530.00	41,825.10	38,295.10
1994	3,530.00	43,916.36	40,386.36
1995	3,530.00	46,112.17	42,582.17
1996	3,530.00	48,417.78	44,887.78
1997	3,530.00	50,838.67	47,308.67
1998	3,530.00	53,380.61	49,850.61
1999	3,530.00	56,049.64	52,519.64
2000	3,530.00	58,852.12	55,322.12
2001	3,530.00	61,800.54	58,270.54
2002	3,530.00	64,062.56	60,532.56
2003	3,530.00	66,415.05	62,885.05
2004	3,530.00	68,861.64	65,331.64
2005	3,530.00	71,406.10	67,876.10
2006	3,530.00	74,052.33	70,522.33
2007	3,530.00	76,804.41	73,274.41
2008	3,530.00	79,666.58	76,136.58
2009	3,530.00	82,643.23	79,113.23
2010	3,530.00	85,738.95	82,208.95
2011	3,530.00	88,958.50	85,428.50
2012	3,530.00	91,469.75	87,939.75
2013	3,530.00	94,056.33	90,526.33
2014	3,530.00	96,720.52	93,190.52
2015	3,530.00	99,464.62	95,934.62
2016	3,530.00	102,291.05	98,761.05
2017	3,530.00	105,202.28	101,672.28
IRR	0.07		

IMPROVED ROAD

1988	200,000.00		(200,000.00)
1989	302,190.00		(302,190.00)
1990	200,000.00		(200,000.00)
1991	1,980.00	35,576.73	33,596.73
1992	1,980.00	39,134.40	37,154.40
1993	1,980.00	41,091.12	39,111.12
1994	1,980.00	43,145.67	41,165.67
1995	1,980.00	45,302.96	43,322.96
1996	1,980.00	47,568.11	45,588.11
1997	1,980.00	49,946.51	47,966.51
1998	1,980.00	52,443.84	50,463.84
1999	1,980.00	55,066.03	53,086.03
2000	1,980.00	57,819.33	55,839.33
2001	1,980.00	60,710.30	58,730.30
2002	1,980.00	63,751.01	61,771.01
2003	1,980.00	66,113.53	64,133.53
2004	1,980.00	68,570.54	66,590.54
2005	1,980.00	71,125.84	69,145.84
2006	1,980.00	73,783.36	71,803.36
2007	1,980.00	76,547.17	74,567.17
2008	1,980.00	79,421.53	77,441.53
2009	1,980.00	82,410.87	80,430.87
2010	1,980.00	85,519.78	83,539.78
2011	1,980.00	88,753.05	86,773.05
2012	1,980.00	92,115.65	90,135.65
2013	1,980.00	94,738.48	92,758.48
2014	1,980.00	97,439.99	95,459.99
2015	1,980.00	100,222.55	98,242.55
2016	1,980.00	103,088.58	101,108.58
2017	1,980.00	106,040.60	104,060.60

IRR 0.06

300

Table 13

COST BENEFIT ANALYSIS PRs,000

	W/O Proj	With	Net Benefit
MINING			
1988	20.00	20.00	0.00
1989	20.00	20.00	0.00
1990	20.00	20.00	0.00
1991	20.00	30.00	10.00
1992	20.00	50.00	30.00
1993	20.00	100.00	80.00
1994	20.00	200.00	180.00
1995	20.00	300.00	280.00
1996	20.00	500.00	480.00
1997	20.00	500.00	480.00
1998-	20.00	500.00	480.00
TOURISM			
1988	750.00	750.00	0.00
1989	750.00	750.00	0.00
1990	750.00	750.00	0.00
1991	750.00	770.00	20.00
1992	750.00	800.00	50.00
1993	750.00	820.00	70.00
1994	600.00	850.00	250.00
1995	600.00	870.00	270.00
1996	600.00	890.00	290.00
1997	450.00	900.00	450.00
1998-	450.00	900.00	450.00
FORESTRY			
1988	4,000.00	4,000.00	0.00
1989	4,000.00	4,000.00	0.00
1990	4,000.00	4,000.00	0.00
1991	4,000.00	4,000.00	0.00
1992	4,000.00	4,000.00	0.00
1993	4,000.00	4,000.00	0.00
1994	4,000.00	4,000.00	0.00
1995	100.00	4,000.00	3,900.00
1996	100.00	4,000.00	3,900.00
1997	100.00	4,000.00	3,900.00
1998-	100.00	4,000.00	3,900.00

-301

AGRICULTURE

1988	121,000.00	121,000.00	0.00
1989	122,000.00	122,000.00	0.00
1990	125,000.00	125,000.00	0.00
1991	127,000.00	127,000.00	0.00
1992	132,000.00	132,000.00	0.00
1993	142,000.00	142,000.00	0.00
1994	137,000.00	154,000.00	17,000.00
1995	128,000.00	170,000.00	42,000.00
1996	129,000.00	182,000.00	53,000.00
1997	130,000.00	192,000.00	62,000.00
1998-	132,000.00	194,000.00	62,000.00

	TOTAL COST	TOTAL BEN.	NET BENEFITS
1988	200,000.00	0.00	(200,000.00)
1989	302,190.00	0.00	(302,190.00)
1990	200,000.00	0.00	(200,000.00)
1991	1,980.00	30.00	(1,950.00)
1992	1,980.00	80.00	(1,900.00)
1993	1,980.00	150.00	(1,830.00)
1994	1,980.00	17,430.00	15,450.00
1995	1,980.00	46,450.00	44,470.00
1996	1,980.00	57,670.00	55,690.00
1997	1,980.00	66,830.00	64,850.00
1998	1,980.00	66,830.00	64,850.00
1999	1,980.00	66,830.00	64,850.00
2000	1,980.00	66,830.00	64,850.00
2001	1,980.00	66,830.00	64,850.00
2002	1,980.00	66,830.00	64,850.00
2003	1,980.00	66,830.00	64,850.00
2004	1,980.00	66,830.00	64,850.00
2005	1,980.00	66,830.00	64,850.00
2006	1,980.00	66,830.00	64,850.00
2007	1,980.00	66,830.00	64,850.00
2008	1,980.00	66,830.00	64,850.00
2009	1,980.00	66,830.00	64,850.00
2010	1,980.00	66,830.00	64,850.00
2011	1,980.00	66,830.00	64,850.00
2012	1,980.00	66,830.00	64,850.00
2013	1,980.00	66,830.00	64,850.00
2014	1,980.00	66,830.00	64,850.00
2015	1,980.00	66,830.00	64,850.00
2016	1,980.00	66,830.00	64,850.00
2017	1,980.00	66,830.00	64,850.00

IRR 4.60

Table 13

COST BENEFIT ANALYSIS PRs,000

	W/O Proj	With	Net Benefit
MINING			
1988	20.00	20.00	0.00
1989	20.00	20.00	0.00
1990	20.00	20.00	0.00
1991	20.00	30.00	10.00
1992	20.00	50.00	30.00
1993	20.00	100.00	80.00
1994	20.00	200.00	180.00
1995	20.00	300.00	280.00
1996	20.00	500.00	480.00
1997	20.00	500.00	480.00
1998-	20.00	500.00	480.00

TOURISM

1988	750.00	750.00	0.00
1989	750.00	750.00	0.00
1990	750.00	750.00	0.00
1991	750.00	770.00	20.00
1992	750.00	800.00	50.00
1993	750.00	820.00	70.00
1994	600.00	850.00	250.00
1995	600.00	870.00	270.00
1996	600.00	890.00	290.00
1997	450.00	900.00	450.00
1998-	450.00	900.00	450.00

FORESTRY

1988	4,000.00	4,000.00	0.00
1989	4,000.00	4,000.00	0.00
1990	4,000.00	4,000.00	0.00
1991	4,000.00	4,000.00	0.00
1992	4,000.00	4,000.00	0.00
1993	4,000.00	4,000.00	0.00
1994	4,000.00	4,000.00	0.00
1995	100.00	4,000.00	3,900.00
1996	100.00	4,000.00	3,900.00
1997	100.00	4,000.00	3,900.00
1998-	100.00	4,000.00	3,900.00

AGRICULTURE

1988	121,000.00	121,000.00	0.00
1989	122,000.00	122,000.00	0.00
1990	125,000.00	125,000.00	0.00
1991	127,000.00	127,000.00	0.00
1992	132,000.00	132,000.00	0.00
1993	142,000.00	142,000.00	0.00
1994	137,000.00	154,000.00	17,000.00
1995	128,000.00	170,000.00	42,000.00
1996	129,000.00	182,000.00	53,000.00
1997	130,000.00	192,000.00	62,000.00
1998-	132,000.00	194,000.00	62,000.00

206

	TOTAL COST	TOTAL BEN.	NET BENEFITS
1988	200,000.00	0.00	(200,000.00)
1989	302,190.00	0.00	(302,190.00)
1990	200,000.00	0.00	(200,000.00)
1991	1,980.00	30.00	(1,950.00)
1992	1,980.00	80.00	(1,900.00)
1993	1,980.00	150.00	(1,830.00)
1994	1,980.00	17,430.00	15,450.00
1995	1,980.00	46,450.00	44,470.00
1996	1,980.00	57,670.00	55,690.00
1997	1,980.00	66,830.00	64,850.00
1998	1,980.00	66,830.00	64,850.00
1999	1,980.00	66,830.00	64,850.00
2000	1,980.00	66,830.00	64,850.00
2001	1,980.00	66,830.00	64,850.00
2002	1,980.00	66,830.00	64,850.00
2003	1,980.00	66,830.00	64,850.00
2004	1,980.00	66,830.00	64,850.00
2005	1,980.00	66,830.00	64,850.00
2006	1,980.00	66,830.00	64,850.00
2007	1,980.00	66,830.00	64,850.00
2008	1,980.00	66,830.00	64,850.00
2009	1,980.00	66,830.00	64,850.00
2010	1,980.00	66,830.00	64,850.00
2011	1,980.00	66,830.00	64,850.00
2012	1,980.00	66,830.00	64,850.00
2013	1,980.00	66,830.00	64,850.00
2014	1,980.00	66,830.00	64,850.00
2015	1,980.00	66,830.00	64,850.00
2016	1,980.00	66,830.00	64,850.00
2017	1,980.00	66,830.00	64,850.00

IRR 0.05

APPENDIX G

SOC AL SOUNDNESS ASSESSMENT

G.1 Introduction

G.1.1 Purpose of Trip

The purpose of the field trip was to gather information concerning the potential social impact of the proposed Lowari Tunnel Project on the people of Dir and Chitral Districts, NWFP, Pakistan. This information will be a part of the overall planning process for this project.

The scope of work for assessment of the potential social impact of the proposed project requested that particular attention be paid to the following topics:

1. Ethnicity
2. Economic aspects
3. Industries
4. Porterage and other labor
5. Bazaar economy
6. Women
7. Communication and transportation
8. Tourism
9. Overall assessment of project benefits potential

This report incorporates findings on these issues for the Chitral Access Project.

G.1.2 Procedures Followed

Prior to arrival in Pakistan, published and unpublished documents on Dir and Chitral were reviewed; discussions were held with several persons who had recently conducted research in the region; the AID/PPC/CDIE/DIU data base search service was consulted; and copies of a number of publications on the study area were obtained. Those documents which have proved useful will be listed at the end of this report. Several additional documents, including material from work in progress, had not been received prior to my departure from the U.S., but will be utilized for the final report as and when they are provided to me.

On arrival in Pakistan, the analyst interviewed several persons known to have personal experience in research in Chitral, and/or were associated with various activities in the region. Names of people in Swat, Dir, and Chitral who might provide further information on the topics of our inquiry were obtained. Due to the lateness of the season, and the possibility that bad weather might hamper our field work, as little

308

time as possible was spent in Islamabad and Peshawar before leaving for the field site visit portion of the assignment.

The field site visit to Dir and Chitral Districts was conducted using rapid appraisal techniques, including observation and semi-structured interviews with both selected key informants and an "accidental sample" of local residents. The analyst was accompanied by Major (Ret.) Kenneth S. Davis, USAID/Peshawar Liaison Officer, and by an experienced USAID driver from Chitral District, Mr. Adina Beg. With their assistance, interviews and discussions could be conducted in Pukhto and Khowar, supplementing the analyst's Urdu and very limited Pukhto. After initial discussions with the Commissioner and Assistant Commissioner, Malakand Division, in Swat on 5 October 1987, time was allocated as follows: 6-8 October in Dir, 8-10 October in Drosh and Ashrait, the towns in the immediate vicinity of the proposed construction area, and 10-13 October in Chitral Town. Due to heavy rains, and the consequent blockage of roads in the Chitral Valley during our stay, plans to visit several outlying areas were changed. However, in the small town of Chitral, the team located and interviewed both residents of those areas, and researchers as well as officials and private individuals who were familiar with conditions in the region.

Due to increasingly bad weather conditions, and concern that the road over the Lowari Pass might become blocked for an indefinite period, the team decided to leave Chitral a few days earlier than planned. The team returned to Peshawar for drafting the report, which was then put into semi-final draft form in Islamabad.

G.1.3 Background: The Proposed Lowari Tunnel Project

According to the cable ISLAMABAD 17636 of 21 August 1987, the proposed project will involve construction of a tunnel approximately five miles long beneath the Lowari Pass between Dir and Chitral Districts, NWFP, Pakistan. The tunnel will provide two-way traffic via a two-lane road, enabling year-round road access to Chitral District from the rest of Pakistan. Deep snow, high winds, and difficult terrain make road access over the 10,200 foot Lowari Pass impossible from November thru May, imposing a significant hardship upon the population of the Chitral Valley, and a significant financial and administrative burden upon the Government of Pakistan. Year-round road access to Chitral is possible via the route from Jalalabad, Afghanistan up the Kunar river valley to Arandu, but due to the current situation in Afghanistan use of this road is not feasible or desirable.

Project implementation will include substantial upgrading and realignment of existing roads; construction of a major bridge; improvements in drainage; and construction of temporary site housing and equipment storage facilities in addition to the tunnel itself. The existing road will continue to be used for summer traffic during the construction period.

Several studies of the technical feasibility of the Lowari Tunnel have been made, dating to 1962. The GOP has evinced serious continuing interest in its construction. In 1976, the GOP constructed a tunnel excavation 600 meters into the southern hillside, but suspended operations for technical and financial reasons. More recently, a feasibility study based on review of earlier work as well as on field surveys and investigations has been undertaken using USAID financing. In addition, an economic analysis and an environmental assessment of the proposed project and its impact have been carried out. However, none of these reports were available prior to our field site visit.

Accordingly, it seemed best to assume that the basic question regarding social impact was not construction of the tunnel per se, but simply: What would be the impact of opening the Chitral Valley to year-round road access upon the people of Chitral District, and also in the immediately adjacent region of Dir District? The scale, scope, duration, and precise location of construction activities associated with the proposed tunnel project are important potential impact variables. A complete, adequate social soundness assessment, based upon the technical information contained in the other reports and "fine-tuned" to the precise components and procedures which will be included in the final project design, must take them into consideration. This report is intended to provide a basis for project documentation of social/cultural impacts, but cannot entirely encompass the requirements of the project design at this stage of its development.

G.2 The Social/Cultural Environment: Chitral and Dir Districts

G.2.1 Chitral District and the Kho

Chitral District is the northernmost district in Pakistan, set in the high mountain valleys of the Hindu Kush/Karakoram ranges. The district's total area is 14,850 sq. km. It is bounded on the north and west by the Hindu Kush, and separated from Dir District, and the rest of Pakistan, by the Hindu Raj Range. There are over 100 mountain peaks over 6000 meters in the district. Tirich Mir (7778 meters) towers at the head of the main Chitral valley. Passes over the mountains link Chitral with Gilgit, Dir, and Swat in Pakistan; and north to the Wakhan corridor of Afghanistan. A road connection via Arandu in the southwest of the district, down the Kunar River valley, also leads to Jalalabad in Afghanistan. The main valley is approximately 300 kilometers long, from Arandu to Mastuj; and its width varies from 2 to 15 kilometres. The altitude of Chitral Town, the district headquarters, is 1518 meters above sea level.

The Chitral valley is one of the largest of the high mountain valleys which occur in the Hindu Kush-Karakoram-Himalaya mountain chain. It is a high altitude arid region,

- 310

with an annual precipitation of approximately 658 mm/year, mostly in the form of winter snowfall. The population of Chitral District in 1981 was 208,560, and increasing at an average annual rate of 3.3%. The population is overwhelmingly agrarian and rural. The main market centers are Chitral Town, Drosh, and Mastuj.

According to rock inscriptions in the valley dating from 900 A.D., at that time the people of the valley were Buddhists, and were under the rule of the king of Kabul. In the 16th century A.D., the ancestor of the Chitral State ruling family established control of the valley, and his descendants, called Mehtars, ruled until final incorporation of Chitral as a district of Pakistan's Northwest Frontier Province in 1969. During that period, Chitral was constantly at war with surrounding rulers, and the combination of political turbulence and physical remoteness isolated and insulated the peoples of the valley from the outside world to a remarkable extent.

The Kho constitute the dominant ethnic group in the Chitral valley. Their language, Khowar, is linked to the series of Indo-Aryan languages which extend eastward into Ladakh, and which includes Shina as well as a number of Kohistani languages. Khowar may be distinguished from Pukhto, which is Indo-Iranian, and the Kho have inhabited the Chitral region for several centuries before the invasion of the Dir/Swat region of the Northwest Frontier by the Yusufzai Pukhtuns in the 16th century A.D.

Linguistically, the lower Chitral Valley is more diverse than the area above Chitral Town, with several villages claiming origins from Chilas, Bashkar, Badakhshan, and other regions. In addition, the three side valleys of Bumboret, Rumbir, and Birir contain the villages of the Kalash, who speak a different, related "Dardic" language. Most Chitrali men have a working knowledge of the lingua franca, Pukhto, and/or Urdu.

Chitral valley settlements are clustered along the alluvial outwash fans and on the river terraces. Above the villages, livestock are grazed on the steep slopes. Villagers have common property rights to forage, twigs for fuel, and trees for house and mosque construction. Agricultural production relies upon gravity flow irrigation systems from mountain streams and glaciers, brought to the fields by sometimes lengthy canals constructed and maintained by the villagers cooperatively.

Kho social organization closely resembles that of their mountain neighbors. Descent is patrilineal; inheritance follows Muslim rules, with the exception that girls do not receive the half-share which Islamic law prescribes for them. Households are formally headed by the senior male member; however, women exercise considerable informal influence on domestic matters.

Chitral society was traditionally divided into three social classes. The ruling family of the Mehtar, and close kin, constituted the highest class. The "middle class", or Arbabzadas, made up the majority of the population. "Faqir-miskiin", or the poor, composed the lowest class, and were thought to be descendants of slaves. However, the major class differentiation today is between a relatively small number of large land-holders, mostly descendants of the Mehtar's family, and the majority of small farmer families.

In the northern valleys, most are Ismaili Muslims. Below Chitral town, however, the majority are Sunni. Settlement patterns are tied closely to the availability of arable land and water in the narrow valley. Agriculture is limited to the alluvial outwash fans, where cultivation of field crops and orchards is intensive. Holdings are usually small: approximately 8 out of 10 farms are one-half acre to 5 acres in size, according to official statistics, and interviews indicate that the majority of those are nearer the low end of this scale. Farming follows the usual complex pattern of hill farms in the Himalaya-Karakoram region, where the stark limitation of resources forces adaptive strategies which include trade and labor as well as farming and livestock keeping.

Depending on elevation and potential growing season, one or two crops are grown. Major crops include wheat, barley, maize, and orchards, but most production is from small farms. Due to lack of marketing, transport, and processing facilities, most production is consumed locally either fresh or preserved. Reportedly, some fruit rots in the field, as well.

During the winter season, some male family members leave the village for larger towns, or go out of the valley for work. Women, children, and the elderly remain behind. Migrants from Chitral are found in many parts of Pakistan, and abroad. Due to limited educational opportunities, most migrants find jobs as laborers rather than service or professionals. Remittances from migrants form an important part of the income for many families in the district. Difficulties of access to the valley force migrant family members to remain away for lengthy periods of time. And, once in Chitral, travel delays in returning to work pose serious problems for migrant workers.

G.2.2 The Kalash

The three valleys of Bumboret, Birir, and Rumbur, southwest of Chitral town and reached via the village of Ayun, are the traditional home of the Kalash, a socially and linguistically distinct ethnic group which has been studied extensively by scholars for several decades. The Kalash occupy 6 villages, and number approximately 4000 persons, with a population growth rate of 2.65% per year (LeFeuvre 1987). Most Kalash are non-Muslims, although many, especially men, have adopted Muslim names. Kalash men dress much like other Chitralis, sometimes with the addition of a feather, or a small bell, on their "pakol" hats. Kalash women, however, wear a

312

distinctive costume, with a long black cotton or wool dress and an elaborate headdress with feathers, cowrie shells, and other decorations. Kalash women, unlike Muslim women in Chitral, do not observe segregation of the sexes ("purdah"), and earn income from tourists by posing for photographs and by group dancing.

The Kalash subsist on maize farming, livestock herding especially sheep and goats and the products of their orchards, including especially apricots, mulberries, and walnuts. Kalash social organization is patrilineal; descent segments are organized in to several exogamous clans. While households cultivate individual plots, overall control of the resources of the valleys is managed by clan elders in council. Agricultural surpluses go to support elaborate and colorful ceremonies at intervals during the year. These "rites of intensification", incorporating rituals, songs, dances, and stories, serve to maintain and reinforce the social and cultural integration of the Kalash.

G.2.3 Dir District

Abutting Chitral District on the south and southwest, Dir District is the entranceway to Chitral from Pakistan, via the Lowari Pass. Dir, like Chitral, is a relatively narrow mountain valley, whose settlements lie in the watershed of the Dir and Panjkora Rivers. The total area of the district is 5,282 sq. km.

Although the upper portion of the Panjkora valley contains a majority population of Bashgali and Gawri-speaking Kohistanis, the population of the Dir Valley, where the proposed project will be undertaken, is almost entirely composed of Malezai Yusufzai Pukhtun ("Pathans"). That is, at least 85% of the 150,000 people in Dir Tehsil, in the vicinity of the proposed project area, are Pukhtun. Like their Yusufzai kinsmen in the adjacent Swat Valley, the Dir Pukhtuns invaded the valley some 400 years ago, displacing both Kohistanis and Pukhto-speaking "Swatis", and establishing a stable agrarian society founded on double-cropping of wheat, maize, rice, and poppy in the lower elevations, maize and barley and potatoes in the higher part of the valley. In Swat, the limits of Pukhtun expansion seem to have coincided, until very recently, with the limit of double-cropping. Beyond this limit, Kohistanis farmed the increasingly scarce and steep lands of the upper valley. However, in Dir, Pukhtuns occupy all the villages, right up to the pass itself. Up to Qolundi village double-cropping is possible; beyond, to the last village, Lowari, only a single annual crop of maize or potatoes, can be grown. As in Swat Kohistan, however, livestock, chiefly sheep, are an important part of the economy of the upper valley.

Pukhtun social organization is based on patrilineal kinship, tracing linkages over many generations. Kin segments are corporate descent groups. The basic social and economic units are male-headed households, whose most important asset,

agricultural land, is held by virtue of membership in a tribal segment. However, over time, economic differentiation has produced a status difference within Dir, and there are several relatively wealthy families with lands, businesses, and significant political connections outside the district.

Until 1969, Dir was a semi-autonomous state. Misrule by the reigning Nawab, and continuing political turbulence, resulted in its being absorbed into Pakistan. The process of adjustment continues, however; in 1976, bloody battles were fought between local residents and Pakistani troops over the question of rights to forest products.

Intersecting the settled society of the Dir villagers is the transhumant, livestock based society of the Gujars, usually called "xaanaa-baa-dosh", or nomads, by the Pukhtuns. With the arrival of warm weather, Gujars move their flocks of sheep, goats, and donkeys to graze on the higher slopes of the valley. They may maintain up to five "baanDaa", or summer residences, at increasing altitudes on the slopes, and retain customary rights to graze in specific regions. They also exchange goods, and provide labor, to Pukhtun farmers. With the coming of cold weather, the Gujars shift down-valley, to lower Dir, Swat, and sometimes beyond.

G.2.4 Change Processes and "Pukhtunization"

The peoples of the Chitral Valley have maintained their distinctive languages and ways of life in the midst of the complex ethnic mix of the Karakoram region for many centuries. Contacts, and conflicts, with Gilgit, Dir, Swat, and Afghanistan have continued for as long as the history of the region has been recorded. However, with the establishment of political stability and incorporation of the valley as a district of Pakistan, increasing social, cultural, economic, and political pressures are intensifying the pace of social change. Particularly important is the increasing involvement of the provincially dominant Pukhtuns in the economic life of the Chitral Valley. Several of the largest merchants in Chitral are Pukhtuns from Peshawar, who have been established in Chitral Town for generations. Many of the government officials posted to Chitral are Pukhtuns, as well. The bulk of the transport of goods into and out of the valley is controlled by Pukhtuns from Dir, Swat, and elsewhere. And, with the influx of refugees from Afghanistan, a considerable number (approximately 80,000) of non-Chitrali speakers, many of whom are Pukhtun, now live and work in the valley. These refugees may remain indefinitely, and may be increasingly assimilated into the economic and social life of the valley.

An additional factor, which is difficult to assess without more intensive, yet discreet inquiry, is the potential for increased "fundamentalist/revivalist" pressures in the Chitral Valley via the "taabliighii jama'at" movement which is strong in parts of Dir District. The Chitral District officials noted that, in the relatively peaceful valley, the most

important disturbances to law and order came from clashes between rival religious sects especially between Sunni fundamentalist maulvis, usually from outside the valley, and members of the Shia Ismaili community. Members of the Agha Khan Rural Support Project, and other Chitralis, did not see this movement as posing a significant immediate problem with the opening of the road access, but in the longer term it is one of the many elements which will intrude into the district as a consequence of increased integration into the wider society of Pakistan.

With increasing access to Chitral, processes of cultural assimilation, combined with economic expansion, will continue. However, when queried about this, most Chitralis expressed confidence that serious problems were unlikely to occur. In Ashuret village, elders said that the villagers had agreed not to alienate lands to outsiders. In the very rare instances where village lands were to be sold, they were reserved to other members of the village community. Other villages in Chitral were reported to have made similar arrangements. However, with both internal population pressures, and the possibility of increased in-migration as a result of better access to the Chitral valley, the potential for conflict over the scarce land, water and forest resources of the valley must be taken into consideration.

G.3 Social/Cultural Feasibility: Chitral Access Project

All those interviewed during the field site visit to Dir and Chitral District were unanimously enthusiastic at the prospect of better road access to Chitral. Earlier attempts at tunnel construction in the 1970s were viewed hopefully; their failure caused dismay. Access to modern production inputs, markets, social services, and job opportunities is a clearly perceived need. Construction of roads is traditionally a function of government in South Asia, and it is an important symbol of the extension of government to an area as well as a physically important means of improving law and order, administration in general, and development in particular.

G.3.1 Communications and Transport: Dir and Chitral

A key element in the economy of Chitral District is the transport of goods, and people, into and out of the valley. Chitral,s major road link to the rest of Pakistan is the road from Dir, over the 10,200 Lowari Pass. In addition, Pakistan International Airways maintains a two flight per day schedule from Peshawar to Chitral Town, weather permitting.

There are some 800 vehicles registered in Chitral, most either trucks, pickups ("Datsuns") or four-wheel drive jeeps. According to officials of the Chitral Jeep/Datsun Drivers, Union, between 200 and 300 vehicles per day, including trucks, buses, jeeps, and Datsuns, cross the pass into Chitral during the six month period when the road is open. Transport

upcountry, to side valleys, is mainly accomplished by Datsun, jeep, or porterage.

Transport registration is valid for all Malakand Division, so there is no restriction on transport of goods between Dir and Chitral, or from those districts down-country. Trucks larger than the 3-ton "Bedford" cannot cross the pass safely. During the open season, a minimum of 10 to 15 trucks make the trip from Dir to Chitral each day. The Dir Transport Drivers' Union books orders for goods transport from Dir, but much of the goods transport comes up directly from Peshawar or other places.

Passengers and goods are also carried over the Lowari Pass from Dir to Chitral by jeeps and Datsuns (the local generic term for pickup trucks most of which are actually Toyota trucks). No special permits in addition to registration of the vehicle are required. There are about 60 vehicles enrolled in the Dir Jeep/Datsun Drivers, Union. There is a charge of Rs. 60/- one way for jeep transport from Dir to Chitral; Government Transport Service bus fare for the same trip is Rs. 40/-. In addition, "flying coaches" operated by Afghans ply the route from Peshawar to Chitral, charging Rs. 130/-. According to both Chitral and Dir union officials, nearly 90% of the jeeps and Datsuns plying the route are based on the Dir side of the pass.

During the season when the road is open, there are four GTS buses per day to Chitral from Dir. Although there are supposedly only two flying coaches permitted per day, union officials claim that six to eight actually make the trip, travelling at night.

Truck and jeep/Datsun unions are registered in both Dir and Chitral. Although formally separate, officials of all unions stressed that they cooperate closely with each other. Announcement of this cooperation, in connection with resolution of a recent strike, was prominently posted on the wall of the Dir Jeep/Datsun Drivers, Union office. Passenger and goods transport arrangements, including issue of tickets to passengers, is handled by the jeep/Datsun Union clerk at the office. Jeeps are officially limited to 10 passengers; Datsuns may carry 14 plus goods. No schedule is maintained; jeeps and Datsuns are filled in rotation, and when fully loaded they go.

The unions have been in operation continuously for over 20 years. The officials, and drivers, believe that if year-round access to Chitral becomes available, larger trucks will ply the route from Peshawar. There will be less need for storage and trans-shipment of goods from Dir, but the loss in income from this source will be more than compensated for by acquisition of larger vehicles by local people, who will continue their trade with Chitral on a safer, and more profitable basis. They also anticipate a boom for transport during construction of any project which will open up Chitral District, carrying labor and supplies and equipment.

316

Under the current conditions, trucks, jeeps, and Datsuns go down-country during the winter, when the road is closed, and work there. They return in the spring, perhaps bringing with them the livestock and goods of the local Gujar population, which also migrates to winter grazing down-country.

A feature of the current transport situation is the inevitability of strikes by transporters during the season when the road is open, and the GOP as well as private merchants is attempting to build up stocks of essential items against the winter closed season. As pressures build toward the end of the summer, strikes are declared, related to a variety of grievances. A three-day strike ended on 22 September 1987, called, according to union officials, because of harassment by police. Three different sets of police were conducting checks of goods in transit to and from Chitral, causing delays and extra costs to transporters.

The major types of goods transported by trucks are supplies to Chitral (wheat, sugar, fuel, edible oil, etc.) and lumber from Chitral down-country. An estimated 400 trucks per season, carrying 250 ft. of lumber each, or 100,000 ft of pine, cedar, and walnut, leaves the Chitral Valley.

The season for transport to and from Chitral is from approximately mid-May to early November. In Chitral, drivers look at the snow covering a nearby hill, said to be at the same height as the Lowari Pass, to gauge whether the pass is open. The trip from Chitral to Dir takes a minimum of 4 hours. With narrow, twisting road, mud, snow, and uncertain weather conditions, and poor maintenance as well as overloading of vehicles, the trip is a dangerous one. Four drivers were killed this season, according to Chitral jeep/Datsun union officials; and several others, as well as passengers, were injured. In addition, bandits on the Dir side caused some difficulty, and one policeman was reported killed.

G.3.2 Porterage

During the winter, goods are transported, and foot-travelers are guided over the Pass between Qolundi Village and Ashuret by local porters. Porters are both Gujars, and local Pukhtuns from Lowari village and other, smaller hamlets on either side of the pass. Residents of Lowari village, the last inhabited place before the pass on the Dir side, estimated that as many as 200 persons might cross the pass in a single day, when relatively good weather prevailed. When the weather is bad, they must remain in the small hotels along the road, sometimes for several days, paying for food and lodging, which can cost Rs. 30 or more per person per day. Most travelers are men, according to people we interviewed, but very occasionally women and children may accompany them for what is viewed as a difficult and hazardous journey. From Lowari village, it is 13 miles to the next settlement, Ziarat, on the Chitral side of the pass.

Along with the foot travelers, an equal number of porters, each carrying an average of 30 kilograms of baggage, also cross the pass. Porters charge Rs.3.50 per kilogram for baggage. They are recruited from the population of the villages near the pass, including Bundo Dara, PannakoT, Qulandi, and Lowari, and include both Gujars and Pukhtuns, but primarily the latter. Porterage is an important source of income for these villagers during the winter months, but it is dangerous. Five men were killed last winter; the bodies of three were not found until Spring. Lowari village residents noted that, if all-year access to Chitral were to be provided, porters would have few clients. However, the villagers felt that if opportunities to work on construction were available, men who now worked as porters would be happy to take up new occupations, supplementing their current summer income from farming and livestock raising.

G.3.3 Air Travel

Two flights a day, weather permitting, connect Chitral Town with Peshawar. However, flights are often erratic, especially in winter, the number of seats is limited, (Fokker F-27 aircraft have a maximum passenger capacity of 40) and there are many official claims on seating, so that delays are common. Many of the people interviewed had favorite stories of the problems encountered in trying to reach Chitral, or Peshawar. Informants estimated that waiting for the flight to Chitral cost approximately Rs. 300 per day, for 6 to 8 days and sometimes longer. In Ashuret village, informants told of a villager working in Saudi Arabia, who came back to Pakistan on one month's leave. After waiting for a flight to Chitral for two weeks, and spending the money he had saved on hotels and meals in Peshawar, he gave up in disgust and returned to Saudi Arabia.

In case of medical emergencies, it is possible to book seats for the patient and attendant, but the seats must be removed to accommodate the stretcher in Rawalpindi and then the unit flown via Peshawar to Chitral. In practice, this is very rare, and very expensive.

During the entire period of our stay in Chitral District, there were no PIA flights in, or out.

During the last winter season, there were reportedly serious disturbances at the PIA office in Peshawar, when continued delays enraged an increasing backlog of would-be travelers.

With the information provided by jeep/Datsun and bus drivers, by PIA officials, and from other knowledgeable people in Dir and Chitral, it is possible to make a tentative calculation of the average daily volume of travelers to and from Chitral, by various means, during the summer and winter seasons.

318

SUMMER

jeeps @ 10 persons x 40/day	=	400
Datsuns @ 14 ditto x 40/day	=	560
GTS buses @ 60 ditto x 4/day	=	240
Coaches @ 50 ditto x 6/day	=	300
PIA @ 40 ditto 2/day	=	180
TOTAL TRAVELERS TO CHITRAL	=	1580

WINTER

Foot travelers @ 100/day	=	100
Porters @ 100/day	=	100
PIA @ 40 persons x 1/day	=	40
TOTAL TRAVELERS TO CHITRAL	=	240

That is, the number of travelers in winter is approximately 15% of those in summer, under current conditions of access. And once in the valley in winter, travelers have no way of knowing whether they will be able to leave in a reasonable span of time, nor have they any assurance of safe passage, especially by road.

G.3.4 Baazaar Economy: Chitral and Dir Districts

Trade and commerce in Chitral and Dir Districts is defined spatially by the physical aspects of the steep and narrow mountain valleys in which the population is settled, and temporally by the severe winters which restrict travel both into and within the region. There is virtually no industry in either district, except for some processing of forest products in southern Dir, and some production of woolen cloth (pattii), by handloom methods, in Chitral. The valleys produce little for export to the rest of Pakistan. Most baazaar trade is in basic staple goods: atta, oil, sugar, condiments and spices, cloth, and kerosene.

Prices are, as one would expect, higher in Chitral than in Dir for virtually all items, except those, such as petroleum products, which are controlled by the Government of Pakistan. The differential is due to the costs of transport, handling, and storage between the two districts. Since the road between Dir and Chitral is closed during the winter season, the Government as well as private merchants makes an effort to build up stocks of basic commodities in the valley during the summer. Government stocks are then released into the market during the winter season. However, the costs of subsidization of some items, and of stocking and storage of commodities, as well as administration of this system of "food security", would appear to be a significant charge upon the Government of Pakistan.

With the influx of Afghan refugees, and of goods provided to them by various relief agencies, the baazaar of Chitral Town has expanded substantially. Food stalls, tea shops, and Afghan-operated grain, cloth, and "general" stores have become a highly visible element in the market. Several of the larger, and longer-established enterprises are owned by Pukhtuns originally from the Peshawar/Mardan/Nowshera area, who also have interests in other parts of the Province.

Any expansion of the scale and scope of the baazaar economy in Chitral District will require improvement in overland access to the valley from the outside. Year-round movement of goods, via an improved road over the Lowari Pass, will enable both the Government, and private entrepreurs, to establish or expand operations in the small baazaars along the main road up the valley, and to extend operations as well into the side valleys where access is likely to remain difficult for other than jeeps, mules, or foot traffic for some time.

Social organization at community levels and above, and cultural traditions relating to construction projects like the proposed Chitral Access Project are clearly established in Pakistan as a whole and in this region in particular; economic institutions involving transport and commerce are of the sort easily adapted to the exigencies of the project itself, and the development activities which will inevitably accompany it; and there is a clearly perceived need, supported by information available about current conditions of access to Chitral District, expressed universally by residents of the area. This indicates that the social and cultural feasibility of the proposed Chitral Access Project is quite high.

G.4 Social Impact and Benefits: Chitral Access Project

The Chitral Valley has for centuries been a "refuge area", isolated from both Central Asia and the South Asian subcontinent by the extreme physical difficulty of access to it, and by the political turbulence which historically has characterized the region. With the establishment of the Islamic Republic of Pakistan in 1947, the first steps toward reconciling the warrior tribesmen of the Northwest Frontier Province were taken. Successive moves by the GOP resulted in the assimilation of the formerly autonomous "feudal" states of Dir and Chitral into the wider polity. These actions culminated in the establishment of Dir and Chitral as districts, under full administration by the NWFP, in 1969. However, difficulty of access to Chitral has continued to hamper administration, extension of public services, development activities, and expansion of private enterprise until the present day. In addition, the war in Afghanistan since 1979 has resulted in severe pressures on physical resources, government services, and the local social system due to the influx of thousands of refugees.

320

"Life in Chitral is a six-month jail sentence", is the commonly heard statement in the district. Deep snow, high winds, fierce cold, and landslips or snowslides close the road to Chitral over the Lowari Pass to all but hardy foot travelers from October/November to March/April every year.

Accordingly, the immediate beneficiaries of a project which opens Chitral District to year-round road access to the rest of Pakistan are all those resident in that district. Extensive discussions with Chitral valley residents, official and non-official, rich, poor, and middle-class, women and men, revealed a unanimous and energetic desire for better contact with the rest of the country, for reasons very obvious to anyone who has ever experienced the current, difficult and erratic modes of communication and transport to and from the District. Benefit potentials for specific areas of the economy and society of Chitral are discussed in greater detail below.

In addition to Chitral District residents, the beneficiaries from this project will include various categories of non-resident Pakistanis, as well as foreigners, who will be able to obtain access to Chitral for business, tourism, social purposes, and administration, effectively increasing the process of integration of this economically and politically marginal area into the wider society of Pakistan. These, to are discussed in greater detail below.

G.4.1 Benefits for Residents of Chitral

1. Improved local production of basic staples and cash crops on the very limited cultivable land base of Chitral District will be most feasible with increased ease of technology transfer from outside the district. This covers the spectrum from improved seeds and input mixes, to support of agricultural and livestock research in the specific production setting of Chitral,s high mountain valleys. While most field activity will continue to occur during the summer growing season, continuity of effort involving both public and private-sector institutions will require continuous access and communication between Chitral and outside centers.

2. Improved marketing for Chitral's products, such as orchard crops and wool, will only be possible with better road access to the district. Informants --both officials and farmers reported that fruit, especially apples, rotted because it could not be gotten to market. A considerable effort is now made to dry and preserve apricots, tomatoes, and other crops for local consumption over the winter season. Much of this production might be marketed if facilities were available, injecting cash income into the local economy, along with greater diversity of foodstuffs. This

would not occur immediately, since the processing and marketing infrastructure in the district is undeveloped. But the key to initiating such changes lies in improved physical infrastructure, and specifically the year-round road access to the rest of Pakistan which is proposed in this project. With the road, transport facilities will improve, and the high costs of transport will be reduced.

3. In both Dir and Chitral, transporters emphasized their interest in increasing the scale of their operations, which they felt were constrained by the conditions of the Lowari Pass road. With year-round access, transporters said, they would invest in larger vehicles, and would buy more vehicles, to service Chitral. The number of people, as well as the volume of goods transported, may be expected to increase dramatically with the completion of this project.

4. Increased access to the rest of Pakistan will allow Chitral residents to more easily search for seasonal or permanent employment. Many Chitral households depend upon remittances from family members working elsewhere in Pakistan, or in foreign countries. At present, migrant workers find it difficult, and expensive, to travel to and from Chitral. Air service is erratic, and even more so in winter. Long delays between flights, caused by bad weather, lead to backlogs of would-be travelers, and occasionally to riots in the airports.

   In addition, travelers incur an estimated minimum of Rs. 300/per day in food, lodging, and transport costs while waiting for flights from Peshawar. The increased ease of access to the district, which would result from this project, is an important perceived benefit for all classes of Chitralis.

5. The paucity of services in Chitral is also due in some degree to the difficulty of year-round access. Government officials, especially non-Chitralis, are extremely reluctant to accept postings to Chitral. Many government positions, although formally occupied, in fact are not served because those who are posted to them in fact avoid coming to the district, or take frequent leaves which they then over-stay. This is particularly noticeable in the case of posts occupied by women teachers in girls, schools, social welfare officers, and health workers. In addition, officials, and "middle-class" townsmen mentioned their concern for their children,s

-322

travel outside the valley for higher education, for health reasons, and for employment. Given the difficulty and high costs and danger, in winter they were reluctant to keep their families in Chitral. Thus, attracting, and keeping officials in the valley will be facilitated greatly by improved road access.

6. Within the valley, improvement of the road system may be expected to have an immediate and positive impact upon the development of trade and commerce in the villages which lie along the main road up the valley, and which act as service centers for smaller communities in the side valleys. Ashrait, Mirkhani, Drosh, Ayun, and other communities in lower Chitral will be most immediately affected, as will Chitral Town itself. However, there should be rapid expansion in the number of small shops in the entire valley, as goods from outside become more cheaply available, and as rural capital is invested in local opportunities. Merchants in the bazaars of the small communities, and in Chitral Town, were excited at the prospect of improvement in road access, and mentioned that they were ready to take advantage of the opportunity. They also noted that, with improved prospects for trade, the demand for investment credit would grow.

7. Chitral is "backward" in the number, type, and effectiveness of social development programs which have been undertaken, in comparison with the rest of the NWFP. Obtaining commodities, recruiting and retaining staff, and communicating with isolated communities over mountainous terrain, are expensive and difficult. Health care is minimal for all; it is especially poor for women. Many people interviewed noted that, in case of emergencies, and special instances requiring treatment in Peshawar, severe problems occur. Several mentioned cases where inability to reach an adequate treatment facility resulted in death. Other social services which are now becoming available in other parts of the province, are poorly developed in Chitral, in part due to the high costs of implementing them with the limited access to the district at present.

8. With year-round road access, and accompanying improvements in the number of vehicles and reduced travel time, important dealings with divisional and provincial-level official agencies will be greatly facilitated. Court cases, permits of various sorts, and other matters may be dealt with more expeditiously, increasing, at

the same time, the level of involvement between the people of Chitral and the affairs of the wider society of Pakistan.

9. Employment in enterprises related to transport, in Chitral and elsewhere, may be expected to increase substantially with greater use of the Lowari Pass road. Automobile, truck, bus, and jeep sales, service, and repairs; goods handling for a greater volume and wider variety of commodities; tea stalls, hotels, and restaurants; and other enterprises will be established or expanded to meet the new demand. This, in turn, will have important secondary effects in the growth of market towns along the main road up the valley.

10. Forest products constitute one of the few items exported from the Chitral Valley. Currently, 400 Bedford trucks per season carry lumber over the Lowari Pass and down to Chakdarra, providing income to a sizeable number of woodcutters, as well as to timber interests who appear to be located outside the district. With year-round access, the volume of lumber extracted may be expected to increase. However, without adequate attention, from the outset, to controlled harvesting enforcement, and to reforestation, the timber resources of the district, which are already under serious assault, will be rapidly depleted. The removal of timber without management of the steep slopes of the valley,s watersheds will accelerate problems of landslips, flooding, siltation of irrgiation channels and watercourses, and alterations in the water tables of the area, severely affecting irrigated farming and orchard cropping in this arid region.

11. A potentially important source of income to residents of the Chitral Valley which has been given impetus in the last decade is tourism. The district is a high mountain valley, with several peaks over 20,000 feet in altitude and some of the finest alpine scenery in the world. However, political instability combined with very limited access via roads limited the number of visitors severely. Even now, only 80 tourists per day can reach the valley by air in competition with local residents, officials, and other outsiders. This number is reduced further by the erratic nature of flights into the valley, especially in the winter season. During the summer, some tourists brave the difficult road over the Lowari Pass, but their economic impact on the district remains limited. There are 5 hotels in

Chitral catering to tourists on a minimal scale, with approximately 120 rooms in total. Restaurants and shops are not numerous, large, or sophisticated by Pakistani standards. The potential for trekking tourism in the district is great. With relaxation of restrictions in the last few years, it has grown in importance (Swift 1982). The Pakistan Tourism Development Corporation, and private entrepreneurs, are beginning to support this form of tourism, recognizing that considerable sums are spent in its pursuit. Further encouragement of this form of "adventure tourism" would provide employment to innkeepers, guides, and porters in the more remote areas of the district. An important component to such encouragement is reliable road access, supplementing air transport.

Skiing has been practiced in Chitral since at least the early 1930s, primarily in the Shishi Kol valley near Drosh. This sport, which requires access during the winter for its devotees, may become a significant source of income for valley residents once the Lowari Pass road is open year-round. Under present conditions, few people are willing to risk the uncertainties of air service into the valley in winter for a skiing vacation.

The Pakistan Tourism Development Corporation has emphasized the unique culture of the Kalash in its brochures. This ethnic group is colorful and exotic, and, with the opening of the jeep road into their valleys in 1983, they have been the increasingly unwilling hosts to relatively large numbers of tourists. Where it was once necessary to stay at least overnight in the limited accommodations of the Bumboret valley, or in Kalash homes, now tourists can drive there for an hour,s visit. Year-round road access into the Chitral Valley may have some effect on tourism in the Kalash valleys, but since the road to those valleys will be frequently blocked during the winter the main effect of the Lowari Access Project per se will be provision of employment to Kalash men as trekking guides. Summer tourism increases will intensify current pressures on Kalash culture and social organization, and means for assisting the Kalash to buffer these shocks, and to mediate their own increasing involvement in the social, religious, economic, and political/judicial systems of the wider society into which they are inevitably enmeshed, should be an important consideration in design of this project.

Beyond the immediate benefits to inhabitants of the Chitral Valley, there are other, identifiable benefits from the proposed project which should accrue to the people of Dir District, on the southern side of the Lowari Pass. Many of these are identical to those mentioned above, such as economic growth in the immediate area of construction and expansion of the road; increased volume of goods transport, and ease of access to Chitral; possibly a growth in tourism -- although the

325

law and order situation in northern Dir poses severe problems to trekking tourism.

For Pakistan and its citizens as a whole, there are both symbolic benefits to incorporating its most inaccessible district into an all-weather road network which will enable people and goods to travel from Karachi to Chitral Town year-round; and political and strategic benefits as well from clearly extending its political mandate to a region which has historically been an important part of the cultural shatter-zone between Russia, China, Afghanistan, India, and Pakistan.

G.4.2 Lowari Tunnel Project: Impact on Women

Assessment of the potential impact of the proposed Lowari Tunnel Project, or any project which will have the effect of opening the Chitral Valley to year-round road access, upon the women of the region must consider both effects on women as beneficiaries, and as participants in project planning and implementation. In the conservative Islamic setting in which the project will be undertaken, the participation of women in public decision-making is likely to be limited. However, field investigation in Chitral District indicates that a number of benefits from improved road access into and out of the district will be disproportionately important to women and girls.

First in importance is simple physical access. During the winter months, Chitral is closed to road traffic. Air travel is erratic, seats are very limited, and men, especially officials, are given preference. Foot travel over the Lowari Pass is extremely difficult and often dangerous. Local informants report that very few women even attempt the journey during the winter. For Chitral District residents, the winter months are "like a jail sentence"; and for women this sentence is more likely to be strictly enforced than for men.

Isolation means that women cannot participate in important family ceremonies; cannot leave Chitral for emergency medical treatment; cannot consider attending educational institutions outside the district without severe financial hardship; and cannot obtain reliable and adequate supplies of foodstuffs, medicines, and other necessities during the period from October thru April (or November thru May).

Women amount to 48% of the population of Chitral. There are schools for girls, but no girls' college. There is one lady doctor posted in Chitral; and one in Drosh. However, getting those appointed to posts in this isolated and backward district of Pakistan to take up their postings, or to remain in them, is exceedingly difficult.

While women "officially" do not do field labor in Chitral, in fact their contribution to the family economy is substantial, especially among those households whose male members have migrated for work outside the district. Women are

326

responsible for selecting seed, assisting in preparing land, weed removal, threshing wheat, shucking maize, drying grains, vegetables and fruits for winter, and food and fodder storage, as well as preparation of meals. Women and girls are responsible for winter feeding of livestock; for carding, spinning, and weaving wool; for milking cattle and goats; for preparing milk products such as butter, ghi, curd and cheese; for making shawls, blankets, and some clothing. In the absence of men, the senior women of the household often effectively act as household heads, overseeing harvest laborers and conducting business transactions when necessary.

Improvement in road access during winter will have direct, and immediate impact upon food supplies in the district. Chitral was once famous as a valley where "even the rich people were thin". With incorporation of the valley as a district within Pakistan, and with initiation of air service in the mid-1960s, conditions during the winter are no longer quite so severe as before. However, compared to other regions of the NWFP, Chitral is a hard place to live. And, since women traditionally are less well-fed than male members of their families, Chitrali women are even more at risk of nutritional deficiencies, and even starvation, than men.

In the past, the people of the Chitral Valley, like those of other valleys of the Karakoram and Himalaya, coped with their environment by tightly adapting their way of life to their limited resources, and by forced as well as voluntary outmigration. A major export from the valleys of the Hindu Kush, Karakoram, and Himalayas until a few years ago was "slaves"; girls from Chitral commanded premium prices in the zenanas of northern India and Afghanistan. While this trade is much reduced, the overall status of women in Chitral remains low. Improvement in the living conditions of the Chitral Valley brought about by year-round road access will, over the long run, tend to bring women more effectively into Pakistani society, where they may benefit from educational, health, and employment opportunities and, over the long run, play a more productive role outside the household.

321

REFERENCES

AHMAD, M. T. Social organization of Yusufzai Swat. Panjab University Press, Lahore, 1962.

AHMED, AKBAR S. Social and economic change in the Tribal Areas. Oxford University Press, New York, 1977.

AHMED, FEROZ. Transformation of agrarian structure in the North-West Frontier Province of Pakistan. Journal of Contemporary Asia 14 (1), 1984:

ALLAN, NIGEL J.R. Impact of Afghan refugees on the vegetation resources of Pakistan,s Hindukush-Himalaya. Mountain Research & Development 7 (3), August 1987: 200-204.

A.V.E.C. Recontre: agriculteurs Bretons/agriculteurs Kalash. Trigomeur, Brittany, France, 1987

BARTH, FREDRIK. Ecological relationships of ethnic groups in Swat, north Pakistan. American Anthropologist 58 (1958): 107-189.

Political leadership among Swat Pathans. Athlone Press, London, 1959.

Indus and Swat Kohistan: an ethnographic survey. Studies honoring the centennial of Universitetets Etnografiske Museum, No. 2. Ethnographic Museum, Oslo, 1956.

CAROE, OLAF. The Pathans 550 B.C.- A.D. 1957. Macmillan and Company, New York, 1962.

CONWAY, GORDON, ALAM, ZAHUR, HUSAIN, TARIQ, AND MIAN, M. ALIM

Agroecosystem analysis and development for the northern areas of Pakistan. Aga Khan Rural Support Programme Report No. 1. Gilgit, 1985.

KEAY, JOHN. The Gilgit game. John Murray, London, 1979.

KEISER, R. LINCOLN. Foul shots and rifle fire. Natural History, September 1986.

KHAN, LT. COL. M. AFZAL. Chitral and Kafiristan. Printing Corp. of Frontier, Ltd., Peshawar, 1980.

328

LINDHOLM, CHARLES. Generosity and jealousy: the Swat Pakhtun of northern Pakistan. Columbia University Press, New York, 1982.

Leadership categories and social processes in Islam: the cases of Dir and Swat. Journal of Anthropological Research 42 (1), Spring 1986: 1-13.

MC MAHON, CAPT. A.H., RAMSAY, LT. A.D.G.

Report on the tribes of Dir, Swat, and Bajour, together with the Utman Khel and Sam Ranizai. Saeed Book Bank, Peshawar, 1981 (original 1901).

MICHEL, ALOYS A. The Indus rivers. Yale University Press, New Haven, 1967.

PAKISTAN, GOVERNMENT OF. 1981 district census report of Chitral. Islamabad, 1983.

1981 district census report of Dir. Islamabad, 1983.

ROBERTSON, SIR GEORGE S. The Kafirs of the Hindu-Kush. Oxford University Press, Karachi, 1974 (original 1896).

SCHALLER, GEORGE B. Stones of silence: journeys in the Himalaya. Viking Press, New York, 1980.

SPAIN, JAMES. The Pathan borderland. Mouton, The Hague, 1963.

STALEY, J. Economy and society in the high mountains of northern Pakistan. Modern Asian Studies 3 (3), 1969,: 225-243.

STRAND, RICHARD F. Notes on the Nuristani and Dardic languages. Journal of the American Oriental Society 93 (3), 1973.

SWIFT, HUGH The trekker,s guide to the Himalaya and Karakoram. Hodder and Stoughton, London, 1982.

WORLD BANK Land tenure systems and social implications of forestry development programs. Staff working paper No. 452, Washington, DC, 1981.

ZARIN, M. MANZAR, SCHMIDT, RUTH LAILA.

Discussions with Hariq: land tenure and transhumance in Indus Kohistan. Berkeley working papers on South and Southeast Asia. Center for South and Southeast Asian Studies, University of California, Berkeley, 1984.

Appendix H
Description of the Existing Road between Dir and Ashret

The following description was prepared by transcribing tape-recorded travel observations and coordinating them with photographs taken during the passage. Reference is made to kilometer markers found along the road. Dir is located at KM 113 and Ashret is at roughly KM 63; thus 50 km or approximately 31 miles of road are described. Photos of the described area follow the text in this appendix.

From Dir the road crosses the Dir River to the east side at about KM 112. It continues to climb and is paved.

At K M 109 from Chitral the road is still paved and has no hairpin curves.

The first 150° curve has a centerline radius of probably 50-60 ft. It is located just before KM 108. At KM 107+500, there is a 120° curve to the left over a drainage structure, 120° large enough for trailers.

The road width here, at KM 108, is probably 14 ft. The road is paved, with some obstructed drainage ditches on the hill side and some collapsed dry masonry rubble walls on the valley side. There is a moderate grade.

The road continues to follow the river on the east side. The first damaged section appears just before KM 107.

Right after KM 106+500 comes the first set of hairpin turns; the grade is moderate, the radii are adequate for trailers and the pavement width is maintained.

KM 106 is just at the upper end of the hairpin curves. At KM 105 the road is still full width; the pavement looks good, appearing to have been recently constructed; the grade is moderate. There is evidence of retaining wall reconstruction on the stream side, which is the west side of the road looking uphill.

Photo 1 illustrates the road at KM 104. At about KM 104 + 500, a large slide occurred damaging the pavement. Another slide area is located at approximately KM 103+500. The road is damaged and has not been re-surfaced.

Downstream from KM 104, the next hairpin curves radii are adequate, grade is moderate and pavement is maintained.

There is pavement deterioration between the two hairpin curves. The upper curve is tighter, the pavement is partly damaged and the grade is still moderate.

-330

After the Pathan check-points (at approximately KM 105) the pavement deterioration is such that there is only 30 percent of the pavement left exposed. There is a slide area between the Pathan check-point and the building with a big tin roof. The road resumes paved. The building with the tin roof is just 200 meters upstream from KM 101 and the pavement here is in need of repair.

Photo 2 is the view south of these two hairpin curves described downstream from KM 104. The end of pavement is just before the next turn, at KM 103, a 120o curve to the right. The road bed is adequate, the grade is moderate but there is no pavement. Next is a hairpin curve to the left leading over a stream. The structure seems to be in good condition, it is located just south of marker KM 100. The road continues at a moderate grade and adequate width, but is no longer paved.

Photo 3 shows the width of the road at KM 99. Right after that marker the road narrows somewhat and there's another hairpin curve which seems to be subject to landslide. A big rock is sitting where a structure was at one time. At this time it is a ford which needs to be transversed to get to the other side. This turn is the first which could not be maneuvered by a tractor-trailer unit.

Right after KM 98 comes a large "S" curve traversing a gulch with a structure which is in good condition. It is illustrated in Photo 4.

The road now enters a wide valley. It continues at a width barely adequate for jeeps to pass one another. There is no pavement and the grade is moderately steep.

At the entrance to the hairpin curve at the end of the valley, there appears to have been a substantial landslide before the turn is entered. It has been cleared, but the retaining walls have not been reconstructed and the width of the road is limited. The valley just mentioned is the Miana Kliawar Valley. Photo 5 shows this valley. During the first hour, 18 km were covered.

A landslide occurred last spring at about KM 94+700. The damage has been repaired in a way that one lane is passable (refer to Photo 6). The section is about 150 meters long. Just before the next hairpin curve there is a drainage structure obstructed by a large rock. At the turn there is an Irish crossing, the headwall near that crossing was destroyed by a landslide, but the crossing itself is intact.

Photos 7 through 11 illustrate the area surrounding the existing South Portal. Extensive slides and deterioration are evident at the turn just before this area which is located near KM 92. The grades are steeper and the slides appear to occur every spring. North of the South Portal there are fewer

markers. The road is jeepable, deteriorated through rainfall and slides.

This portion of the road is not suitable for getting heavy mining and tunnelling equipment to the other side. The erosion from landslides is pronounced.

The Engineering Consultant's 10000 scale map does not seem to reflect the actual alignment, particularly the section of road near KM 88. It is possible that the alignment changes each year because of the clearing operations required to make the road operational.

Photo 12 shows Lowari Pass from the South. The road is on the right and switches to the left further up where the sun hits the hill side. The road condition remains as previously described. The grades are steep, probably between 6 and 8 percent, maybe steeper. The width is adequate in places but washed out at times and reduced to a single-lane in some spots. The hairpin curves are getting tighter.

The hairpin curve just below the pass is adequate in width, grade and radius, but takes up a lot of land in the scree side, which will cause slides eventually.

The pass is located at KM 82, elevation 10,500 feet. Near the pass, the road could be widened and improved in such a way that trailer traffic could reach the top. The landslides could be retained by adequate structures on the hill side as well as on the valley side. Construction equipment could be brought to the pass from the south. The same cannot be said about the descent on the North side.

Leaving Lowari Pass to the North the road enters a scree field which is barely cleared. Only one lane can be used.

The road from the pass to the first hairpin curve is wide enough for one vehicle. Passing is possible, but only if one vehicle pulls over and stops. This is right near marker KM 81.

The grade on these hairpin curves appears to be steeper than it was on the South side. This needs to be checked with good topographical maps. The curve radii are such that a trailer would not be able to make these turns. This set just North of Lowari Pass consists of 26 hairpin curves. (Figure 4, located in Chapter 2, shows approximate existing road alignment between the proposed north portal location and Lowari Pass)

In this area the possibility of a different alignment may have to be studied. A near alignment could take the highway from the pass on the west side of the hill where it leaves the pass, to a point where it can be turned south, descending all the time without the existing number of hairpin curves. Then it could be brought over to the other side of the

valley, if possible, making long turns in valleys rather than switching back on the slope.

Unlike the Karakoram Highway, there is no maintenance evident here. The road seems to be just barely adequate to handle the present traffic. This described road condition is apparent in Photos 13-20.

The next set of hairpin curves starts below KM 78. There is a marker without a notation, probably KM 76.

The road continues to drop at a pretty steep grade, the radii are tight. It is basically a road fit for one-way traffic. There are places where cars can get out of another's way, but the road is definitely not laid out for two-way traffic.

Radii of the hairpin curves are in the vicinity of 10 meters at centerline, at most.

Near marker KM 75 the road is cut through soil which flows and erodes when it rains. The damage is not as severe as it is where the rock slides, and the maintenance task appears to be easier. (Refer to Photo 21).

The valley now becomes heavily wooded, relatively speaking, compared to the Chitral Valley. The trees are mature and plentiful. Fields are located on the sides of the valley which have been forested already. Earth houses are interspersed with those fields. The bottom of this valley is populated.

Pictures 22-27, showing the horizontal and vertical dimensions of curves occurring in this area, were taken at KM 74+500 and KM 72.

The Check Point at the North Portal of the proposed tunnel is just south of marker KM 70. Photos 28-29 illustrate this site. After the Check Point the road continues on the right side of the bank of the river looking downstream. The river flows north.

At marker KM 69 (refer to Photo 30) the road is not very wide. This marker is just 200 meters from a restaurant, and it is in a curve that seems to turn North. The road here is quite steep, quite narrow and not well maintained.

The alignment of the road described above, north of the North Portal, would have to be improved considerably.

The valley now gets quite narrow and the road reaches almost the level of the river. It is about one meter above the river, and there's evidence of considerable blockage, requiring clearing each spring. The granite, or what appears to be granite, is overhanging the road in places, and seems to break cleanly. There are loose pieces hanging over the road. A

lot of scaling would be required to make this road safe in time.

The speed at which this road can be travelled is not more than 10 kilometer per hour, at best. Along this stretch of the road there are red and white concrete survey markers, or what appear to be survey markers. This area is shown in Photos 31 and 32. Further toward Ashret there is a monument marked, "Engineering Consultants, Karachi", which could mean that these markers were put in by Engineering Consultants and that some road alignment work may be in the design stage already.

At marker KM 67 (refer to Photo 33) the road is still following the river on its right bank, looking downstream. In the background, high mountains are probably located in Afghanistan. Additional photos of this area are numbered 34 and 35.

North of marker KM 67 the ground becomes different in that large rounded boulders up to three feet in diameter are imbedded in soft clay like material. This material holds up well up to 20 feet, but is obviously subject to erosion because when it rains the soft material between the boulders washes out. (Refer to photo 36).

In addition, the road widens between marker KM 66 and KM 65. A maintenance crew was observed clearing the remains of a landslide which constricts the full width of the road in this area.

At approximately marker KM 63, the village of Ashret is reached. There the road becomes wider and less steep. The retaining walls are intact, the hillside slope is more gentle, the ditch is functioning and an old D-7 is sitting in the road, which apparently was used at one time for maintenance.

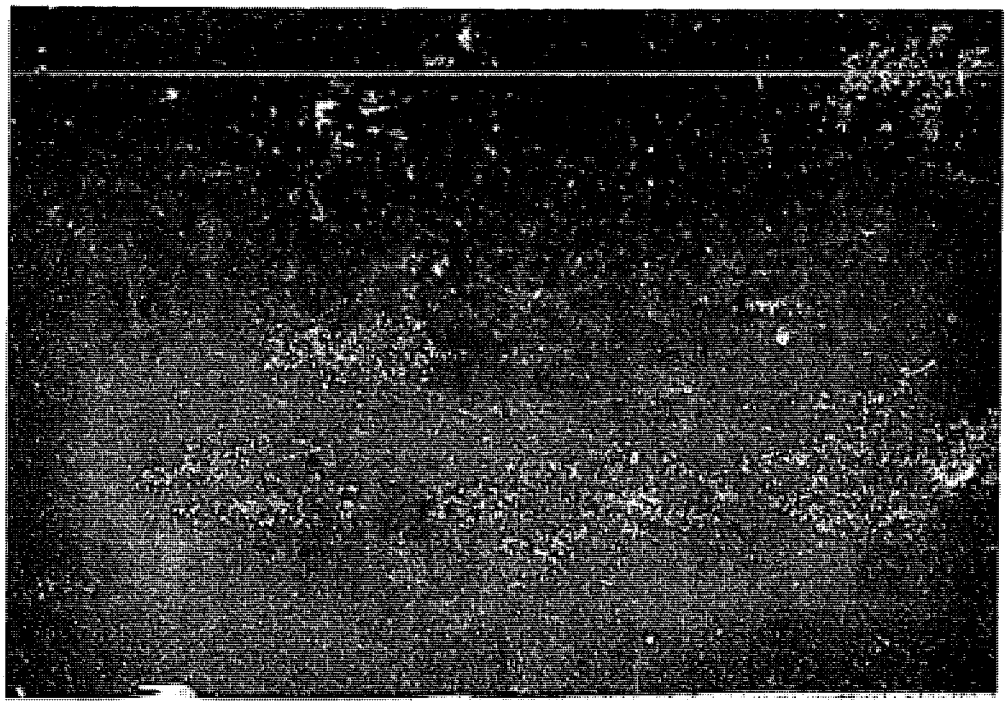
Just upstream, or south, of Ashret, the pavement begins again, but is it partly destroyed. Apparently, at one time, the road was paved beyond the town.

Just above Ashret the road crosses a river (Kotgah Gol?). It seems that it is covered with loose rock every spring. Road pavement begins as one enters the town. (Refer to Photos 37 and 38).

Below Ashret the road is in good condition, with the exception of some spots. It is paved, the curves are wide, the grade is reasonable. At marker KM 62 there is an area which is covered with gravel, which came down one of the gullies and has not been removed. This is a minor maintenance item. After 50 meters, the road is paved again and in good condition for large trailers with heavy loads.

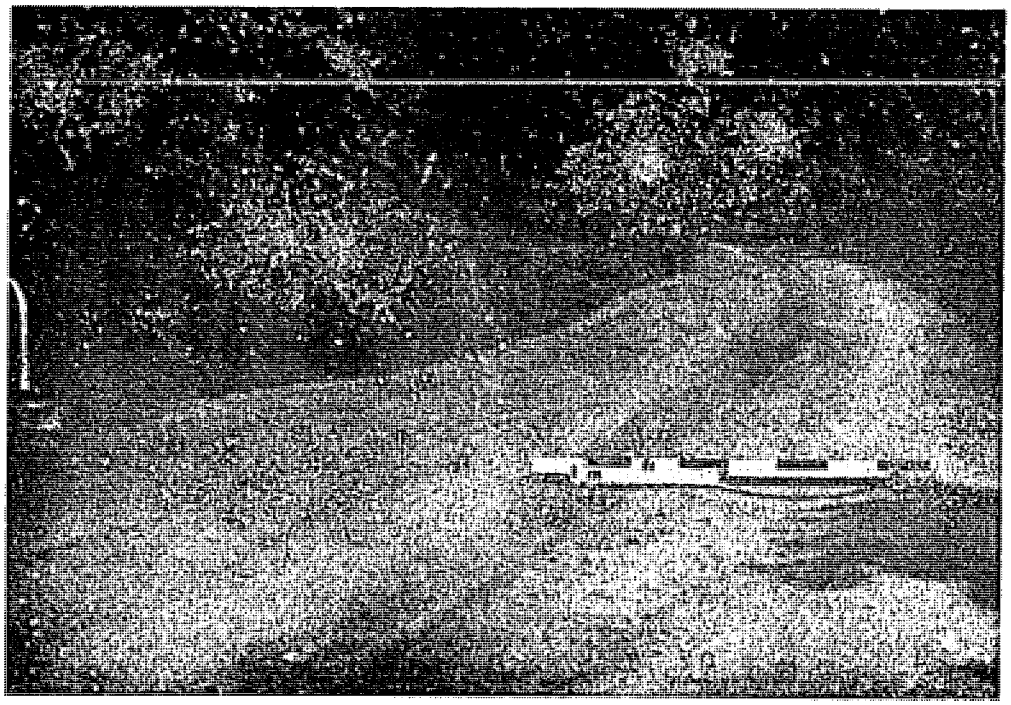
There are several spots between KM 61 and KM 62 where rock slides were not removed from the pavement. (Refer to Photo 39).

The road improvements (including pavement) begin around marker KM 62, between Ashret and Mirkhani. Mirkhani is located at KM 58. This portion of roadway is illustrated in Photo 40.



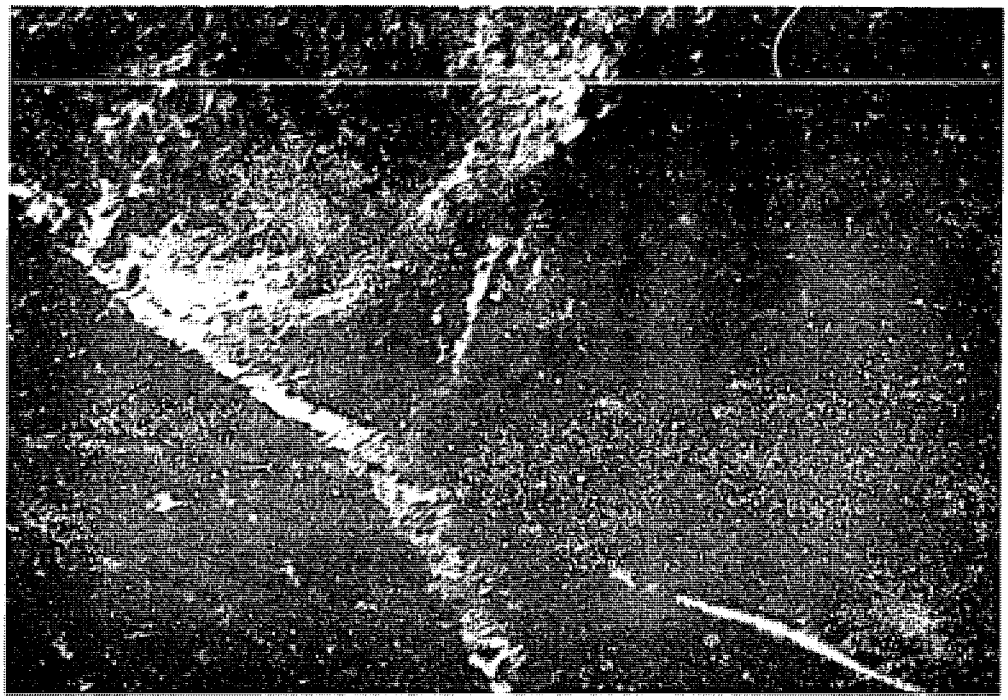
1. KM 104

2. Looking south toward Dir



3. KM 99: width of road

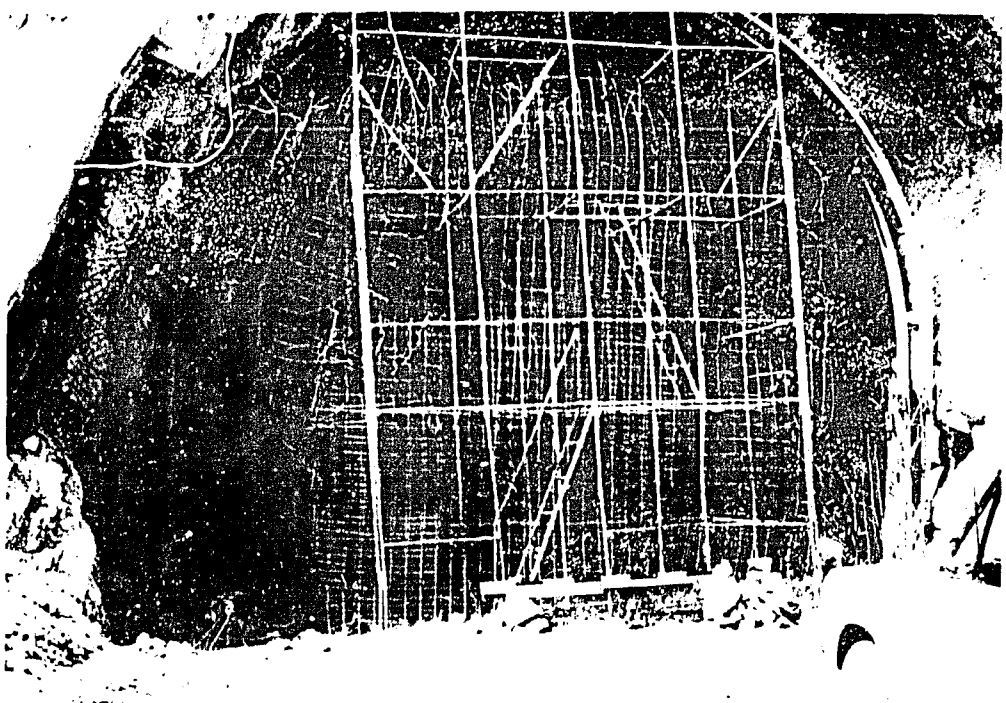
4. KM 98



5. Miana Kliawar Valley

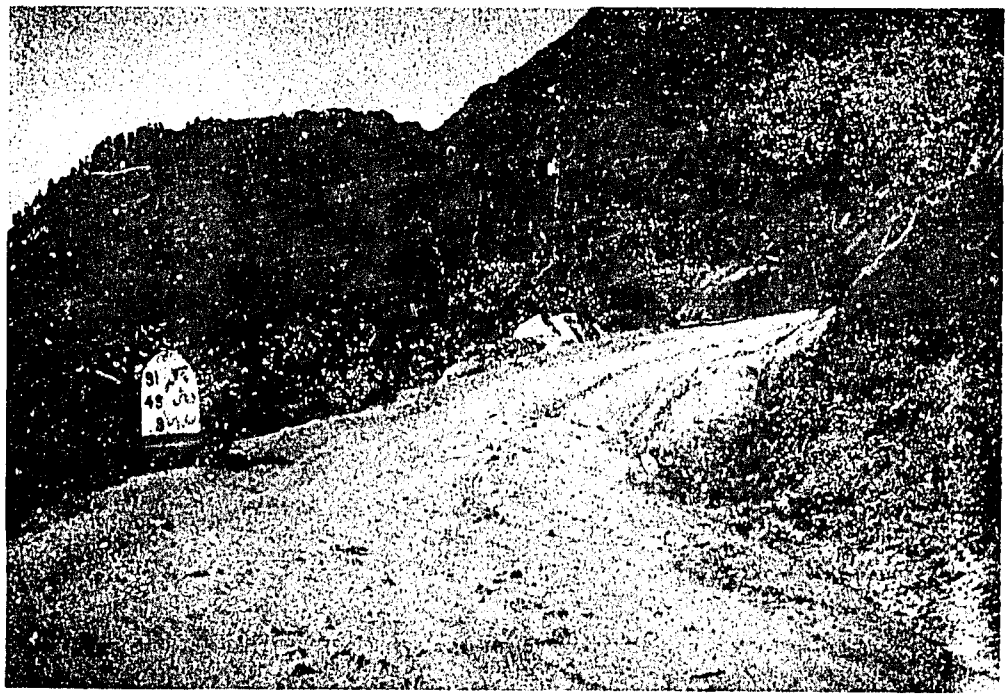
6. KM 94 + 700

7. Ford at Nirga Khwar, area of the South Portal

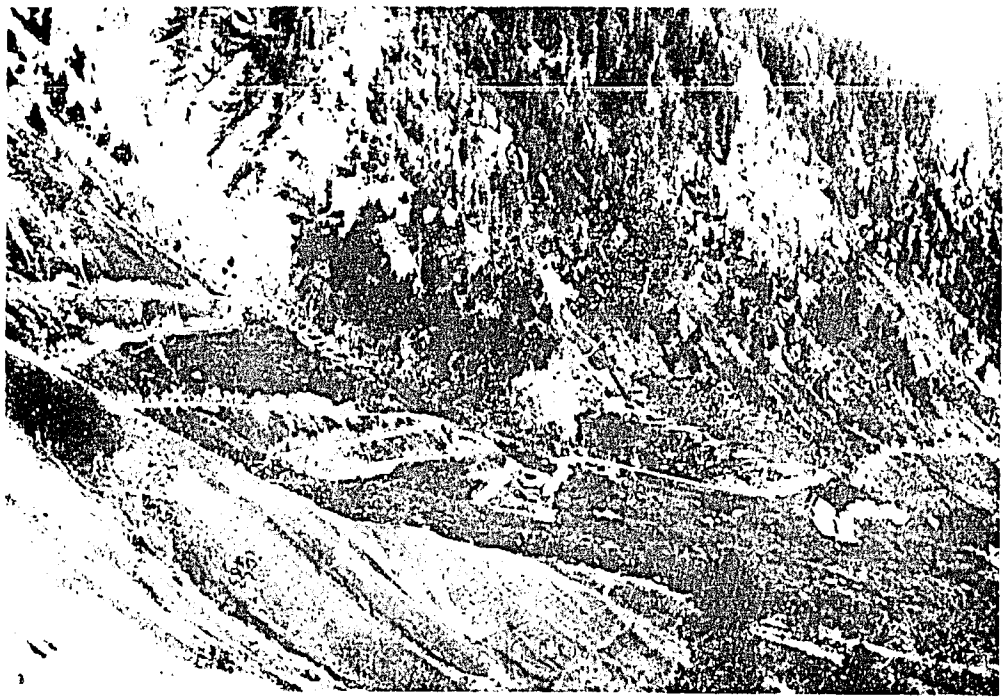


8. South Portal of the existing tunnel

9. Area in front and east of the South Portal



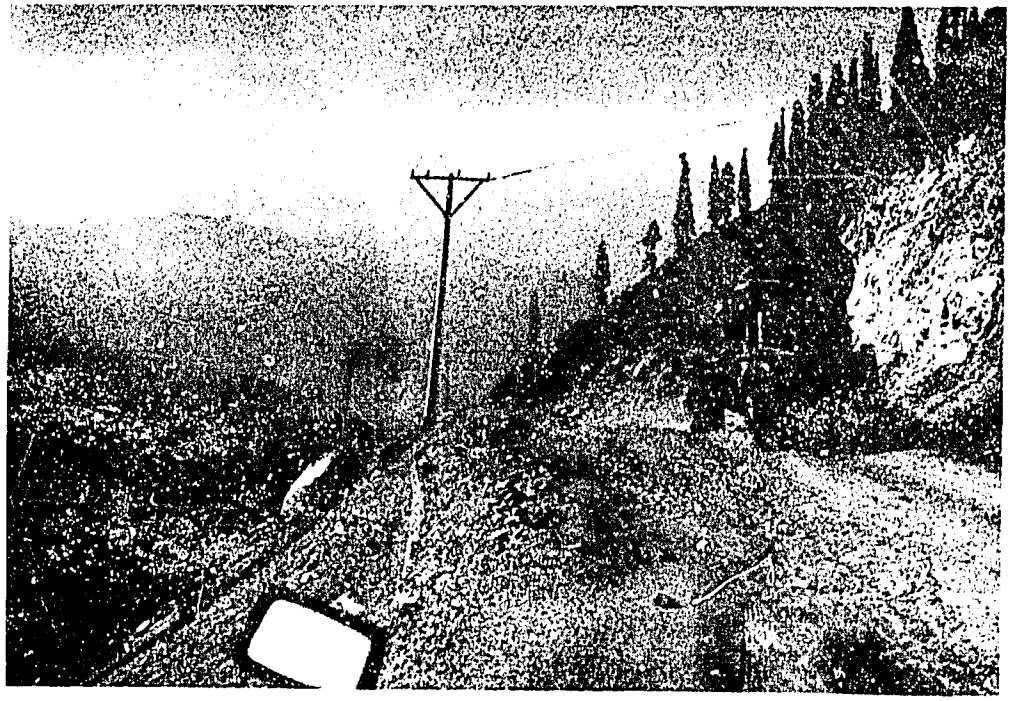
10. Road at KM 91



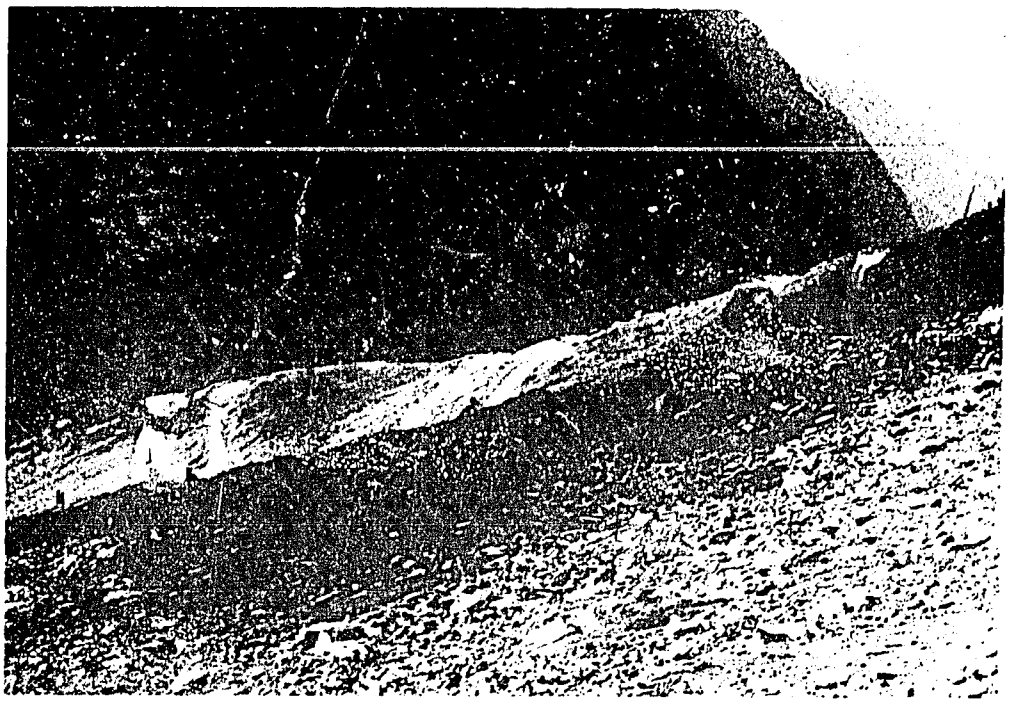
11. Looking southeast (toward Dir) from KM 91

12 Looking northwest (toward Lowari Pass) from KM 91

13. Road at KM 35

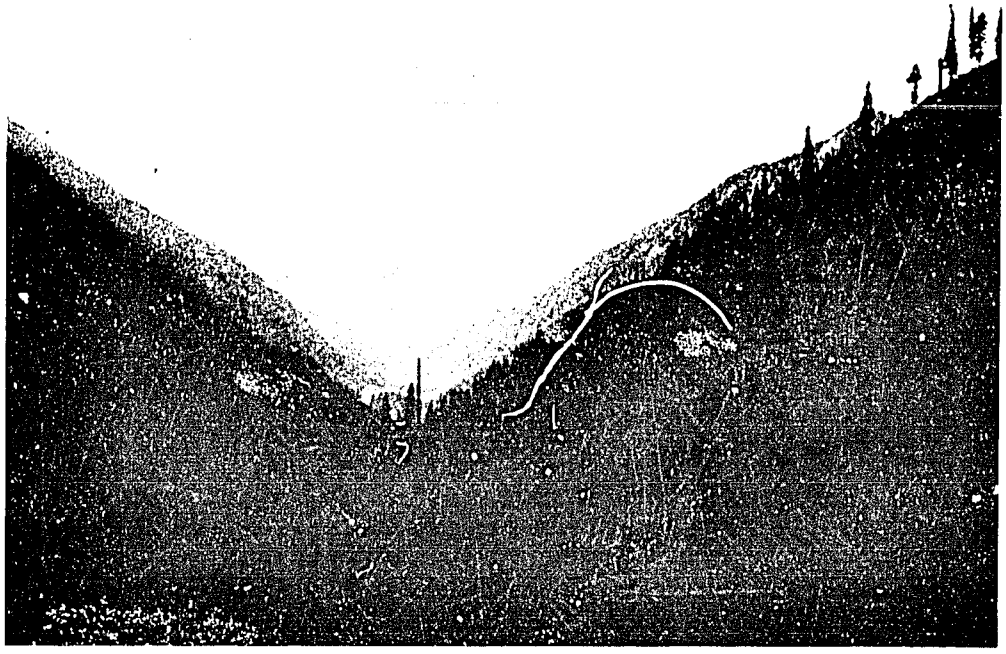


14. Truck approaching Lowari Pass from the north

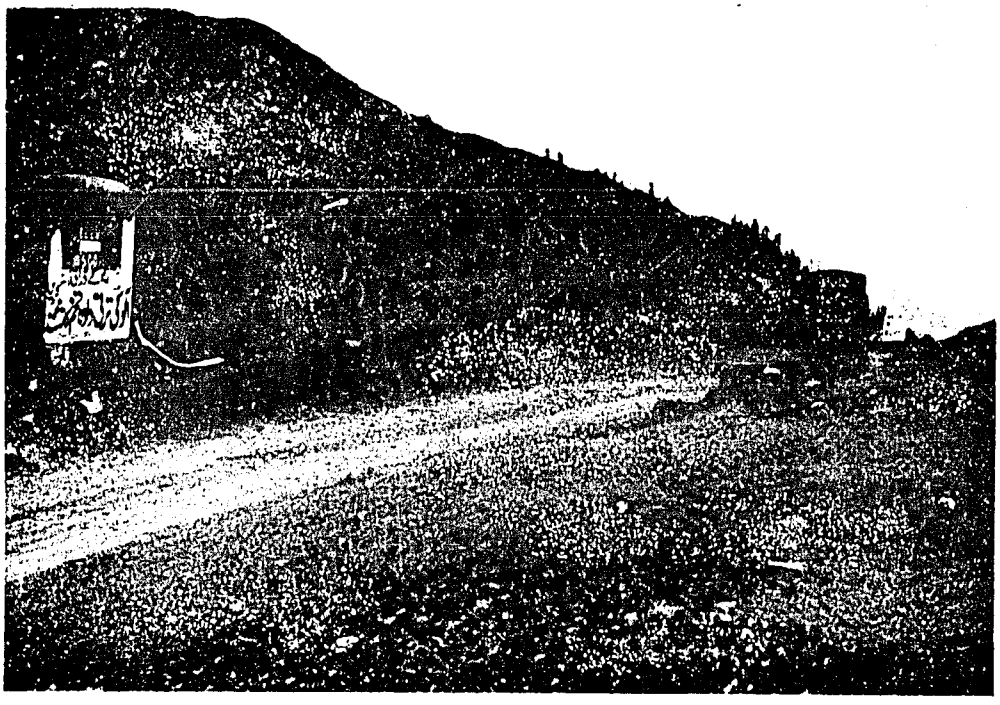


15. Hairpin curves north of Lowari Pass

16. Slide area abouth 500 m. north of Lowari Pass

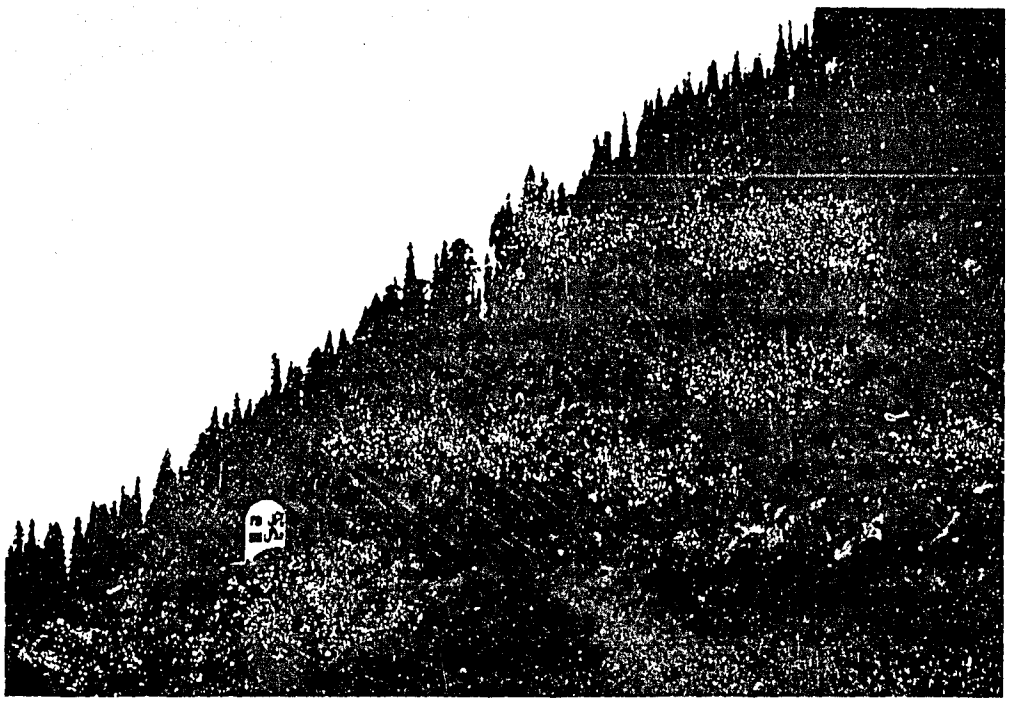


17. Looking southeast from about KM 81



18. Lowari Pass, looking south, at KM 82

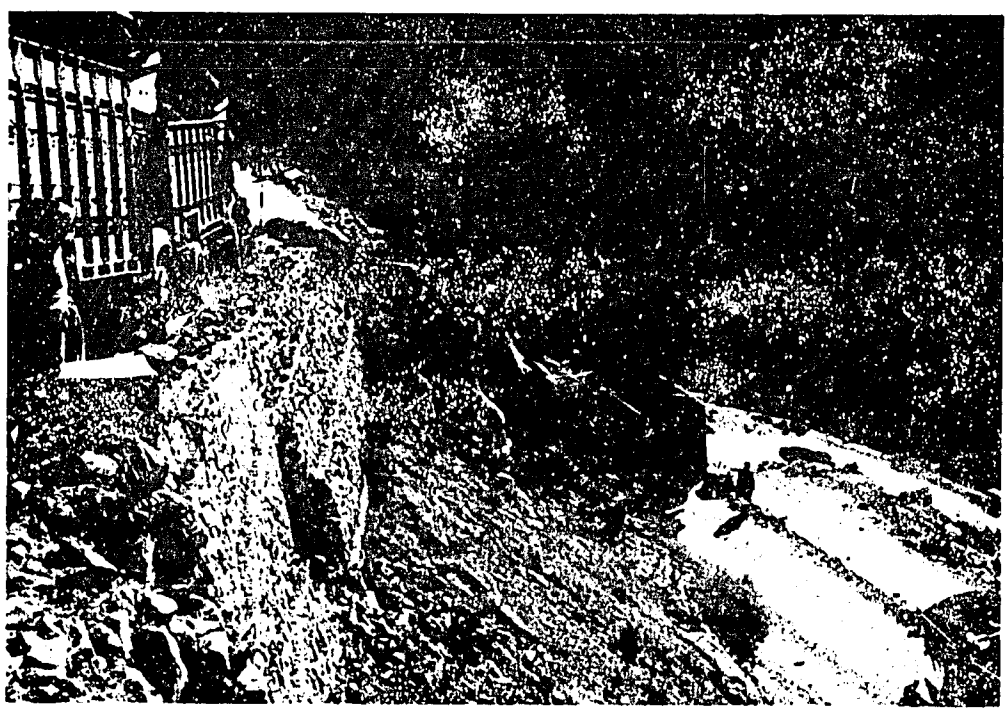
19. First hairpin curve north of Lowari Pass



20. Road at KM 79

21. Road near KM 75

22. Trucks on hairpin curves above the North Portal area

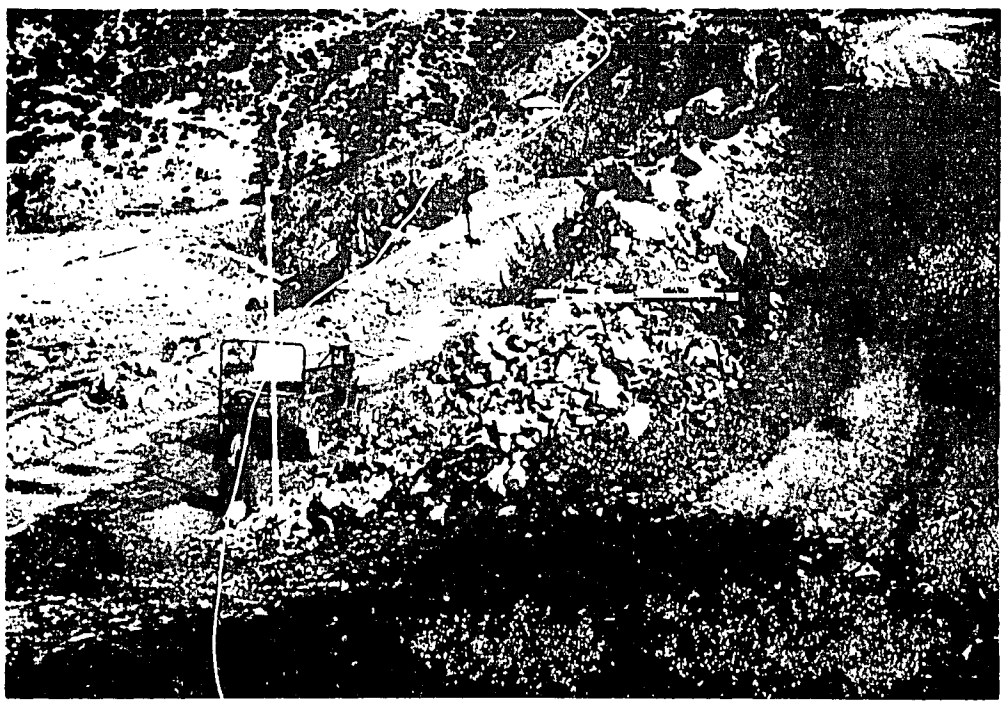


23 Trucks on hairpin curves above the North Portal area

24. Hairpin curve near KM 76

25. Road at KM 76

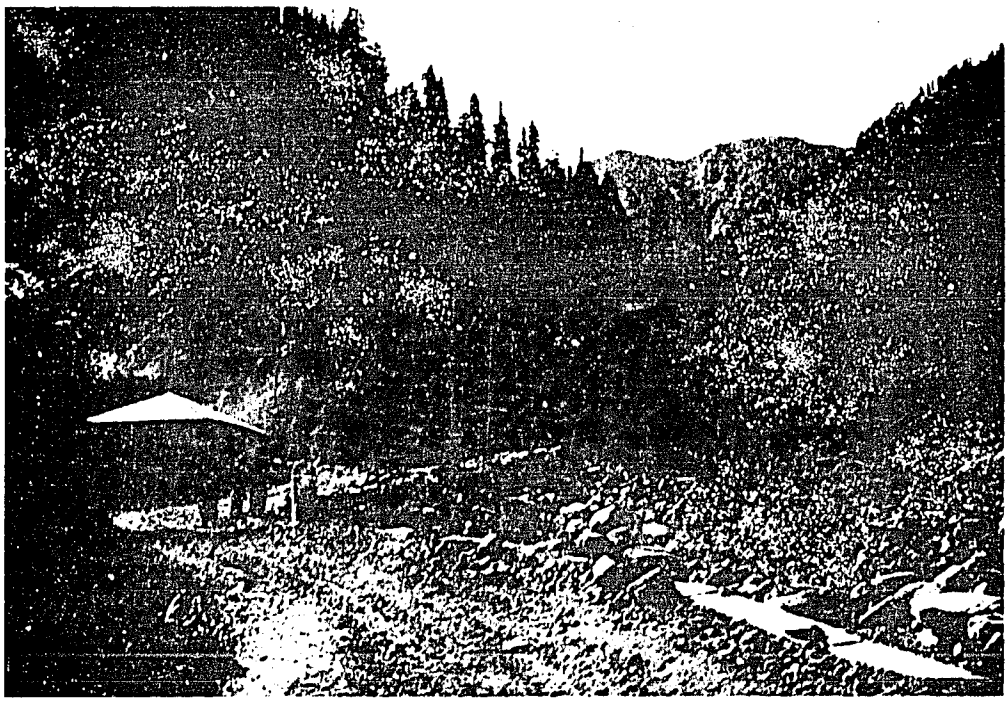
26. Hairpin curve measurement near KM 74 + 500



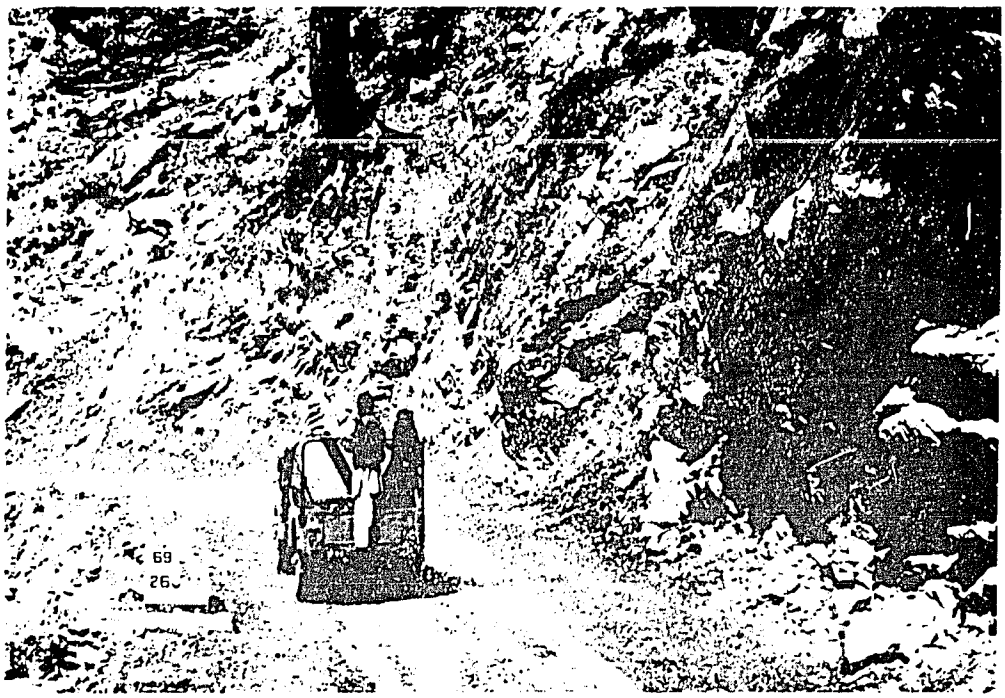
27. Hairpin curve No. 5 from Check Point

28. View of the road near the Check Point, looking north

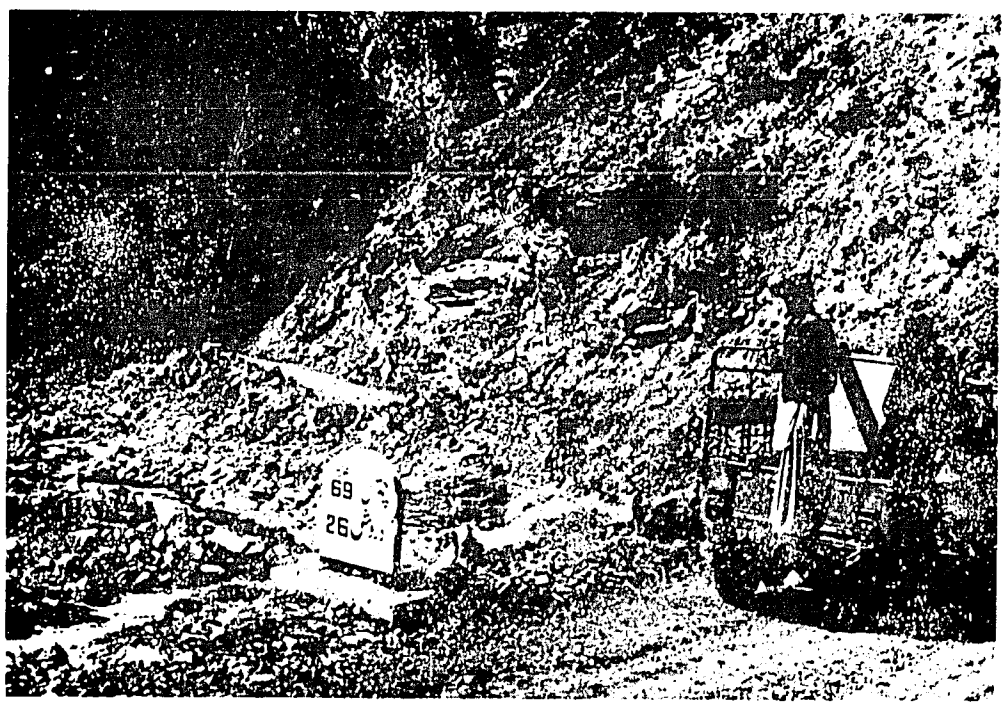
29. Road at KM 70



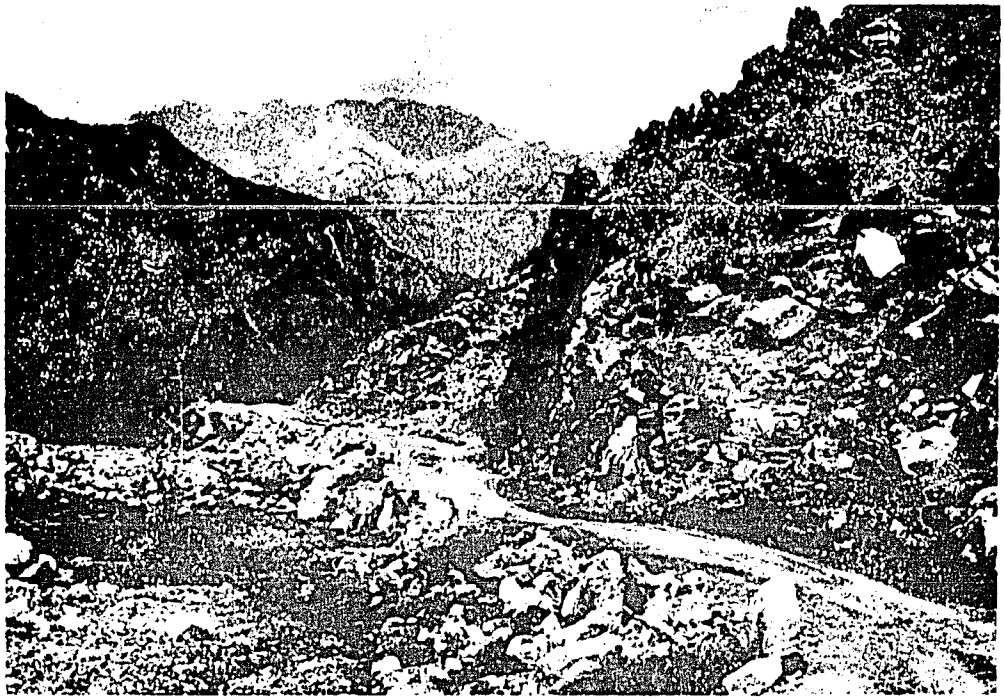
30. Road at Check Point (North Portal area), KM 69



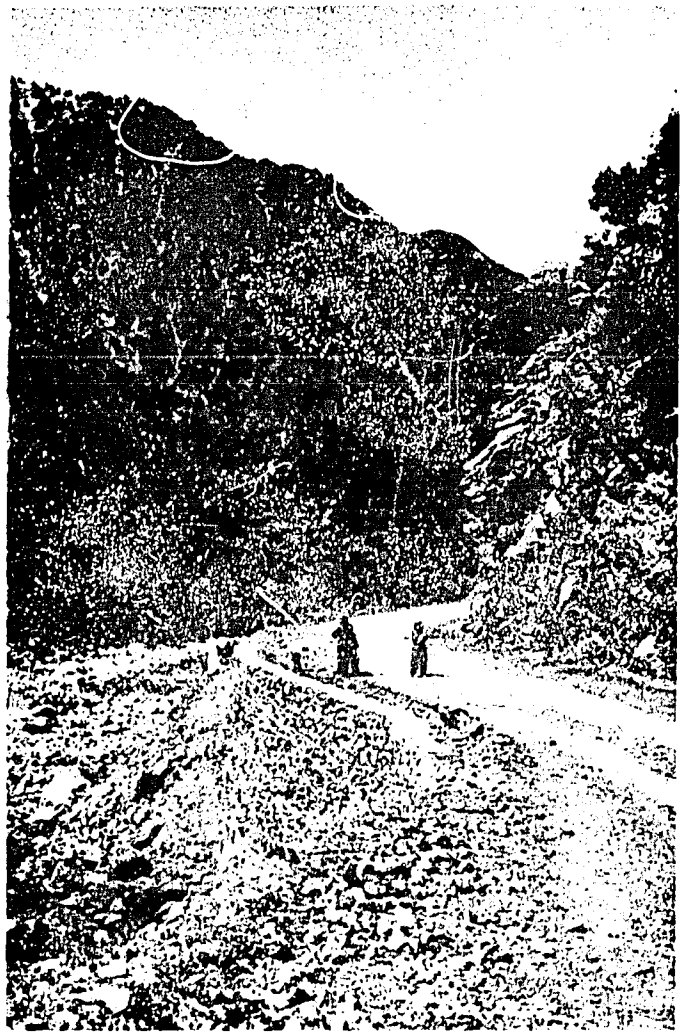
31. Road at Check Point, looking north



32. Road at Check Point, looking northwest



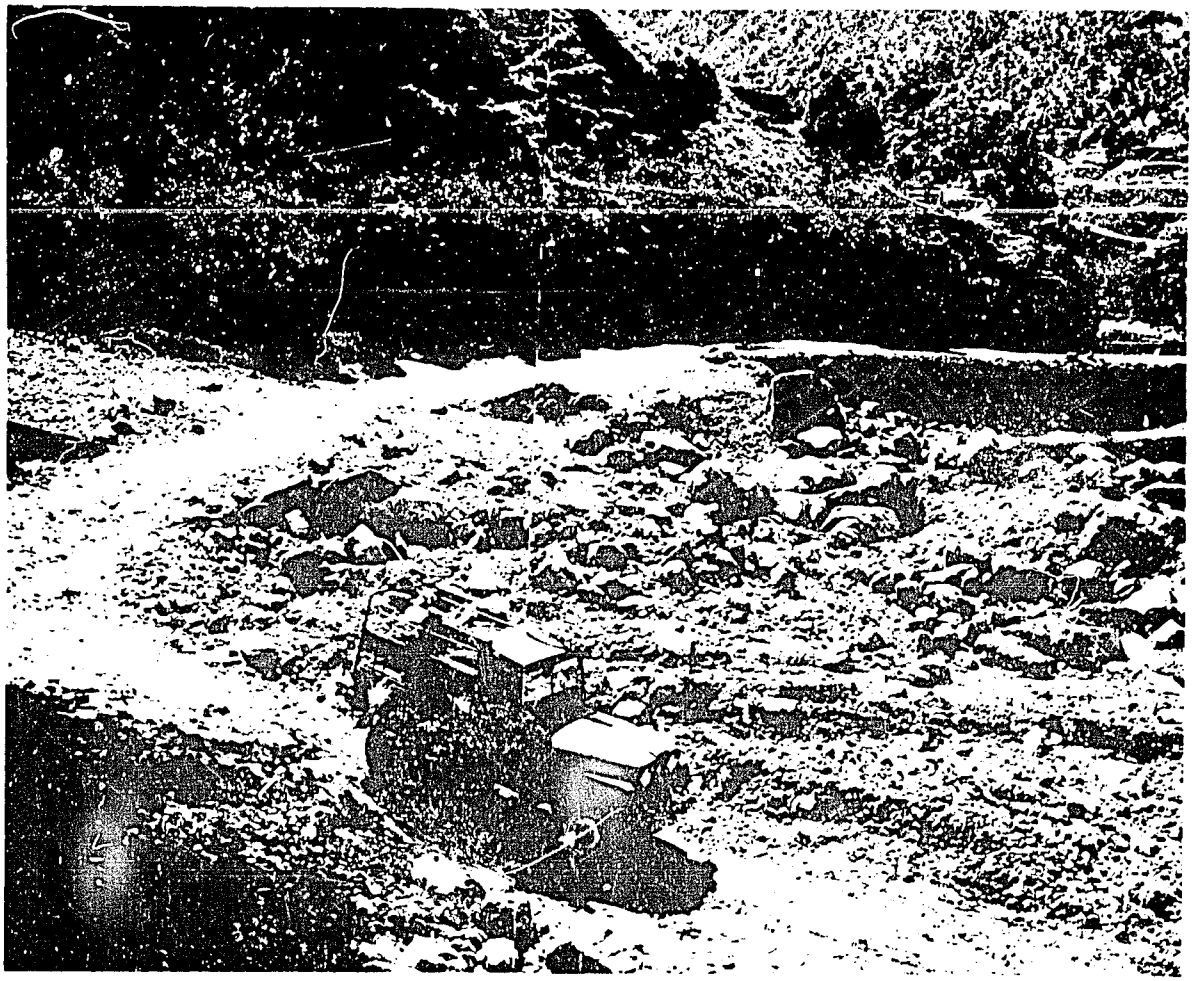
33. Road at KM 67



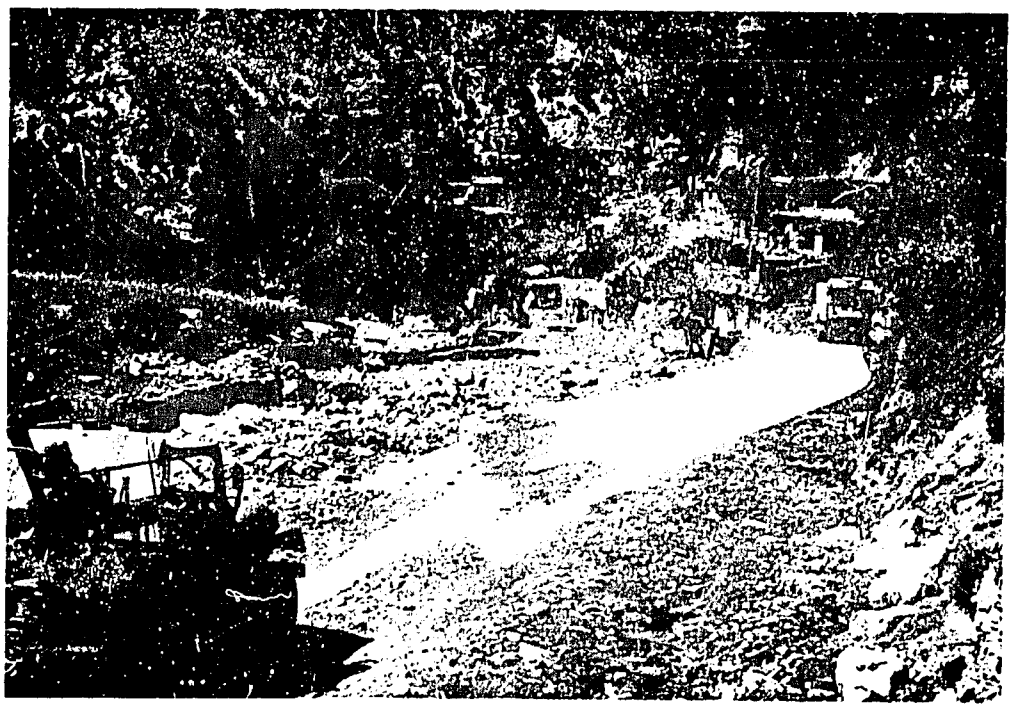
34. Road at KM 66

35. Road at KM 64

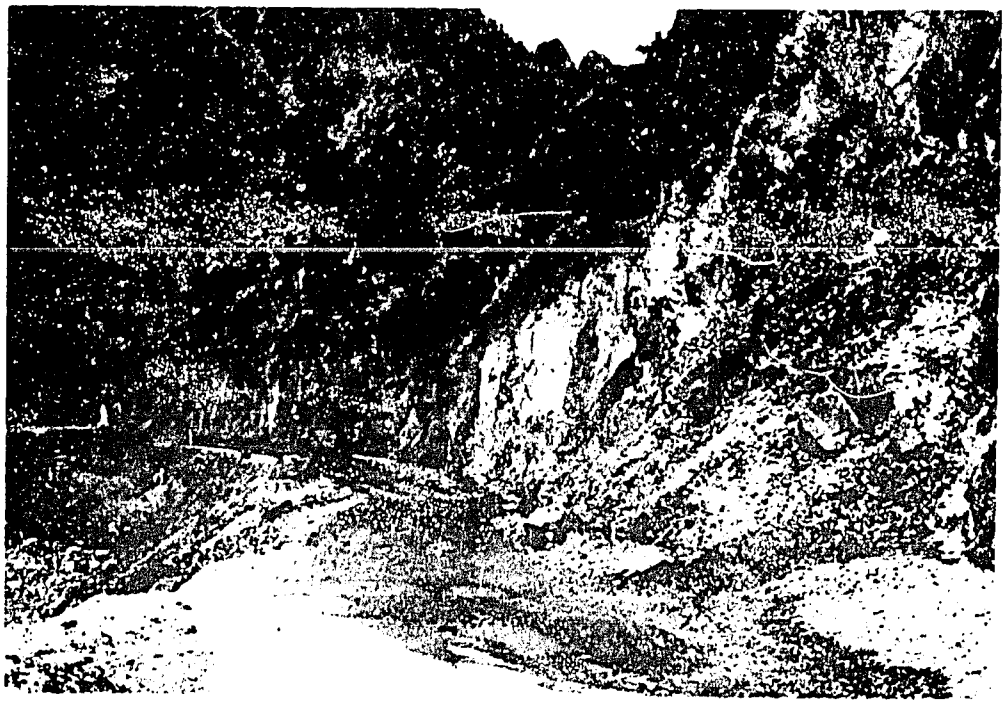
36. Boulders embedded in soft clay,
KM 66 + 500 ±



37. Crossing just before entering Ashret (KM 63)



38. Pavea road begins again, entering Ashret



39. Road damage near KM 61 + 500 ±

40. Road between Drosh and Chitral

Appendix I
Report on 1957 Survey Mission
Dir - Chitral All Weather Road Connection

The following pages represent the narrative part of a report entitled "DIR-CHITRAL ALL-weather Road Connection - Report on 1957 Survey Mission (1st Phase)" by Etablissements Billiard and Sainrapt & Brice, Engineers and Contractors. The report was re-typed verbatim to improve legibility. As certain words were illegible in the original copy obtained, there are blanks existing in this reproduction. Photographs, engineering sketches and tunnel sections were not reproduced, because they were not relevant in the context of this report.

CHAPTER 1 - PREAMBLE

I.1.0 In January 1957, we were requested to take in hand the survey of a project aiming at a permanent connection between DIR and CHITRAL States.

During a short mission the writer observed the snow conditions in the first days of February 1957, along the line DIR - ASHRET, over the Lowari Pass. Then a survey mission was promptly decided and although the agreement between PIDC and our firm was signed on May 21st 1957, the first members of the mission arrived in Pakistan on May 1st 1957, and started the field works after a week.

The mission, the work of which is presented under this report, worked throughout the summer until October 1957 on the spot and until December in Karachi. The topographical survey has been carried out by seven experts of two joint survey companies under the direction of Mr. MEMIER who came twice in Pakistan. They were supervised and coordinated by Civil Engineers of our firm.

In the meantime the French Government offered to PIDC the advices of one of the best road experts, Mr. BAUDET, Chief Engineer, who came in Pakistan for a mission of three weeks. Guided by our officers, at PIDC's request, Mr. Baudet surveyed the area, witnessed the field and drawing work already completed and after mutual exchanges of views, wrote a report where he clearly stresses the various aspects of the road and tunnel problem, in the manner of a Civil Servant advising his own Government.

We did not hesitate:

- To undertake additional survey works in order to actualize some of Mr. Baudet's assumptions.

258

- To take into account the suggestions of his report in examining them from the contractor's point of view and implementing them with figures and observations which we gathered during six months of presence in DIR and CHITRAL.

We think to follow, in this manner, the wishes of PIDC and are sure that this cooperation, brought about by the circumstances, will serve better the interests of Pakistan.

I.1.1 Evolution of the Survey Works

Initially, when the agreement for the survey works was prepared, the idea was to realize the all weather connection by a long tunnel and a road keeping with the existing lay-out except for a few diversions.

From the first month of observations until August and as when the results of the topographical survey appeared, the ideas of the engineers working on the survey have appeared, the ideas of the engineers working on the survey have undergone a continuous evolution. Similarly the survey works were gradually adapted to this evolution, so that this report and the map and drawing attached are finally worked out in order to allow:

a. The Authorities to take their decisions, based on concrete facts and figures about four different layouts of tunnel, their section and specifications and to make their choice between a new road or an amendment of the existing track.

b. The next and final surveys to be facilitated, whatever is the alternative proposal selected.

CHAPTER 2

THE WORKS OF THE MISSION

I.2.0 The field works started in May 1957 and both observations and preliminary drawing works were carried out in DIR and CHITRAL until October 1957, then the rest of the drawing works was completed on December 15 the in Karachi. Till that date the results of the survey were examined and interpreted for draughting the present report.

I.2.1 The Mission in Tribal Area

The installation and the work in DIR and CHITRAL has not been always easy. The kind help of the secretariate to Tribal Affairs, the Political Agent and the APOs have been greatly appreciated, as well as the hospitality of the Hawab of DIR and of the Army Officers in CHITRAL.

In spite of all this good will, there were still a number of difficulties to struggle with, in order to keep up with the intended progress of the survey works. We had to open the road from DIR to GUJAR POST in May when large pieces of rock had fallen on the track and powerful torrents flew across the road. Then the hills were still snowcovered and the triangulation on the summits started in the mountaineering style. In Summer the storms often cut the acrobatic mule track descending from LOWARI Pass to ASHRET. In the recruitment and training of local helpers, in the supplies of wood and other materials in the transport difficulties in the safety arrangements..., many picturesque incidents took place which constitute a profitable experience for the future planning of the works.

The next pages of photographs show some aspects of the life and work of the missions.

A base camp was set up close to DIR with drawing facilities stacking and parking space. During the field work teams also put up at TIMURGARA, GUJAR Post and ZIARAT. Jeeps and trucks ensured the supplies of fuel and food, as well as the transports of personnel along the 120 miles of the surveyed area.

Under these circumstances, the progress of the ___ work was kept at a high level of efficiency, thanks to the dynamism of the young team of surveyors and to the rather heavy equipment which we placed with the _____.

360

I.2.2 Surveys

A diagram (in the set of drawings) shows the chronological development of the observations and computation works. _____ executed are the following:

_____ over the LOWARI PASS:

With measures of two bases, distant of 8 miles, -Traverse map of the existing road;

- CHAKDARA to LOWARI Village
- MIRKHANI to highest tunnel entrance on the northern face

Longitudinal profiles of the same road and the observations of the lateral slope and nature of grounds.

Contour lines map in the vicinity of possible tunnel entrances and of valleys likely to be crossed by the lay-out of the tunnels.

Longitudinal profile and lay-out of the various tunnel projects.

Design of two main diversions of road

- between BANDAGAI and TIMURGARA,
- near DARORA.

It is to be noted that this extent of survey work amounts to nearly the double of what was originally intended when we contracted for it.

I.2.3 Content of the Report

All the maps and drawings corresponding to the above works have been blue printed for the original of the report. The list of same is attached. All the tracings are handed over with the report.

This report gives technical and economical considerations about the road and tunnel (s) in Chapter 3 and 4. Chapter 5 describes the amount of survey works necessitated for estimates when the main decisions will be arrived at, and also our opinion and advices for the future planning of works.

Our personal conclusion is given at the end whereas we are showing everywhere the various possibilities, examined in the most objective way.

261

CHAPTER 3 - ROAD

I.3.0 Generalities

Before entering into details we wish to emphasize the following factors of appreciation:

The problem of road is as important as that of the tunnel.

The design of the road should be homogenous from end to end and have characteristics which can stand for the long run; modifications, in lay-out for example, are sometimes practically impossible to execute without remodeling the entire road.

- A good design saves money in maintenance and cost of transport.

I.3.1 Description of the Existing Road and Mule Track

We have preferred a selection of a few photographs, which give a more concrete ideal of the spots encountered. We have based our survey on CHAKDARA to MIRKHANI route, but the section MIRKHANI DAMNER NISSAR does not involve different problems and can be considered as similar to section "DARORA to DIR", for sake of rough estimation.

I.3.2 Lay-out and Specifications

The first idea was to amend the existing track by widening the road in order to allow small trucks to run both ways. The specifications were to be of a very cheap type.

While determining the services that the road was to provide and as and when the survey of the existing road was progressing, our opinion changed. We progressively brought to light that, amending the road as it stands would be uneasy and finally rather costly, would not serve the purposes of the traffic, would be a temporary work to be completely remodeled in a few years. We wish to stress below a few points of view which we have figured out in order to help the authorities in appreciating the economic consequences of the decisions they will have to take about this project.

We successively examine the purposes of the roads, the specifications, and qualities required and the economic aspects as regards the cost of the future traffic and the construction of the road.

I.3.2.1 Purposes of the road connection DIR - CHITRAL

The development of the traffic will be of two natures:

- Industrial: transport of iron ore as contemplated (1.000 T. per day) and probably of other ores as recently discovered; transport of timber and other products from CHITRAL notwithstanding supply of goods to DIR and CHITRAL.

- Touristic and individual.

When traffic of persons and tourists will take place it is to be noted that this development will actually take large proportions only if the road allows a trip up and down in a day time (for example CHITRAL to MARDAN and back or DARGAI to DAMNER NISSAR and back), a safe driving in any weather not reserved to exceptionally skilled drivers, a reasonable cost of transport of a ton of goods.

A half-way solution of the road problem would lead to a dead-lock in this development.

A few consequences are:

a. The section of road CHAKDARA-DIR is as important as that of DIR - ASHRET in the economy of a traffic going to CHITRAL State; for example in a trip "CHAKDARA to DROSH" one can roughly drive a light truck as follows:

	Miles	Existing Road		Existing road amended		Well designed road	
		Speed	Time	Speed	Time	Speed	Time
CHAKDARA to DARORA	35	15 -	2 h.10	25 -	1 h.25	40 -	55 m.
DAROKA to KULANDAI	43	10 -	4 h.20	18 -	2 h.25	30 -	1 h.
KOLANDAI to ASHRET	25	impossible		12 -	2 h.	20 -	1 h.
ASHRET to DROSH	15			15 -	1 hr.	25 -	35
	118			Nearly 8 h. without stop		No much more than 4 h.	

These figures are tentative and relate fair weather. for the existing road, in jeep, "CHAKDARA - DROSH" can hardly be covered in a day time in perfect weather (about 12 hours of hard driving), if the road is not interrupted by rocks or slides.

b. The road should accommodate a quick traffic mostly composed of heavy trucks, therefore the local traffic with bullock - carts, hand carriages, mules, etc. which serves

363

presently the purposes of land cultivation and short distance transports would be of a great inconvenience for the new road, if it were to be on the same lay out. In about 3/4 of its total length, the existing road serves the cultivated land. Often runs along the road a canal which, coming from the river, irrigates the fields. That is why the road is frequently at the limit of the cultivated land, just above (see photograph No. 1 of page XXIII). Another remark is that the steel -lined wheels of the animal vehicles produce a heavy wear and tear of a road, and request a much more costly pavement.

As a conclusion it is logical either to keep with the existing lay out with dangers of obstruction of traffic, small liberty in the lay out (because of the canals) and a costly pavement or to select a completely different lay out connected to the old one, in a _____"

c. Another aspect, relating also to the traffic is the crossing of the villages. Everybody knows the tendency of the shopkeepers to invade progressively the roadway. This is a distance of one or two furlongs away from the villages, and constructions of shops to be allowed on one side only and at a certain distance of the road axis. The writer is convinced that even with these precautions there will still be difficulties in applying a policy. In any case, crossing the villages in their single street, as it presently stands, would on this account only, increase the trip CHAKDARA ASHRET by one hour or more.

d. For the first years, an amendment of the road on its present layout would also be inconvenient for it will result in:

- Partial interruption of the traffic during the construction instead of developing it progressively.

- Slow and more costly execution of the excavation as well as of the pavement which should be done in two parts or with special protections.

- Difficulty for starting the tunnel construction and costly interruptions during its execution.

On the contrary a completely new road would call for the existing road to be quickly amended and completed for the part LOWARI pass to ZIARAT by the left bank of the northern high valley. This would transform the track, at a reasonable cost, in a good service - road for the rest of the construction. The advantages are the following:

- Such amendments done specifically for a service road, would be quick to plan and execute, therefore the tunnel construction could be started shortly and not hampered by lack of supplies.

- Traffic would be still much amended for the outsiders, who would take advantage of the contractor maintaining the service road during the construction period. Traffic would therefore start developing and serve the immediate requirements of mine surveys and others in CHITRAL state.

- The new road construction would not be made in a hurry. Well planned and executed by parts thanks to many short access from the service road, this roadway construction could be achieved smoothly and in the best conditions of economy and financing, so to be finished about at the same date as the opening of the tunnel to traffic.

I.3.2.2 Specifications of the road drainage and protection

The report of Mr. BAUDET is clear about the specifications of the road; some preliminary decisions need to be taken before estimating the roadworks, even if the layout was perfectly known. We only wish to point out a few aspects of the problem from the construction point of view and help by some typical photographs with the visualization of their importance.

a. Roadway Course

The widths recommended by Mr. BAUDET look quite satisfactory. As for the specifications, a roadway is generally composed of a foundation course laid on the surface of the formation (as cut in the ground or compacted), then a base course and a surface course.

- The foundation course can be executed by stabilizing the formation with addition of sand or medium size gravels, as suggested by Mr. BAUDET. This is advisable for all the parts of the road in earth and earth mixed with stones where it precisely happens that the quarries for such sand and gravel are available nearby. This process is cheaper than the classical foundation in large packed stones of 6" and the execution is much quicker. But in that case, a thorough investigation of the various coils encountered is to be made in laboratory, in order to determine the correct grades in size of materials to be incorporated in the foundation for a satisfactory compaction. The chapter 31 above shows a number of various soils. Each one is to be analyzed and a proper grade selected for the foundation materials. In the part KOLANDAI to ASHRET, except for a few passages, and in some sections before DIR, road is to be cut in sound rock and the foundation is naturally easy.

- The base course in waterbound macadam seems to be the best, materials can be broken and stacked long before this stage of construction.

- The surface course can be of two types: either bituminous concrete on 2" to 3". This delicate process requires great care in the grade and heating the aggregates: it gives a very strong structure, imprevious and capable of supporting the stress of heavy axles.....or opened (15 to 20% voids) bituminen - coated stone materials laid in a 3" course (which may be compacted lately by the traffic) but which should always be covered by an imprevious wearing course. The first solution requires more equipment especially for heating aggregates but gives long lasting results (the formula has already been satisfactorily carried out by ESTABLISHMENTS BILLIARD in PAKISTAN). The second one is easier but the protection coat is to be replaced as soon as it wears out, for the frost action quickly destroys the other coats.

It is to be noted that, with embankments levelled with the road or even slightly lower (which is practically necessary with small grained foundations) the foundation course should be spread both sides of the pavement on the embankments. It is also advisable to execute the water bound macadam slightly overlapping the embankment and stabilize the remaining portion, this would additionally allow parking on the embankments and sometimes avoid side kerbing to limit the surface course. The figures given by Mr. BAUDET for the quantities of materials are sufficient to visualize the size of the supplies. More precision would be useless when the axle loads and widths are not yet finally decided.

b. Drainage

The evacuation of water or melted snow off the road formation is essential and the next page shows the damages that bad sewers can result in.

- For lateral drainage, in most of the cases the open sewer cut in the ground will be sufficient; a rip-rap lining will be necessary wherever the maintenance is too difficult and/or the erosion is high (soft soil or high declivities) and also in the vicinity of transversal drains.

- For transversal drainage, pipes are recommended, for packed stone drains are likely to fill up and be obstructed, whereas pipes are easily maintained; packed stone drains can be used in flat parts, in large quantities in order to avoid a difference of level of water on both

- 366

sides of the road resulting in a percolation of water through the formation and thus in washing out of its fine particles. This last phenomenon is extremely frequent in existing roads all over PAKISTAN where shrinkage of the formation can be so explained.

Especially with a fine grained foundation course, drainage must be capable of disposing the water off the foundation when the heavy rains of summer occur and large snow melting in spring. Sections of sewer spacing of transversal pipes and their sizes cannot be selected before a very thorough survey is made of the climatic conditions and the geometric characteristics of the ground along the finally selected road.

c. Protection

There are roughly three types of protection to be taken care of:

- Protection against the rivers

When the road will approach the rivers or run along them, the formation shall be protected. The great rise in level and the speed of water at the time of heavy rains or spring snow melting justifies a strong protection. We have observed parts of retaining walls completely torn out by the torrent near ZIARAT (in 7 different places after a summer storm). Right from CHAKDARA the road embankment shall be protected, as shown on the photograph of the next page, during the long crossings of wide river beds encountered in flat valley up to BANDAGAT.

- Protection against land slides or rock falls

Along the steep slopes of the hills, especially between KOLANDAI and GUJAR POST AND around ZIARAT, there are dangers of such slides coming down on the roadway. Photographs on pages XIV & XV show heavy rocks fallen down along the mountain; such pieces can have a great destructive action; trees and earth obstruct the road and can endanger the vehicles. There are difficulties but still there is no ground for a serious worry. In these cases trees are growing on the hill and the face of the mountain can be surveyed, natural drainage amended to prevent erosion, and ground fixed, eventually thanks to young plantations (for the long run), in the most delicate parts. Naturally the road cross section shall take this difficulty into account. Sometimes a road practically built outside the natural profile of the hill,

would be the answer. This is costly in retaining walls but the stability of the ground is not affected in this manner, for it can be observed that erosion starts from the road excavation to progressively climb the face of the hill and produce slides higher and higher.

Protection against snow

The real problem involved in the selection of the altitude of the tunnel is not on account of the heights of snow-falls considered as much. Snow sweeping equipment is quite able to clear the road by continuous running during show falls even for bigger falls than those encountered. The danger is the wind, blowing in open spaces. If there is not much danger up to KULANDAI and from BARADUAM, the formation of snowdrift is likely to occur especially in the vicinity of LOWARI village and above ZIARAT (where the high military camp is set up in summer) about the exit of the projected high tunnel.

In a snowdrift the snow is packed on important heights and that in a very short time; additionally the density of the snow increase (such differences as from 3 to 44 lbs per cft have been observed, taking also into account melt and frost action).

To avoid the snow-drifts to occur on the road, wooden or concrete lattice alls can be erected at a certain distance of the road about 15 times the height of the wall, to force the snowdrift to settle outside the road. But steep slopes often render the problem intricate and also this solution is sometimes temporary when the snow-drift grows up and endangers the road on a bigger height. From his own experience, the writer thinks that this aspect must be one of the factors for the selection of the lay-out of the road in such sections where strong winds of a well known direction occur; the road cross section, in that case, to be outside the ground profile rather than embedded, for the general action of the wind is to remodel with snow the original shape of the ground disturbed by the road excavation.

Anyway these protections are a problem which has been studied in FRANCE and the question is only to select the low cost permanent protective structures consistent with the snow/sweeping equipments to be place on the road and some of those are very powerful.

Avalanches also have been the subject of long theoritical and practical studies. Textile nets set up along the dangerous face of the hill, avoid the formation of avalanches. In the most exposed portions of road, especially at the crossing of deep ravines (see photographs 3 of page XV ___), the

roadway can be covered by a R.R.C. shed. This is costly, but safe. Beforehand, the writer thinks that protection on lengths of 100 to 200 feets, even shorter for such expected avalanche can be concentrated in a narrow channel by well placed pieces of wall.

I.3.2.3 Bridges, culverts, fords

Next pages of photographs show the various types of river and torrents to be crossed by the road. The importance of those permanent structures has been stressed by Mr. BAUDET whose statistics, cited for FRANCE, show that half the cost of the road is spent on them.

Whatever will be the final lay-out of a new road, it will cross the same rivers, with smaller spans if this new lay out is, as planned, slightly higher above the main valley in many cases. We have noted on the existing road, between CHAKDARA and LOWARI village:

5 large span bridges,
33 small bridges.

But it will be necessary to provide, for the same section of road:

8 large span bridges,
193 small bridges or culverts.

We are quite of the opinion of Mr. Baudet that masonry work shall be used as far as possible, but this type of construction still is long to execute, therefore requires a heavy cost of supervision to avoid weaknesses in the construction of arches. We would recommand:

8 large span bridges in reinforced concrete structure,

about 60 average size bridges in masonry,

130 culverts with transversal concrete pipes laid and covered by proper materials.

Those pipes can also be poured in "situ" using pneumatic rubber shuttering and a mobile plant along the road; that gives a large output.

The necessity of planning all the bridges of the first two types outside the lay out of the existing road to avoid permanent interruption of traffic also pleads for a completely new lay-out.

The cost of the big bridges can be reduced in constructing them single way in a first phase of work with provisions in design and foundations for the second half to be

constructed later on. Special parking arrangements and regulations for traffic are then to be foreseen.

I.3.3 Cost of Transport for Various Lay-outs

It is obvious that a road linking two points and with frequent ups and downs, is not economical as regards the transport costs. Moreover steep slopes are difficult and sometimes impossible to be run over by trucks; at least the greater is the slope, the heavier the cost of transport per mile.

Mr. BAUDET'S report gives the results of recent studies in FRANCE. We will apply them to the survey executed and figure out the respective economy of various road lay-outs in the next paragraphs.

I.3.3.1 Aggregate difference of level

This first figure is self explanatory for the existing road. Namely, for the section CHAKDARA to DIR where the general slope is low, the existing lay-out of road shows unnecessary ups and downs.

In Appendix I this aggregate difference of level is fully computed. It shows that:

- Going from CHAKDARA to DIR, a vehicle climbs a total height of ..... 2,092 meters (6,850 ft) while the difference in altitude between DIR and CHAKDARA is only: 1,401 -682 = 719 meters (2,360 ft).

This means the vehicle is to ascent a total height three times bigger than the difference of level between CHAKDARA to DIR, viz. three times more than if the road was ascending gradually from end to end. Moreover, when the vehicle runs down from DIR to CHAKDARA, it ascents a total height of 6,850 -2,360 = 3,490 ft (i.e. twice the difference of level in the opposite direction) instead of descending smoothly all the way.

Naturally the perfection where ____ = difference of level, is never reached even in a well designed road. There are contingencies such as connecting towns, crossing rivers at definite points, running over small passes, etc. However when we started, during the survey works, realizing such figures as those shown above, one can imagine that we immediately turned our mind to a completely different lay-out of road, since a mere amendment of the existing one would never rub out such adverse proportions.

I.3.2.2 Equivalent length

The value of the aggregate difference of level ____ gives a preliminary idea. If one wants to go further and analyse the economy of a profile of road, he should refer to the

270

equivalent length, i.e. the flat length which costs the same for transport purposes than a given profile with definite slopes for a given type of vehicle.

We have taken below a few typical examples which we have figured out in order to illustrate better the importance of this factor, in the case of a road connecting two points with a small difference of level (a), and in the case of a road with a big general slope (b).

a. Road with small general slope

This is roughly the case between CHAKDARA and DIR. We have computed the values of the equivalent length of the existing road for a 10 tons truck in two typical sections of road (please refer to Appendix II).

- One is the section BANDAGAI to KONGHI (profile No. 4) where we have studied a diversion (please refer to drawing "Tentative diversion").

- The other is the section corresponding to profile No. 9 along the PENJKORA river, between WARI and JAGHABANG.

In the first case, profile No. 4, the diversion along the river (instead of climbing the pass) saves about 30% of the equivalent length. Even more, for the equivalent length has been calculated on large ascending sections with a general slope of 4,55% for example, whereas actually partial sections 5 6, 8 and 10% are encountered.

In the second case, profile No. 9, the equivalent length is nearly 2.6 times the real distance. in the theoritical case of a road ascending gradually from WARI to JAGHABANG the equivalent length would be only 1.1 times the real distance with a saving of nearly 60% of the cost of transport. Even if, for contingencies in the lay-out, a well designed road reaches only R=1.3 it will still give a saving of 50% on the equivalent length, with 10 tones trucks.

b. Road with high general slope

This is the case for the part DIR to LOWARI village. It is obvious that reducing the slope would reduce the equivalent length, but at the same time the real length of the road is increased since the problem is to connect two points with a great difference of level.

Therefore the problem is to determine for which slope the equivalent length is the smallest along a road connecting two points with a given difference of altitude.

311

We have drawn up the diagram of the next page which shows the best slope for various types of vehicles. In our opinion, the slope of 6% maximum would be the most suitable for the projected traffic along the road.

c. Other factors

Apart from the slope of road, other factors should not be forgotten for sake of estimating the cost of transport on a given road.

The curves, for which the vehicles slow down and are submitted to excentric strains. The road surface preventing from the danger of slipping and the abnormal wear and tear. The visibility at curves and width of road when crossing other vehicles.

All these factors cannot be easily figured out but dictate the rules for the design of road which we have stressed in paragraph 32 above.

I.3.3.3 Real length

We have considered in the above paragraphs the savings expectable from a better profile. Naturally the actual length itself of the road can be also shortened with a relocation of its lay-out. One should not expect too much in this regard. As for the section CHAKDARA to DIR several obstacles might be shortcut. This is the case for a piece __ road situated just after DARORA. We have studied the diversion which eliminates nearly 2 miles of road with only one big bridge (instead of 3 average size bridges). Please refer to the drawing "Tentative Diversion". However in the sections DIR to tunnel and tunnel to ASHRET, the necessity of keeping a slope of 6% maximum would increase the length of road.

Therefore a total saving of 6 miles on the total road CHAKDARA to MIRKHANI is to be considered as an excellent aim.

I.3.4 Cost of Construction of Road

We have often shown in the above paragraphs the advantages of a completely relocated road. Naturally, the savings in the transport costs arising from a well designed profile are to be balanced with the initial extra cost for a construction of a new road compared with an amendment of the existing track.

Taking the statistics given in Mr. BAUDET's report which relate to costs of road in FRANCE, we figure out below the difference in cost, as per proportions.

372

	In wide valleys		In high mountain	
	New Road	Amendment of the existing road.	New Road	Amendment of the existing road.
	20%	10%	20%	10%
drainage	20%	20%	12%	12%
culverts, etc.	50%	50%	60%	60%
	10%	10%	8%	8%
	100%	90%	100%	90%

Remark: The cost of earthwork is the only one to vary. We have arrived at the proportion of this statement in computing the amounts of excavation on cross sections either cut out of virgin land or amended from the average cross-section of the existing track. However this proportion of 50% is too high since the existing road would have to be amended also in longitudinal profile by additional earthwork in order to fill up the gaps and rub out the peaks.

If we take 100% for the cost of a completely new road how much will cost the amendment of the existing one?

In valleys:

(80% on the previous lay-out at 90% = 72%
(20% on a new lay-out at 100% .... = 20%
Say.. 92%

In high mountains:

(40% on the previous lay-out at 90% = 36%
(60% on a new lay-out at 100% ... = 60%
Say.. 96%

Therefore one can see that a decent amendment of the existing lay-out would cost only 7% less than a completely new road.

i.e. 2/3 in valleys at 92% . . . . = 61%
1/3 in mountains at 96% . . . = 32%
93%

This figure should yet be interpreted, in taking also into account the remarks of paragraph _____.

I.3.5 Conclusion of Chapter 3

The savings in transport costs arising from the thorough selection of a good lay-out of the road are likely to depreciate very quickly the initial excess in investment neces-

313

sary for a systematical survey of the best lay-out of a new road together with the difference in cost of construction.

It will not escape the authorities' attention that those savings in transport are to be considered as foreign exchange savings for the main part. A quick estimation, for PAKISTAN, based on the figures given by Mr. BAUDET, shows that for each mile saved in the equivalent length of the projected road, it is to be expected that in 10 years there will be, in the traffic only, a saving of about 14 lakhs of rupees, out of which 10 lakhs in foreign currency.

374

CHAPTER 4 - TUNNELS

The difficulty is to select the proper altitude of the main tunnel and of others, if any; then to select the cross section. Before these decisions, no accurate estimate or planning can be usefully undertaken. Mr. BAUDET's report shows the various factors involved in such a choice. We wish to outline some of them from the construction point of view and also to give an otoh of the extent of the technical problems of tunnelling in the LOWARI hills.

I.4.1 How to Select the Altitude of the Tunnel

We have surveyed 4 alternative lay-outs for the tunnel(s).

We give below as many elements as possible so that the authorities can roughly figure out the various possibilities and appreciate the corresponding technical answers.

I.4.1.1 Technical problems

The problem of tunnel is merely connected to the problem of high roads. The drawing "TUNNEL PROJECT" gives three possible levels for the inlets and outlets of the various intended tunnels. One can see that, below a certain altitude, the length of the tunnels grows very fast for small drops in altitude.

First of all a tunnel mouth cannot be placed anywhere and the lay-out is to follow certain rules:

a. The mouths should be in good rock and in places where the tunnel enters in a steep face of the mountain, in order to obtain quickly a safe cover over the tunnel ceiling.

b. The mouths should also be in places where installations for the work can be easily accommodated and disposal of the spoils managed in the vicinity, to avoid long transportation of spoils. A mouth, right at the bottom of a valley is not suitable.

c. The longitudinal profile of the tunnels should run in good rock and preferable not cross zones where geological sliding surfaces may be encountered. A good precaution is to drill from end to end in the same ____ of hill.

d. The cover (thickness of rock above tunnel level) should remain as high as possible, especially when the tunnel lay-out crosses rivers.

375

e. The slopes of the longitudinal profile should be reasonable and preferable down to the mouths.

All these conditions are not imperative; it is often a matter of cost and one or several may be contradicted, for valid reasons otherwise. Now this shows that a tunnel mouth cannot be selected at any altitude or at any place.

For the southern side, three places for mouths have been located at the following attitudes:

2.160 m (7094 ft)
2.390 m (7849 ft)
2.670 m (8768 ft)

On this southern side the road can be executed as easily to the lowest mouth than to the higher, if we leave for the moment the problem of snow which is examined elsewhere.

The difficulty lies in the northern side, for the valley of the ASHRET is steep and narrow. As a matter of fact both the technical possibility of road construction and the protection against snow lead to select the exit of the tunnel along the ASHRET River, not too high above the river bed. The writer has been surveying the spot in full winter and it is clear that the bottom of the ASHRET valley is particularly protected, as regards snow falls and snow accumulation by wind. In BARADAN at an altitude of 6700 ft. there was no more than 3" of snow after two days of snow storm in the area; on the contrary at the same altitude but on the face of the mountain, let us say half way to the hills, there was large snow accumulation. Another proof is the absence of huts or villages high above the river bed.

Progressing into the problem we have now to place the various possible exits of tunnel not far from ASHRET River with one more condition: not to cross lateral "nallahs". There are two rivers descending to ZIARAT on the right bank of ASHRET River - either the tunnel exit is higher or much below to provide a sufficient cover.

- If it is higher and if the longitudinal slope of the tunnel is to be kept below 2%, the lowest possible tunnel is the alternative No 3. But unfortunately this solution requires a road climbing from ZIARAT to the tunnel exit and the snow problem is not much better than in the case of higher alternative No. 4, while the road construction is very difficult at the same time.

- Then, if one wishes to reduce the dangers of snow, he should start on the northern side from GUJAR POST mouth and go under protection of tunnel up to nearly BARDAN. This is exactly the opinion of army officers having great experience

376

of the area, who later confirmed this conclusion of the writer -but naturally those officers have never seen the possibilities of modern snow sweeping machines. This leads to longitudinal slopes of 5% in the tunnel and to the alternative No 2, the helicoidal tunnel being useful to lower the altitude of the exit, while keeping the mouth in the ASHRET valley (and not high in the hill). Additionally the idea of such a shape, which may seem rather odd, is justified by the multiplicity of attacks, two being grouped together for common installations near BARADAM.

- We have mentioned the long tunnel of 44.350 ft just to strongly disapprove it. There are only two attacks possible at the ends, and the delays in construction would alone eliminate this alternative.

Finally, there are two alternatives to be particularly retained from the construction point of view:

Alternative No 2
Alternative No 4

Disadvantage of alternative No 4 is:

- Road difficult to protect against snow in the last two miles after both mouths. Difficult, naturally but not impossible at all.

Disadvantages of alternative No 2 are:

- Great longitudinal slopes necessitating costly crawler type equipment for drilling and ____ transport of spoils.

- The greatest inconvenience is that there would be one attack on the southern side and three on the northern side, whereas progress in tunnel is possible from a southern attack in winter but practically not on the northern side. The disequilibrium is then on the wrong side.

We have much developed this part of our report for it is important that one should not miss the topographical problems which surprisingly limit the number of possible layouts of tunnels.

We also have spent a lot of time in survey and studies for scrutinizing all the aspects of this essential problem.

37

I.4.1.2 Cost of tunnel related to the length

There are great difficulties to find out from records tunnels of different lengths having the same characteristics otherwise. The question is this:

> Is a long tunnel more costly per running foot that a short one, or of any lower cost?

We have tried to give a rough idea by scrutinizing the various components of the prices which increase or decrease when the length of a tunnel increases. Naturally exact figures would necessitate a huge estimation work. The previous page is a diagram showing the shape of the curve of cost per unit length for various lengths of tunnels. Roughly when a tunnel increases in length (with only two attacks) the time of completion is nearly increased in the same proportion, for the equipment is always selected in view of the maximum progress for a given section. Then the unit cost could be the same. It is nearly true for tunnels longer than 2 miles. Factors vary in opposite directions:

Increase - in cost of transport of spoils, concrete, etc.

- in cost of ventilation, in diameters of pipes for water and compressed air, etc...

Decrease - in depreciating the same installations

- in unit cost for labour whose skillness gets confirmed in higher progress of drilling and shovering.

This last factor is often neutralized by the rise in salaries which necessarily occurs after a few years.

As a conclusion a tunnel of 6 miles is nearly two times more costly than a tunnel of 3 miles and the period of completion is also nearly double.

I.4.2 Choice of a Cross Section

The cross section may accommodate a single traffic or a double lane traffic; on the other hand ventilation apparatus ____ be placed in the section; what are the advantages and the difference in cost of various solutions?

I.4.2.1 Single or double way

Next sketches show cross sections in both the cases. It is surprising to note the small difference in quantities. However the cross sections have not been selected arbitrarily.

The section for ventilation should be nearly the same, in fact we have taken a slightly smaller one for the single way tunnel.

As for the clearance of a large vehicle, a height of 4,m50 (15 feet) is accommodated in the single way tunnel where 16.1/2 feet have been left in the double way traffic for a vehicle using 5 m (17 feet in width) in the center of the pavement. The width of 4.3m (14 feet) in the single lane tunnel is necessitated by military vehicles which can be 3.80 (12 1/2 feet) wide.

I.4.2.2 Position of the ventilation ducts

Next page of sketches shows 3 types of cross sections where ventilation ducts are to be placed.

Type No 1 : is the one we would be inclined to choose.

The main inconvenience is that the concreting of the road slab cannot occur during the drilling phase, this is a minor point.

Type No 2 : is not easy to execute, for the channel should be drilled and lined separately.

There are methods possible for a simultaneous progress; these suppose that the channel for ventilation is bigger than the one likely to be required in our case (25 to 40 sq. ft.)

On the other hand, in bad ground, the cross section is practically the same, just completed in a oval shape in the lower part.

Type No 3 : is much more costly. There are really two attacks with double piping for ventilation, compressed air and water and also two types of equipment. The main advantage is the speed of drilling phase. The small section gallery runs quicker and discovers the types of ground and pockets of water if any, allowing for a better planning of the progress in the main tunnel.

We have not cited the perfectly circular cross sections which are used in soft soils, such as undercrossing or big rivers.

We do not think that there will be decompression of earth and except for a passage in schists near the exit mouth, there might be rather sound rock encountered. Decompression of rock is produced by high covers, generally exceeding 1.500 m (5.000 feet), it is not likely to occur here. Also raise of temperature is probably not to be of any inconvenience.

I.4.2.3 Type 1 alternative cross section

Sketches of the previous page show two alternative cross sections for type No 1. The idea of raising the ceiling is to provide ultimately space enough to fix an horizontal roof. This would constitute a duct for the evacuation of polluted air of the tunnel, in case the traffic becomes very high or the natural ventilation appears to be insufficient under specific climatic conditions on both sides of LOWARI PASS.

I.4.2.4 Variation in cost for a wider tunnel

Taking into account the figures given, for France, by Mr. BAUDET (Mont Blanc Tunnel), one can figure out roughly the difference in proportion.

We have worked the proportions for the various components of price, with slight modifications to take into account our specific case, in the following statement:

	Two Ways Tunnel	One Way Tunnel	
Excavation	50%	Coeff. $\frac{39}{53}$	= 37%
Lining & Roadway	19%	Coeff. $\frac{22}{28}$	= 19%
Mouths	3%	Same	3%
Ventilation	4%	Nearly same	3 1/2%
Miscellaneous	4%	Nearly same	3 1/2%
Contingencies	20%	(at 25% of above)	18%
	100%		80%

This shows that the single lane tunnel would be roughly 20% cheaper than the double lane one.

I.4.3 Specifications and Data

I.4.3.1 Lining in the tunnel

Depending on the ground condition, it may be executed as follows:

- Guniting in sound rock. This is to avoid water dropping in located points of the road and also to protect the rock against corruption by contact with the atmosphere.

- Lining of 0.20 to 0.30 (8" to 12") in case of fault rock or dangers of small rock-falls.

One shall consider that 8" minimum lining means 13" to 17" actual average thickness, although modern technic of closed drilled holes along the border of the section is now used along with half charged explosive cartridge, with better results in cutting to profile.

- Avoid cross section with eventually R.C.C. lining in case of very bad ground.

I.4.3.2 Support in case of bad ground

It is to be particularly studied. The danger is that a temporary wooden support cannot be removed at the time of lining, if the ground is in pressure. The technic of rock-nails to fix the big unstable pieces of rock is also to be contemplated.

I.4.3.3 Designs are to be made for the mouth installations, for the road slab and the shape of the ventilation duct to avoid costly losses of head and blowing the fresh air, for the garages in super-excavation every 1.000 feet of tunnel for example, etc...

I.4.3.4 Duration of the tunnel work for alternative No 4

The diagram of the opposite page shows a tentative schedule of time. It explains why the 2/3 of the longitudinal profile is ascending from the southern mouth.

As a conclusion, we support the opinion of Mr. BAUDET to have rather a short tunnel (Alternative No 4) with good ventilation and double way traffic, than a long single lane tunnel, which might have to be abandoned when the traffic reaches a stage highly expectable altogether. This is also a much cheaper solution for the protection of the highest portions of road (and not their construction which is some a few miles below) and the cost of their maintenance in winter will never be as costly as long tunnels.

CHAPTER 5
DECISIONS AND URGENT WORKS

I.5.1 A work of this magnitude requests generally several years of surveys, studies and estimations before the decisions are taken and the job started.

We are conscious of the urgency of the present project and our aim has always been to save time. Both the advices of Mr.BAUDET and the elements of appreciation which we have, even roughly, tried to stress in this report, are sufficient to allow the authorities to take the main decisions. May we recall that such a position is now reached exactly one year after we have been called upon to participate in the launching of the project.

Moreover we have endeavored to visualize and prepare the future requirements in order to be ready, whatever are the decisions, to undertake the next studies, surveys and works. We remind below the main decisions to be taken and give briefly the list of immediate requirements which could be cumulated in the shortest time possible, should the decisions be taken early enough to have the advantage of the good season of 1958.

I.5.2 Decisions

The essential decisions concern the following points:

a) Location of the tunnel?

One of the four alternatives is to be selected.

b) Double way tunnel, type of ventilation?

c) New road or amendment of the existing one on the same lay-out?

d) Width of the road and generally speaking geometrical data and axle loads of the vehicles to run on the road? (even exceptionally: military convoy or transport of industrial plant).

e) Double way or single way bridges?

I.5.3 Survey and Design

In spite of our efforts to summarise the problems for sake of an earlier decision, we wish to draw the attention on the importance of detailed survey and design. The survey is not only an initial expenditure for a project; it is merely a way to save money in the execution of the work. The deeper goes the detailed design, the greater is the saving in the cost of construction or exploitation sometimes in large proportion

such as for the following example. We have seen in chapter III (paragraph 35) that an economy of one mile in the equivalent length of road saves about 14 lakhs in 10 years on account of smaller expenditures of the traffic. Now, should the principle of a new road be selected, the studies could be more or less developed. It is enough to outline that a well designed road can save easily 5 to 10 miles more (in equivalent length) than another one which results from a less accurate survey and design?

We will successively contemplate:

- technical problems for road and for tunnel,
- climatic and geological problems,
- service road and general installations for the works,
- economical and social problems

I.5.3.1 Technical problems for the road

a) The exact lay-out of the road is to be thoroughly located keeping in mind the following factors:

- economy for the cost of traffic,
- alignments in the vicinity of the existing road,
- favorable lay-out as regards the protection against slides, snowdrift and avalanches,
- alignments avoiding as much as possible irrigation canals and cultivated lands.

It is obvious that taking into account so many factors would lead the survey, if carried out from the ground by classical instruments, to scrutinize a number of various locations of road, therefore to take several years of survey work only.

On the contrary aerial photographs combined with general knowledge of the area would allow this systematical work to be completed within one year.

The aerial photographs, as available at General Survey of PAKISTAN, are not at the proper scale to solve this problem. We have verified by steroscopic instruments that they give an interesting view of the ground conditions but they cannot be used to reproduce contour maps at the proper scale. We have consulted specialists of aerial survey and we arrived at this concrete planning of work:

- Determination of a strip to be at surveyed at low altitude. This determination will be made with the help of aerial photographs available at General Survey of PAKISTAN, of the maps included in this report and of the observations made by the mission on the spot, everything combined together.

- Mission of aerosurvey from two different attitudes with a view to get a general contour map at the scale of 1: 5,000 within a few months and a map at the scale of 1: 2,000 within about one year. It is understood that the canvas laid out all along the road by the mission of 1957, would serve to determine immediately the restitution points for the map at the scale 1: 5,000.

More data can be given on the possible planning of such an aerial survey the possibility of which we have particularly scrutinized in PAKISTAN and in FRANCE, for its importance on the general planning of the work is essential.

b) Surveys at the location of the large bridges when the road alignments are determined. Small scale contour map are then necessary.

c) Analysis in laboratory of foundation soils encountered and of the materials of quarries to result in the specifications of stabilized foundations of the roadway.

d) Designs of bridges and culverts, estimate of quantities of the total road works.

e) Survey and studies of the special protective structures against rivers, slides, rockfalls, snow, etc.

I.5.3.2 <u>Technical problems for the tunnel</u>

a) Geological survey of the hills where the tunnel is to be drilled. Explorations with small section galleries at the projected mouths.

b) Design of ventilation apparatus, including barometric surveys near each mouth (to determine natural ventilation effect), design of the cross section with proper ventilation ducts and loss of head calculations.

c) Design of other elements of the cross section, gutter(s), cable trench, garages, etc.

d) Design of the installations whether permanent for exploitation of tunnel or temporary for the constructional phase.

e) Selection of an homogeneous type of equipment.

I.5.3.3 Climate and geological observations

We have already mentioned the necessity of a geological survey around the tunnel area. This is also valid for the road layout in general with a view to get precise advices about the foundation in certain delicate parts.

Meteorological data in various points along the road are no less necessary for the determination of the discharge through culverts and bridges. It would be a waste of money, to try and design profiles of bridges and sizes of pipes with the rough data now available for very distant points. We could observe that the weather and especially the rainfalls are different in DARORA, in DIR and in GUIJAR-POST, although a few miles distant from each other.

I.5.3.4 Service road

If a new road layout is decided, then the works of amendment of the existing road should start as soon as possible. We are giving in Appendix III the details about nature of soil, transversal slope of natural ground and rivers encountered all along the existing road. This will serve either for the service road or as a basis for a new road placed on the present location. We have even computed for the various natures of ground, the length of road of various transversal slopes. These estimations are not essential at this stage and we have not enclosed them here. They can be got on request. There are three types of works to be carried out for the service road:

a) Amendment of the sections CHAKDARA to LOWARI PASS and ASHRET to MISKHANI (widening, protection, etc.)

b) Remodeling of the section LOWARI PASS to ASHRET with considerable more works since the present layout is often helpless. For the section LOWARI PASS to "high military camp" (about 8.500 ft) the left bank of the "nallah" pouring down from LOWARI PASS, should be utilized as per a new track recently under construction.

c) Reinforcement of the bridges to allow construction equipment to go through and amendment of certain fords where permanent discharges are observed.

Remark: This service road is not to be designed for other purposes than to allow the traffic for serving the work to run safely, if not economically. The cost of such an amendment of the existing track in a service road can be kept reasonably low, while taking into account steady but rather low cost maintenance during the construction period when equipment for works is available nearby.

The service road should also be so constructed as to maintain the traffic _____ over the PASS late in Autumn (1st to 15th December) and to reopen it early in Spring (15th to 30th

385

April) even by bulldozers or manual labour; the danger of avalanches being the only real difficulty.

I.5.3.5 General installations

In order to serve such works as these contemplated in the project, a great number of facilities are to be created in the particularly remote place where the job is to be carried out. Our intention is only to suggest here the magnitude of such installations and the advantages of economy for one who plans those problems in advance.

a) First of all, the installations will necessitate a certain number of offices grouped in subareas and under the control of a head office of the site (probably in DIR). Subareas might be CHAKDARRA, TIMURGARA, DARORA, LOWARI Village, ZIARAT Post and ASHRET. Whereas Drosh and Peshawar would be also equipped for the connections with KARACHI.

Equipment or radios and telephones are to be foreseen early.

b) Electricity and water will have to be provided to both offices and sites of work.

c) Storage of materials and fuel are essential especially on the Northern side which may be cut off in winter and even in summer.

d) At last transports of materials and of personnel and emergency transports are to be organized as well on roads as by air.

The urgency of these installations are so determined for the planning of construction work that we have already thought several of them in detail, namely the electric supply which can be obtained from _____ power with light installations. We are ready to go ahead in this way and at _____ disposal to work out more details.

I.5.4 Economical and Social Problems

We leave apart the administrative problems of land acquisition, property of the wood, policies for having main prices fixed and not opened to bargain, etc., which are not within our scope but which the authorities might think advisable to investigate and settle in order to enable the contractors to discharge normally their duties.

Even supposing those administrative questions settled, there are still a number of problems relating to the labour, the mixing of tribes, the living of european personnel, etc. This is a delicate chapter. Our experience of the area and human observations invite us to place in full light the question of tribes and the expectable human evolution in the area of works.

One has to think about this dilemma: on the one hand large imports of labour from various provinces of PAKISTAN to states like DIR and CHITRAL would create serious disorder, on the other hand employment of tribal labour only from the state where works are carried out, would prove insufficient, would lead to abandonment of the agriculture and create out of Middle Age peasants a temporary class of proletarians, with great disorders on the long run.

We content ourselves with placing an interrogation point. The correct answer is probably a compromise and the matter falls outside the scope of the present report. But we can still suggest the creation of small subcontractors with organized training of their staff on the field of experiments of the installations. No doubt that the "spirit of enterprise" could facilitate the coexistence of various tribes on this large project. Sorts of practical schools for the training on the site of small contractors might also prove beneficial.

CHAPTER 6
CONCLUSION

We have not hesitated to outbreak the limits of the survey mission entrusted to us by our agreement with P I D C which merely concerned topographical works.

We hope P I D C will appreciate that instead of considering our mission as an ordinary contract, we have tried to ----head and contribute in giving shape to the project.

The suggestions and data which are given in this report are the result of observations not restricted to the topographical work, investigations in Pakistan and in France, consultations of specialists, brain and forecast of the civil engineers who have devoted their time and experience to this mission. In doing so we are certain to have worked in the line of cooperation which P I D C expected when they placed their confidence in us.

Our aim in increasing voluntarily the field works by one month and the volume of this report in wide proportions, has been to give the authorities sufficient materials to allow their decisions on the main lines of the project and therefore to gain one year.

We think that the date given by Mr. Baudet: end of 1962 for the completion of the whole project would be possible, should the proper decisions be taken in time.

January 1958 J. M. BERTHELOT

Appendix J
Lowari Rope-Way
Dir-Chitral

(Abdul Rauf Khan)
Superintending Engineer
Development Circle
Peshawar

The following 14 pages represent the narrative part of a paper entitled "LOWARI ROPE-WAY DIR-CHITRAL". They were re-typed to improve legibility. The plan and profile pages were omitted because the quality of copies prohibited reproduction. Within the context of the EA, these pages hold relative insignificance.

Table of Contents

		Page
1.	Summary.	1-5
2.	Introduction.	6
3.	Location.	6
4.	Accessibility.	7
5.	Climate.	8
6.	Natural Resources.	9
7.	Land.	9
8.	Tourism.	10
9.	Problems and Needs.	10
10.	Modern Ropeway Achievements.	13
11.	Location Plan.	
12.	Ropeway Profile.	

381

Summary

It is proposed to construct a rope-way over Lowari Pass to provide an all-weather link between Chitral State and the rest of West Pakistan.

The present road link via Dir is only a fair weather jeepable road, which crosses Lowari Pass, at an elevation of about 10,200 ft. above mean sea level. Portion of the road between Dir and Mirkhani (Chitral State) remains snow bound for about four months or more each year. The road also becomes impassable during rains. On the north side of Lowari Pass the road descends into deep steep and narrow Ashret valley through a large number of hairpin bends which make the road journey hazardous even for jeeps.

Chitral State is believed to be rich in mineral resources which, to a large extent, are still unexplored. Exploitation of magnetite ore of Dammer Nissar Valley alone can revolutionize the local economy and have impact on the national economy as well. This can be achieved only if cheap means of communication were made available for transporting the mineral wealth to the market centres in West Pakistan. Obviously, road is the cheapest means of transportation between Chitral and down-country. To obviate the hazard of the existing road and to convert it into all-weather road, drilling of a vehicular tunnel under Lowari Pass and into Ashret Valley seems obligatory. Investigation of the project has already been started. Considerable work on this project was done by WAPDA and now the FWO has started investigation operations at the site.

Construction of the Tunnel will however take a number of years while the District of Chitral will continue to remain isolated during winter apart from Air-link which is available during fair weather only.

To cross over, passengers and essential goods it seems necessary to provide a rope-way over the Lowari Pass between Gojer Post on Dir side and Ziarat Post on Chitral side. The NCC road will serve as approach road to the Rope-way terminals on both sides.

Rope-ways and Cable-ways have been constructed in mountanious regions of other countries like U.S.A., South America, Switzerland, India and even Pakistan for conveyance of goods, passengers, forest materials etc. and have been in successful operation for years to-date.

Since the subject is a bit uncommon it seems desirable to give a brief description of the systems in vogue.

Aerial rope-ways transport passengers and goods in carriers which are handled along horizontal or inclined suspended steel wire ropes. These ropes connect two terminal stations in a st line and are supported along the line by intermediate trestles. Two main systems have been evolved,

bi-cable and mono-cable. The bi-cable rope-ways (sometimes called tri-cable) in fact incorporated three cables/ropes, two stationary carrying ropes (Also called track ropes) and one endless hauling rope. The two carrying ropes are parallel to each other and are held under tension above grid level by floating counterweights. These ropes are placed one on each side of the rope-way centre line, one side is used for loaded traffic, goods or passengers, the other side for the returning empty cars though many rope-ways carry passengers and goods in both directions.

The Mono-cable rope-way uses only one single endless carrying hauling rope comparable to the bi-cable hauling rope though of larger diameter because of its dual role. The mechanical simplicity of the carriage and the fact that the ropes weigh much less than those of a bi-cable installation means that a mono-cable is easier to erect and costs about 40% less than a bi-cable. A mono-cable rope-way can be used for transport of individual loads of one ton giving 200 tons per hour output. The line speed can reach up to 600' ft. per minute. If the distance is great, the rope-way is divided into straight line sections each with its own driving and tension gear. Each section may be up to 6 miles long but this varies according to the terrain.

Passengers rope-ways do not differ fundamentally from Industrial rope-ways except for extra safety precautions. They may be bi-cable or mono-cable. Large cabin rope-ways holding up to 120 passengers are of the to and fro bi-cable type each with two carrying ropes and two hauling ropes. An arial rope-way can span valleys without intermediate supports and pass over roads, railways, rivers and other natural obstacles. It can negotiate steep gradients and join two stations in a straight line. Operation is unaffected by fog, floods, snow and frost. It can be in use day and night and be efficiently used by the minimum of skilled labour. Construction, maintenance and transport costs are low.

A suitable system for Lowari hill would be a mono-cable rope-way to start at a point near Gujar Post on Dir side, climb the Lowari Pass and enter a top station. The second section should start from the top station and end at Ziarat Post. The length of the rope-way may be kept about 6.5 miles in all. The two posts are situated on the NCC road and the rope-way stations can therefore be connected by approach roads. Portion of the NCC road and the approach roads to the rope-way stations will have to be kept clear of snow for vehicular or pedestrian traffic as desired.

The system will be powered by electric motors housed in the terminal stations, peak station and intermediate stations.

WAPDA and FWO survey plans have been studied and a possible alignment has been drawn up. Actual surveys can be carried out and a project can be prepared by experts in the

field. The Forest Department is at present building a rope-way in NEELUM Valley of Azad Kashmir and may be in a position to undertake this project too.

Work on construction of a tunnel at Lowari will perhaps be started in the near future and with its completion a dire necessity of the people of Chitral will be provided. It will however take a long time and in the meanwhile some means of transport during the winter months is necessary. A rope-way will be a reasonably good medium of transport. During the construction of the tunnel which will perhaps take about 6 years the rope-way will help transport labour and construction equipment across the hill in winter months.

Quite often it is argued that a rope-way across the Lowari will not be possible because of winds and glaciers. This argument is not tenable because rope-ways have been constructed in other parts of the world under more hazardous conditions and it is not understandable why the problems of winds and glaciers cannot be over-come in this case. The designers of rope-ways can surely take care of these snags and design a safe rope-way for the prevailing conditions. In fact rope-ways have been devised for sites where such hazards are encountered and roadways are not safe.

A chair lift way was installed a few years back in Ayubia for tourists and is in operation.

During the British rule in India, a rope-way had been installed between Abbottabad and Nathiagali and was used successfully for transport of goods and passengers for many years. However, with the development of the road in the Galiats, it fell into disuse and was totally abandoned.

As of now, rope-ways are being used in various parts of the world with excellent results. Some of these have been indicated in this report under the heading 'Modern rope-way achievements'.

Introduction

The Chitral State is situated in the extreme northern part of West Pakistan and is connected through a seventy-five miles fair weather road with Dir Town which in turn is connected through an all-weather road via: Chakdara and Malakand with the rest of the down country. Between Dir and Mirkhani in Chitral State, the existing road has to climb upto Lowari Pass Top situated at about more than 10,200' ft. above mean sea level and then descend into Chitral Valley along excessive steep slopes maneuvered through a large number of hairpin bends. Because of high elevation encountered, the road around Lowari Pass remains closed to vehicular traffic for about eight to nine months during the year.

-392

Location

Occupying an area of about 5,700 square miles, Chitral State is situated in the extreme northern part of West Pakistan bordered for about three hundred miles along Afghan territory. Gilgit Agency forms eastern boundry whereas Dir and Panjkora Valley forms the southern and south-eastern rims of Chitral State. The entire Chitral State is a mountanious region cut into deep and steep sided valleys by the Chitral River and its numerous tributaries. The Chitral River, also known as Kunar River, rising in the Hindu Kush ranges of the extreme northern tip of the State, east of Trich Mir - the highest peak of the Hindu Kush - flows towards south and south-west for about 200 miles in Pakistan before entering Afghanistan territory near Arandu. It joins Kabul River downstream of Jalalabad (Afghanistan). Most of the developed townships in the valley have grown on either bank of the river. Chitral, Drosh and Mirkhani are the most important towns of the valley. State population, as of 1961, is estimated to be 150,000 with an average density of about twenty-six persons per square mile.

Accessibility

Topographically the only natural route to Chitral State would have been along the river gorge but since the Chitral river crosses over to Afghanistan before its re-entry into Pakistan territory, a road crossing over the mountains had to be an obvious alternative. At present, the State is connected to Dir through a fair weather jeepable road, crossing over Lowari Pass (elevation 10,200' ft). Despite recent improvements in this road a nine mile stretch of road from Lowari Top to Ashrat via: Ziarat is still very hazardous because of long stretches of steep gradients and a large number of hairpin bends. Steep climbing and additional maneuvring required to negotiate curves results in high consumption of fuel and excessive wear and tear of the mechanical parts of vehicles. It is for this reason that the camel, donkey and mule transportations easily compete with vehicular transportation in this part of journey. The road between Gujar Levi Post and Ziarat Levi Post passes over elevation ranging from 7,000 ft. to 10,000 ft.and hence remains covered with snow. Slides cause heavy damages to the road every year resulting in major costly repairs. During monsoon season the road gets damaged along considerable portions and consequent repairs not only entail heavy expenditure on maintenance but also block the traffic for a considerable duration. Thus the period during which vehicles can ply on this part of the road is short. Crossing Lowari Pass during winter entails trapping by avalanches and blizzards.

Chitral has also been connected by air from Peshawar, but air transport can hardly replace road traffic. It is not only very costly, one way air fair from Peshawar to Chitral being Rs 62/- which is well beyond common man's pocket, but it is also subject to weather conditions and other factors.

The third possible alternative is land route through Khyber pass via: Jalalabad (Afghanistan). The road runs along the left bank of Chitral River within Pakistan territory and then has to cross over to the right bank and continue upto Jalalabad and on to Torkham before entering Pakistan. But since this route involves crossing into and out of Afghanistan territory, it does not serve as a befitting means of transportation for Pakistan.

Climate

Climate of Chitral State is characterized by long persistent winters and short and dry summers. As the region is extremely mountainous, variations in local temperatures are very well pronounced. Many peaks extend well above snow line where temperatures are low. In the River Valley itself where average elevations range from 4,000' ft. to 6,000' ft. above mean sea level, temperatures during summer are comparatively higher. As the valley is situated in the shadow of Dir and Swat Kohistan ranges, monsoon influence during summer is least pronounced. Most of the rainfall occurs during winter months from December to April. Monthly mean precipitation at Drosh is shown in the table given below:

MONTHLY MEAN PRECIPITATION

Jan	2.2"	May	2.1"	Sep	0.8"
Feb	2.2"	Jun	0.8"	Oct	1.2"
Mar	4.2"	Jul	0.7"	Nov	0.6"
Apr	4.2"	Aug	0.9"	Dec	1.5"

Natural Resources

The natural resources of Chitral State are its favourable climate, small tracts of fertile land, supply of good quality water, and its physiography with rugged relief in which Chitral River with its Tributaries courses down through steep narrow defiles providing opportunity for construction of dams to store water for use in irrigation and power production. Mineral resources are largely unexplored but the area holds great promise for future.

Land

The total culturable area in the valley is about 40,000 acres of which nearly 20,000 acres are under some form of perennial irrigation while the rest of 20,000 acres constitute barren or unused areas. Main crops sown in the state are wheat, barley, maize, pulses, onion and potatoes. Due to snowfall and severe cold in the upper region of the state, cultivation is limited. Local production falls far short of local requirements.

Chitral produces different kinds of fruits of good quality and flavour. An area of about 1,500 acres is under fruit production which included "Khurmani" (apricot), "ghuz"

394

(Walnut), applies, grapes, "aloocha" (plums), loquat and mulberry. Grapes and apricots are of very good variety and can compete favourable with those from Afghanistan. They can fetch very good price in the settled areas and would thus increase the earnings of the people provided transport facilities were available. Except for a small quantity which is exported to the rest of West Pakistan by air, most of the fruits are sold locally at nominal price. Dry fruits such as apricots and mulberry mixed with walnuts constitute winter food of the common man.

Tourism

The state with its picturesque green valleys, snow clad mountains, people with quaint charms and strange customs offers tourist attractions. Kalash Valley (previously) called Kafirstan, forming the north-western part of the state, inhabited by the people commonly known as Kafirs, consists of a group of three main valleys namely Rumbur, Bumboret and Barir with renowned scenic beauty. This region has recently gained popularity with tourists because of its natural beauty and the interesting customs of the people. These people belong to the Central Asia stock and some of them still pursue their strange old customs. From the requests people make for permits for visiting Chitral, it can definitely be said that the place could become a great attraction both for the foreign and Pakistani tourist provided better and year-round means of transporation are available. Considerable tourist traffic would materially affect the economic condition of the people.

Problems & Needs

Chitral State though quite rich in natural resources, is one of the most backward and under-developed areas of West Pakistan. The phrase "civilization travels by road" would seldom be truer than in the case of Chitral State where lack of adequate means of transportation has been responsible for retarding general development of vast natural resources available in the area. Despite availability of fertile culturable land, quantity of food produced is far less than the requirement of the population. The area in general is deficit in most of the essential commodites such as wheat, rice, salt, kerosine oil, tea, cloth and hardware etc. The nearest market centre is at Peshawar from where transportation costs about Rs 30/- per man by road when it is open to traffic. Wheat and other essential commodities have to be subsidized to the tune of nearly Rs 10 lakhs every year. With the construction of an all-weather road by Afghan Government upto the borders of Chitral Valley, the situation has been aggravated and the need for subsidy has assumed greater proportion to counteract unwholesome influence over the population of the area. A better means of communication with rest of West Pakistan will go a long way in accelerating the pace of development bringing prosperity to this area.

Chitral State seems to be rich in minerals especially good quality iron ore (magnetite). Indications are that Dammer Nissar deposits are susceptible to commercial exploitation. It has been reported that even if the quantity of ore as originally estimated were small, it would be exploited for use as blending material at Karachi and Kalabagh Steel Plants. In any case, whether the ore is smelted at the mining site or transported as such to down-country, cheap and adequate means of transportation is a must.

Afghan Government has recently been very active in constructing all-weather roads along Pakistan borders and regular means of transportation are understood to have been in existence between Chitral and Afghanistan whereas, even today, Chitral State is only remotely connected with the general areas of West Pakistan. This situation can easily create an imbalance in the bordering areas and large population may tend to depend more and more on the alien goodwill. Past experience with the Afghan Government has not been very sweet. In order to be fit to protect her territorial integrity, Pakistan can ill-afford to neglect provision of adequate means of communication within the borders of the country, especially in the areas of strategic importance like Chitral State. Need for a surface link between Chitral and rest of West Pakistan is, therefore, well established.

As is well known, Chitral State and its valleys especially Kalash Valleys (Kafiristan area) have special charm and scenic beauty which attract tourists from all over the world. Tourist industry can be made into a real source of income if unrestricted growth of amenities such as hotels and restaurants, youth hostels and rest houses, and public resorts can be encouraged. This can only be achieved if better means of communication are available all-the-year-round.

From the above discussion, it becomes abundantly clear that it is necessary to provide an easy and cheap means of transportation to open up Chitral area for future development of its natural resources for multipurpose benefits and economic growth of the state, to optimise exploitation of mineral resources of Dammer Nissar valley and to protect territorial integrity of Pakistan boundaries from alien influence, efficient surface link between Chitral and the rest of the country is a must which should no longer be delayed.

Modern Rope-way Achievements

The first long mono-cable rope-way (in operation since 1919) was constructed in LaDorade Colombia. Its 15 sections total 46 miles. Notable bi-cable rope-ways connect Massus and Asmara Eritrea 45 miles, and Kristenberg and Boliden, Sweden 60 miles in 8 sections (constructed during World War II). The longest heavy type mono-cable rope-way is the COMILOG rope-way, starting in Gabon and finishing in the Republic of Congo. Its sections which total 48 miles and run through equatorial forest were inagurated in 1962. In India two

complexes (costing about $7 million) with several rope-ways were constructed in 1966-67 to reclaim sand from rivers to back fill disused coal mines.

Outstanding passenger rope-ways are the Murren - Scheldhorn rope-way in Switzerland, opened in 1966 whose 4 sections total 4.5 miles and whose upper terminal is 9740' ft. above sea level. The Aiguille du mindi (Chammonix France) rope-way constructed in 1953 whose upper terminal at 12500' ft. is more than 9000' ft. higher than the lower one. The Merida (venez) to and fro passenger rope-way built in 1959 is 7.8 miles long in 4 sections with one of its spans approx. 10,000' ft. an upper terminal at 15,000' ft. above sea level and a cabin capacity of 39 passengers.

The longest to and fro passengers rope-way in U.S.A. is the Sadie Peak Aerial tram in New Mexico completed in 1966. Its length is 14,185' ft. its upper terminal 10,378' ft. and maximum span 7,760' ft. Each of two cabins can carry 60 passengers and the trip takes 10 minutes at a speed of 1950' ft. per minute.

Our Gratitudes are due to F.W.O., WAPDA and U.S.I.S. Peshawar who made their reports, Aerial photographs, plans and Books available.

Appendix K
Review of Minerals and Mining

This review of minerals, prospects and mining is based upon field investigations conducted for the EA, review of background materials and contact with agencies and experts.

K.1 Iron

There are three known iron prospects in the Chitral District. The major one is several kilometers south of Drosh, the southernmost prospect in the district (Figure 11). This prospect is known as the Dammer Nissar, is named after the nearby historical landmark, Dammer Nissar Fort. The other two, less promising iron prospects are at Buni Zom (A. Khan and M. Aslam, 1981) and Zarmiru Zom (Asrarulla, 1979; and Austromineral Company, 1978, p. 181) located in the central part of the district (Figure 11).

The Dammer Nissar prospect has received more exploration than other mineral prospects in the district (S.I. Ali, 1953; Asrarulla and S.T. Ali, 1963; A.H. Kidwai and S.A. Imax, 1958; Austromineral Mineral, 1978; and Asrarulla, 1976). It is the only site with core drilling for exploration purposes in the district and this was only one hole. The ore is magnetite and gangue is mainly epidote. Associated rocks are metamorphic and igneous. The magnetite lenses are primarily associated with the Ashret marble formation.

There are ten magnetite lenses up to 425-feet long and 75-feet thick. The lenses dip steeply to the west. These are the largest known reserves of high-grade iron ore in Pakistan. If mining were carried out, underground techniques would be required. Two of the lenses (about 3 million tons) are believed mineable. Austromineral Company (1978) estimated a capital investment necessary for mining these two lenses would be $674,000 with a return on investment of about 30 or about $200,000.

A mini-steel plant in Peshawar is a proposed recipient of the Dammer Nissar ore to be blended with ore from Chilghazi. Reductant coal could come from Sharig or Makerwal and gas for furnace heat could come from Sui. A saleable product could be sponge iron for existing small foundry shops and rolling mills as exist in Lahore. Target production would be about 15,000 tons p.a. Sponge iron would be trucked 170 km from Peshawar to the railroad at Dargi.

A mini-steel plant as described above would likely be built to utilize ore from Dammer Nissar, according to Mr. Bagar Mehdi Rizvi, the mining manager at Karachi Steel Company (Personal Communication, 1987), if there were improved access.

It is likely additional ore will be found, because a magnetic survey has revealed an estimated 6.5 million tons of magnetite ore at Dammer Nissar. There are two other known iron prospects in the district (Figure 11), and there is an unconformity containing iron within the Shoghor limestone. This is a zone of iron concentration, and exploration along this zone will likely reveal additional iron prospects within the Chitral District. The iron carbonate rock near Shaghor, presently being tunnelled as a gold prospect, should also be considered an iron prospect. There are many millions of tons of iron carbonate rock here as this is a strata-bound deposit.

The Buni Zom, Zarmiru Zom and Shoghor prospects have only received cursory examination. There have been no beneficiation tests at these areas to determine if the iron can be concentrated sufficiently to produce ore.

K.2 Copper-silver Prospects

The Sarhad Development Authority (1986), the Pakistani Government mineral development organization, has recently estimated 36.8 million tons of low-grade copper are in the Kaldam Gol area, a few miles east-southeast of Drosh.

The mineralized zone is 4 meters to 40 meters wide and dips steeply to the northwest. The zone has been traced along strike for about 8 kilometers.

The ore is sericitized diorite containing about 0.5 percent copper. Ore minerals are azurite, chalopyrite, sphalerite, tetrahedrite, chalcocite, and galena.

Recent chemical analyses of channel samples from a prospect tunnel along the contact between the altered diorite and marble has revealed local, very high concentrations of silver. The galena in this contact zone was observed to contain silver, as revealed by its curved cleavage surfaces.

The amount of copper ore in the Kaldam Gol area proven thus far falls far short of being enough to be mineable. There are two possibilities for this deposit to be mined: (1) possible sufficient associated metals such as silver to mine portions of the copper deposit along narrow, rich, silver zones using underground mining techniques; (2) possible economical development of the 36.8 million tons at Kaldam Gol to be combined with similar ore now being explored near Dir, south of Lowari Pass, if access and world market conditions change.

K.3 Tungsten

Potential tungsten ore, a scheelite bearing quartzite, has been found a few miles north of Garam Chashma (Figure 11) in the Miniki Gol area. Nine million tons of tungsten have been proven with an average grade of 0.5 percent WO_3 in the ore. However, these deposits are not large enough for mine development. Similar, but much larger, deposits are currently

being exploited in China; tungsten mining is not likely in the Chitral District, unless through drilling and further searching along this strata-bound deposit, sufficient tonnage may be discovered to merit mining. The major exploration for sheelite has been by Dr. C.J.N. Fletcher (1985), Dr. Leake (1983), Dr. R.D. Leake and H.W. Haslam (1985), Austromineral Company (1978), and the Sarhad Development Authority (1985).

K.4 Gold

There are two basic types of gold deposits in the Chitral District: placer deposits and hard-rock deposits. The placer deposits can be divided into two types: those associated with present streams, and those associated with ancient streams which left terraces of sand and gravel many feet above present floodplains.

Present-day stream channels are panned intermittently in several places along the Chitral River and its main tributaries. Three of these areas are near Drosh, Chitral, and Gahrait. Panning takes place usually in winter when stream level is low and gravels are accessible. Also, mining is dependent upon available work for laborers who can only earn about $2.50/day at gold panning (Rahman, 1987, personal communication).

The ancient placer deposits are more voluminous than the sand and gravel deposits in modern stream channels; the gold values in the ancient deposits is reported to be about equal to the modern deposits. Although several economic studies have been made of these modern day and ancient gravel deposit, no mining companies appear to consider the deposits mineable on a scale larger than panning (Iranac et.al. 1955; Coulson 1936; S.I. Ali, 1951; R.A.K. Tahirkheli, 1974; Z. Ahmad et.al. 1975).

Hard-rock gold deposits are currently being explored by the Sarhad Development Authority (1985, 1987) at Sewakht, near Shoghor. Exploration tunnels are being dug using pneumatic drills, and channel samples are being evaluated to assess ore values and volumes. On the surface, trenches are being excavated for channel sampling to assess ore values and volumes.

There are two types of hard-rock deposits: boulangerite veins and a ferruginous dolomite bed similar to those of the Carlin U.S.A. active gold mines.

About 30,000 tons of boulangerite ore have been proven by the Austromineral Company at Aweirth, a few kilometers south of Sewakht; about 15,000 tons of boulangerite ore have been proven at Sewakht, but mining companies do not consider these profitable deposits. Separation of gold from boulangerite is a practical problem (Robertson Research International, Peter S. Bridges) and the sampling techniques for dolomite deposits at Sewakht have not been adequate. Dames and Moore and United Consultants (1987) recently at Sewakht

- 400

evaluated the dolomite gold deposits in the SDA exploration tunnel and their results are not encouraging.

The dolomite gold deposit is apparently strata-bound; thus many kilometers of this dolomite bed outcrop along strike, and many prospects will likely be found. If iron ore can be mined in conjunction with gold, the mining potential is very good. Iron ore beneficial need to be considered for these dolomite gold deposits. Improved access will encourage companies to explore for gold in Chitral, as this is the main mineral commodity presently sought by mine exploration companies throughout the world.

Prospects thus suggest that any gold mining would be underground.

K.5 Antimony-sulfur

Antimony trioxide is presently being produced at a mine and smelter at Krinj, a few kilometers southeast of Shoghor. The ore mineral is stibnite, a sulphide of antimony. It occurs along with quartz as veins up to about 5 feet wide. The veins occur along a major reverse fault and crosscut phyllite of the Chitral Slate formation.

The area within a few miles of Krinj has been mined almost continuously since 1939, and production has been from a few tons to a few hundred tons per year of trioxide. There are no plans for extensive exploration. Estimated reserves at current levels of production are expected to last another 20 to 30 years. The Austromineral Company (1978) believes there is much stibnite yet to be discovered along this major fault zone.

The environmental effects of current mining seem very small, because the mine adits are thousands of feet above the valley on steep mountainsides. Mining is with hand tools and the ore is hand-separated from quartz and phyllite gangue. The waste material is allowed to fall down the mountainside at the mine opening. This adds to the natural scree which has built up at the base of the steep slope. Much of the tunnel is collapsing.

The antimony retort at Krinj has been in operation for most of the time since 1957. There was an attempt to produce sulfuric acid as a byproduct, but this attempt was not economically successful, according to the Director of the SDA for the Northwest Frontier Province, Mr. Bahrawar Khan.

K.6 Arsenic

Arsenic was mined in small quantities in the early 1900's in the high-altitude area of the northcentral part of Chitral District. There were six known mine deposits in 1921: (1) Mirgasht Gol (11,000 ft); (2) Aligot (13,000 ft); (3) Londu (11,000 ft); (4) Wizmich (16,000 ft); (5) Moghono zom (15,000 ft); and (6) Stach (14,000 ft). All except Number 5 were vis-

401

ited by Mr. G. H. Tipper (Records of the Geological Survey of India, Report for 1921, pp. 16 and 17; M.G. White, 1975). A large investment in these hand-dug mines would be needed to resume mining in a safe manner. The ore minerals which occur as veins are realgar and orpiment. Fluorite occurs in ore specimens from Mirgasht Gol.

The extent and value of these deposits is unknown because they have been explored by brief visits from only a few geologists. Improved access may bring interest in further exploration of these deposits, but their isolation from good roads will prevent mining for many years.

K.7 Marble

Several large, beautiful marble deposits occur in the Chitral District. A black marble has been mined near Shoghor for use in the town of Chitral; fine-grained white marble is currently mined at Gahrait, mainly for use as road metal, but it is also used as a building stone in Chitral. A very coarse grained, especially attractive, bed of white marble occurs near Gahrait, discovered by Mr. Moin Islam (A.C.E.). Deposits of red marble with different colored cobbles occur in large quantities along the road near the intersection of Bandu Gol and Chitral River. Small deposits of a gray marble with bright green streaks occur in a fault zone at the intersection of the Shishi Valley and Chitral River Valley. Blocks up to 10 feet thick and several feet long could be mined.

The quantities of marble available for mining will last for hundreds of years. The demand is partly dependent upon the beauty and durability of the marble. There are beautiful marbles in the Chitral District; some marble is very pure calcite and/or dolomite and, thus, will be very durable. The average value of marble in and around Peshawar, is 200 rupees to 1,500 rupees per ton at the quarry. Since price is varied and the market is unpredictable, the value which may be realized from marble mining is impossible to estimate.

K.8 Cooper, Lead, Zinc, Vanadium, Tin, Mercury and Molybdenite

There are many small deposits of copper, lead and zinc; and a few, rare minor occurrences of vanadium, tin and mercury mentioned in the literature, especially the major references of Austromineral (1978), Leake and Haslam (1985), and Calkins (1981). With increased exploration, some of these may turn into major deposits.

Molybdenite occurrences have been known for several years near Shah Jinali (Austromineral, 1978, p. IV). There are enough showings at the surface to merit further exploration. This area is so isolated that major investment would be necessary to get the ore to market, if proven. Deposits are high and very far from the nearest truckable road.

402

K.9 Mica, Beryl, K-Feldspar and Graphite

Mica and beryl have been intermittently mined for many years on a small scale several kilometers (20 miles) northwest of Garam Chashma on the Siruik Gol at four different mines. Mica is mined and hand-trimmed as clear muscovite books up to 6 inches across; beryl is mined only for gem quality material. In this form, these minerals have high value by weight and volume. The bulky minerals are not mined because the truckable road ends at Garam Chashma and minerals must be transported several kilometers on horseback.

If a road were developed between Garam Chashma and the mines, bulk mica, as reported by Austromineral (1978, p. 37), and probably bulk beryl and K-Feldspar, as reported by Allauddin et al. (1972), could be mined on a larger scale and less sporadically. From Chitral to Garam Chashma, this road is currently being improved.

Mica has also been found in books up to 6 inches across from a small pegmatite about 7 miles east of Kesu Village (37.49' Lat., 71.48' Long.), which is 7 miles north of Drosh (Rahman, 1955), pp. 18 and 19).

Graphitic schist has been reported from the Miniki Gol area, near the villages of Sha Saleem, Memo and Mozho Gram, by Mr. Rahman (SDA Manager) and in a Sarhad Development Authority (1987) publication. The quality of the graphite and percentage of graphite in the schists is yet to be determined. Inexpensive transportation would be necessary in order to move this material to markets.

K.10 Clay, Sand & Gravel, and Crushed Stone

One fired-brick clay pit exists in the Chitral District and in many communities, there are very small mud-brick clay sources. Fired-bricks were produced at the former estate of the prince on the first mountain-top just northwest of the town of Chitral. The clay pit is about 150 feet in diameter and about 20 feet deep. The amount of clay remaining is unknown. The brick kiln has been removed, but partially melted bricks are present, attesting to the former presence of the kiln adjacent to the clay pit. The clay was derived from the underlying beds of phyllite and marble of the Chitral Slate formation, as indicated by the presence of much montmorilonite (evidenced by very large desiccation cracks in a dried-up pond within the clay pit).

Clay is generally scarce in the district; the mountainous terrain has little vegetation to hold clayey soil. The "V" shaped valleys have few floodplains and the streams are quite rapid, so clay has little opportunity to settle from the water, once entering a stream.

With improved access, Portland cement for making cement blocks for building purposes may become less expensive because transportation costs would be less. Thus, soil currently lost to mud-brick making could be replaced by the use of sand from the streambeds to make concrete blocks.

Sand and gravel are currently mined along the major streams, where the floodplain sands and gravels are exposed at the surface. Where there is a ramp from the road which can be traveled by the big Bedford trucks, the trucks are driven to the deposits where loading is by hand and shovel. Sand and gravel are used to make Portland cement concrete, asphalt concrete and road building materials.

The construction of a tunnel would result in a large, increased demand for sand and gravel. Concrete would be needed for the tunnel liner, bridges and road construction. Quantities available in the main streams is enormous. Also, there are much larger quantities available in river terrace deposits, as thick as a few hundred feet above the present stream.

Marble is currently crushed and screened along the Chitral River floodplain between Gahrait and Drosh. Yearly production is small, estimated at a few ten's of tons. (The marble is quarried at Gahrait and a few road cuts of marble between Gahrait and Drosh.) The screened crushed stone is used almost entirely for road metal. It is mixed with tar imported into the district to make an asphalt concrete road surfacing and a road-metal base for the asphalt. Between the town of Chitral and Shoghor marble blocks (1 foot across) are being broken with hard-held hammers into about 2-inch aggregate to use as a road-metal base. This marble is being quarried at a few road cuts near Krinj.

There is little environmental impact from existing roadmetal production. Trucks, the crusher, the screening operation, and blasting produce some noise. Marble dust is produced during crushing and is spread by the wind, but this dust mainly blows onto crops. Calcium carbonate added to the soil is helpful in keeping the soil basic, and thus is beneficial in making nutrients available to plants. However, most soils of the district do not need to be limed, according to the Agriculture Department in Peshawar (Personal Communication, 1987). Quarrying operations tend to widen roads and produce much needed flat areas.

Construction improved access by tunnel or road would create a demand for large quantities of road-metal base material. Also, much crushed stone would be needed for concrete. Sources for crushed stone would probably be along the roads as near the construction sites as possible. The available rock for crushed stone will be granite near the Lowari Pass and granite and marble along the approach roads.

404

K.11 Granite

There are vast deposits of granite in the Chitral District, which could be used as crushed stone and as dimension stone. Two deposits have been singled out by Calkins (1981, p. 32): the first about 2 miles (3.2 km) east of Gahrait; and the second in Golen Gol, about 2 miles (3.2 km) east of Koghozi, where the granite is used locally for building stone. Granite also occurs at Lowari Pass.

There is granite already being mined in other districts with improved access Chitral could, perhaps, become a center for dimension stone production, starting with marble and progressing to soapstone, serpentinite, greenstone (actinolite schist), granite, and slate. If skilled quarrymen and skilled stone masons were trained or brought in, Chitral District could produce dimension stone. Equipment for quarrying and cutting dimension stone is relatively simple and inexpensive and Chitral has excellent quarry sites.

K.12 Soapstone, Talc, Asbestos

Soapstone occurs along the major fault zone which passes through the Shishi Valley. Soapstone was evaluated for its talc and magnesite minerals by Austromineral (1978, p. 36), and they concluded these minerals could not be separated economically. The two minerals combined, however, are valuable as soapstone, used as laboratory tabletops and sinks which resist chemical corrosion. Soapstone can also be ground and used as a filler in paint. Serpentinite and actinolite schists along the Shishi fault can also be mined as dimensional stone.

Talc and asbestos veins cross-cut these ultrabasic rocks. Their extent has only been estimated by a few observations in outcrops. Further exploration may reveal mineable deposits.

An outcrop of actinolite schist containing veins of a very pure talc and asbestos in Birir Gol, about 4 kilometers west of Gahrait, was discovered during EA reconnaissance.

K.13 Slate

Slate is one of the most common rocks in the Chitral Valley. The formation in the center of the valley is the Chitral Slate. Slate occurs in road cuts along existing paved roads and many stream boulders are slate. These and other stones are gathered and used for walls, buildings, and aqueducts throughout the district.

About 5 miles (8 kilometers) south of the town of Chitral between the road and the Chitral River to the east, there are exposures of slate which have flat surfaces large enough to quarry table tops and building veneer. Also, roofing shingles and blackboards could be split from such stone. There is no production of this type in Chitral District. There are

405

also other slate deposits in Pakistan which are more centrally located in the country.

K.14 Portland Cement Carbonate Rock

Limestone and marble of Portland-cement grade occur in the Chitral District in easily quarried areas with sufficient amounts to last the next few hundred years. Tests were made during EA reconnaissance, using hydrochloric acid to verify high calcium marbles and limestones. Two prominent potential sites are at Ashret and near Shoghor.

The Shoghor marble deposit is large and in the form of a bed about 700 feet thick, dipping steeply to the west. The best exposures are along a truckable road which following a stream which has cut almost directly across the marble bed.

Petroleum fuel would have to be trucked into the Chitral District for a Portland cement furnace. The demand for cement in the Chitral District may not be great enough to support a cement plant in the near future. A feasibility study of establishing Portland cement in the Chitral District seems justified as well as study of a Portland cement plant near Lowari Pass (if tunnel is constructed).

K.15 Lime

There are two small lime kilns, intermittently used, located on the terrace north of Ayun and about 1.5 miles south of Chitral. Production is estimated to be a few tons per year.

(The site of a former kiln was observed near the currently active copper-silver prospect at Kaldam Gol; although quarries for these kilns were not observed, kilns are usually constructed near their source of limestone or marble.) Lime is used in the Chitral District for whitewash and as a carrier for pesticides.

The small quantity of lime produced currently poses no adverse environmental effects, per se, however, use of wood as the energy source contributes to further depletion of a scare resource.

K.16 Dolomite and Phosphate

Dolostone and dolomitic marble are abundant in the Reshun formation which extends the length of Chitral District in more than one belt. The marble at Gahrait Quarry, for example, is composed of dolomite. Dolomite can be used as a flux in steel production, and as agricultural lime.

Phosphatic carbonate rock of the Reshun formation occurs in the Bumboret Valley, according to Mr. Rahman, SDA Manager. Chemical analyses have not been performed but are recommended, because this commodity could be used to fertilize the crops in the Chitral District.

406

K.17 Glass Sand

Glass sand was found by the SDA during their exploration for tungsten in the Miniki Gol area, according to Mr. Rahman, SDA Exploration Manager. Deposits appear to be very large, but they are far from the nearest road. Since this mineral commodity would have to be trucked in bulk, SDA has not further defined the deposits. If mined, the method would likely be open pit.

Industrial minerals such as glass sand would be searched for more with improved access. The market situation would also need to be determined for glass sand before one could determine if a deposit in the Chitral District were mineable.

K.18 Fluorite

Crystals of green fluorite (an unusual color for fluorite) several inches across are sold in the bazaar at Chitral. The commercial value of fluorite, however is based on industrial value and it is sold by the ton. Used mainly as flux in making steel, high purity fluorite is also used to make hydrofluoric acid and glass. The quality and quantity of Chitral District fluorite has not been determined. Fluorite has been reported from the Yar Khun Valley (36.45'N and 72.50'E), not far from Shoghor (Bakr, 1965, p. 4). Also, fluorite has been found in the high, remote district of arsenic deposits in Mirgasht Gol, in the Tirich Valley.

If deposits are explored and developed, underground mines would likely be the method.

K.19 Gemstones

Garnets are mined on an intermittent basis in Luthko Valley, about 15 miles west of Shoghor. They are sold in the Chitral bazaar. As mineral specimens, they are up to 1.5 inches in diameter. However, they are highly fractured, and only stones of a few carats can be cut from crystal fragments.

Demand for Chitral garnets is low as this is a semi-precision, common, red garnet. Red garnets are found in extensive deposits of metamorphic schists worldwide.

Sapphires have been reported from the Minone Gol, west of the town of Chitral but no published sources verify this report. Additional exploration would be needed to verify this reported discovery.

Although tourmaline most often occurs in small deposits (pegmatites), the Chitral District has some strata-bound tourmaline in potentially great volume. This is a rare brown tourmaline called dravite (Leake and Haslam, 1985, p. 15). Gem quality blue tourmaline has been found in the Lutkho Valley,

near Miniki Gol. More exploration will be necessary to determine the extent of this deposit.

Aquamarine crystals a few centimeters across were observed in the Chitral bazaar. Aquamarine, a form of beryl, has a light-blue color. Intermittently, a few kilograms are mined each year from pegmatites in Lutkho Valley. According to Mr. Jalil Rahman, SDA Manager in Chitral, a recent death in mines at Muner Gol resulted in closing.

K.20 Hot Springs

According to local citizens, there are at least three hot springs in the Chitral District. Two hot springs (visible on Spot imagery along a lineament that parallels part of Lutkho River Valley) are: Garam Chashma (translates into English as hot springs); and a second area a few kilometers west of Garam Chashma, near Gabar Valley. The third hot spring is Pethus Spring, about 70 miles northeast of Mastuj, situated near Chhatiboi Glacier (Lat. 36.47' Long. 73.15') (Bakr, 1965, p. 1).

Geothermal energy has been utilized in the area of Garam Chashma for many years for hot baths and laundry. Energy emanating from these springs was estimated during EA reconnaissance. One of the four springs (about 100 meters north of the road) produced about one liter in 8 seconds at a temperature of 118°F.

A second spring (about 25 meters southwest of the first) produces one liter in 3 seconds at 126°F. A third spring (about 10 meters southwest of the second) produces a one liter in 16 seconds at 130°F.

A fourth spring (about 35 meters north of the second) could not be observed. Volume is estimated to be in the same general range as the others, with a temperature of 116°F. A fifth spring exists, but was not examined.

According to SDA Manager Rahman, hot springs at Gabar Valley are about equal in volume to the springs at Garam Chashma, and the Gabar Valley spring may be slightly hotter.

Overall, the potential for further geothermal energy development in the Luthko Valley appears to be low. The amount of energy expelled at the ground surface is low, compared to areas of extensive geothermal energy development elsewhere in the world.

India has developed geothermal energy in Fuga Valley, Northern India, and this geologic zone continues westward into Northern Pakistan. Hence, there is a possibility of finding geothermal energy resources in Northern Pakistan (Shuja, 1983, p. 24).

108