Environmental Impact Assessment Report

Environmental Impact Assessment Report
Project Number: 40075
July 2007

Islamic Republic of Pakistan: National Trade Corridor Highway Investment Program
Faisalabad-Khanewal Expressway (E-4)
(184 Km)

Prepared by the National Highway Authority for the Asian Development Bank (ADB).

ABBREVIATIONS

˚C	–	Degree Centigrade
AD	–	Assistant Director
ADB	–	Asian Development Bank
AADT	–	average annual daily traffic
APs	–	Affected Persons
BDL	–	below detectable level
CC	–	Construction Contractor
CBO	–	community based organization
CO	–	carbon mono oxide
COI	–	corridor of impact
dB(A)	–	decibel
DCR	–	District Census Report
DC	–	Design Consultant
DD	–	Deputy Director
DDO	–	Deputy District Officer
DFO	–	Divisional Forest Officer
E-4	–	Expressway (Faisalabad-Khanewal)
EDO	–	Executive District Officer
EIA	–	Environmental Impact Assessment
EIRR	–	economic internal rate of return
EMP	–	Environmental Management Plan
EPA	–	Environmental Protection Agency
Ft.	–	feet
GM	–	General Manager
GoP	–	Government of Pakistan
IEE	–	Initial Environmental Evaluation
IP	–	indigenous people
IUCN	–	International Union for Conservation of Nature
JBIC	–	Japan Bank for International Cooperation
JICA	–	Japan International Cooperation Agency

Km	–	kilometer
LAA	–	Land Acquisition Act, 1894
LAR	–	Land Acquisition and Resettlement
Mm	–	Millimetre
MC	–	Monitoring Consultant
M&E	–	monitoring and evaluation
NEQS	–	National Environmental Quality Standards
NESPAK	–	National Engineering Services Pakistan, (Pvt) Ltd.
NGO	–	nongovernmental organization
NHA	–	National Highway Authority
NH&MP	–	National Highway and Motorway Police
NOx	–	nitrogen oxides
NWFP	–	North West Frontier Province
OM	–	Operation Manual
O&M	–	Operation and Maintenance
PAPs	–	Project Affected Persons
PEPA	–	Pakistan Environmental Protection Act
PHV	–	peak hourly volume
PM_{10}	–	particulate matter (10 Micron)
PTCL	–	Pakistan Telecommunication Company Limited
RoW	–	right of way
RAP	–	Resettlement Action Plan
RPF	–	Resettlement Policy Framework
Rft.	–	running feet
Sft.	–	square feet
SPM	–	Suspended Particulate Matter
SC	–	Supervision Consultant
SNGPL	–	Sui Northern Gas Pipe Line
SOx	–	sulphur oxides
TA	–	technical assistance
USEPA	–	United States Environmental Protection Agency
WHO	–	World Health Organization

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EXECUTIVE SUMMARY

• Background of the Project

1. National Highway Authority (NHA) intends to construct Faisalabad-Khanewal Expressway (E-4) as part of National Trade Corridor (NTC) Projects. The proposed Expressway Project with other NTC Projects will provide a reliable, safe and throughway for transportation of goods between central Asian parts and China to Karachi and Gawadar ports. This Project will uplift in the trade activities and in turn increase the economic growth rate of the country. This Expressway will also provide easy access to residents of Faisalabad, Toba Tek Singh, Khanewal and Multan districts and will make easy transportation towards Islamabad, Rawalpindi and Lahore.

2. The Most of the land of the RoW of the Proposed Project is agricultural; however a small quantity of residential and commercial land will also be acquired. The major towns and cities near RoW are Faisalabad, Gojra, Painsara, Shorkot, Toba Tek Singh and Khanewal.

• Objectives and Schedule

3. The prime objective of the proposed Project is to improve trade flows and lower transit costs and time by providing a high speed, safe and reliable access controlled Expressway system.

4. The implementation of the proposed Project is expected to start in year 2008 and complete in December 2010.

• Project Components

5. The proposed Expressway Project comprises the construction of two lane dual carriageway from Faisalabad to Khanewal and construction of ten Interchanges at different road crossings. Two Bridges will be constructed one at Sadhnai Spill channel and other on Ravi River. Nine meter wide section of land will be raised with plantation in between two carriageways; this will be utilized in future to construct one lane of 3.65 meters on both carriageways. The carriageway will include paved shoulders at inner and outer sides. The outer shoulder of each carriageway will be 3m wide with 0.5 meter rounding and the inner side will be 0.6 meter wide. The proposed Expressway will be divided in the four construction Packages

- Package-I: Faisalabad-Gojra Section (57 Km);
- Package-II: Gojra - Shorkot Section (62 Km);
- Package-III: Shorkot -Khanewal Section (65 Km); and
- Package-IV: Two Bridges at Ravi River and Sadhnai Canal.

• Relevant Legislation and Guidelines

6. To carry out the present EIA Study, the environmental legislation and Guidelines enforced by the Pakistan Environmental Protection Agency and Asian Development Bank (ADB) have been followed.

- **Components of the EIA Report**

7. The Report contains the identified environmental impacts and their mitigation measures. Besides, the Report also includes the preparation of Environmental Management and Monitoring Plan to cover the mitigation measures, monitoring requirements and institutional responsibilities (during design, construction and operation phases of the proposed Project).

- **Description of the Project**

8. The proposed project is construction of184 km long road, which will start at end point of M-3 (Faisalabad-Pindibhatian) near Faisalabad and will end at N-5 near Khanewal. It will be 'four lane dual carriageway with each lane 3.65m wide. The proposed Project consists of ten interchanges at various road crossings. The bridges and underpasses will be constructed at suitable locations. The Right of Way (RoW) of the proposed project is100m wide; where as it will be 300 m at the location where interchange is constructed.

- **Description of the Environment**

9. Baseline conditions were studied for the physical, ecological resources and for socioeconomic environment. This alignment of this Expressway passes through Faisalabad, Toba Tek Singh, Jhang and Khanewal Districts. The terrain is quite flat and levelled. All the four districts have mostly agricultural fields with flat and levelled terrain throughout the alignment strip. The climate of the Project Area touches two extremes, characterised by hot summers and mild winters. From April onwards, the summer season continuous usually up to the middle of October after which it becomes cool and the day temperature also begins to recede. May, June and July are the hottest months. The winter season on the other hand starts from November and continues till March. December, January and February are the coldest months.

10. In Kharif, crops such as sugarcane, fodder, maize and rice are cultivated in Faisalabad and Toba Tek Singh districts. In Jhang district beside agricultural land barren land is also present. Sugarcane, Maize, and rice are the main Kharif crops of this district. Flooded areas were also seen nearby the alignment but none of these areas falls into the Project RoW. In Khanewal district kharif season crops are Cotton, Rice and Sugarcane. Wheat is predominantly Rabi season crop of all areas.

11. Faisalabad is for its textile industries but no textile unit is presently situated along the route. In districts of Toba Tek Singh and Jhang, very little commercial units i.e. only a few sugar mills and spinning units but none of them is along the RoW of the proposed Project. In Khanewal district Roshe Power Plant, a hatchery and pesticide factory are situated at a distance of 5 km from the Project RoW.

12. In order to get true picture of the environmental condition of the Project Area, consultants carried out water, air and noise monitoring by taking services of SGS Pakistan (Pvt) Limited.

13. Socio-economic environment of the Project Area was studied in detail for developing the baseline information about the affected people of the Project. Section 3 of this report describes the findings of this exercise in detail.

- **Project Alternatives**

14. Options were considered for this Project that included “No project” and Alternate transport modes. These have been discussed in Section 4 of this Report. Finally this option was selected because it fulfils the future Project requirements in the best way.

- **Environmental Impacts and Mitigation Measures**

15. Various probable impacts on the existing resources due to the proposed Project and vice versa were studied under the parameters of resettlement/ land acquisition, change of land use, dismantling of structures, relocation of existing utilities, soil erosion, water bodies, air pollution, noise, flora and fauna etc.

16. The most significant impact of the project is resettlement of residents and taking about 4715 acres of agricultural land out of production. The loss in production can be met with by increasing the yield from fields in the agricultural sector. Orchards lost to the project will also have to be raised by the private owners of land. However, the owners of land whose land is to be acquired and the neighbouring farmers can be helped to gain access to modern technology to increase production from their land. Similarly the deficiency in livestock feed/fodder will have to be met from the adjoining areas.

17. Construction activities will result in relocation/rearrangement of various utilities within the RoW, including culverts, PTCL cable, electrical poles, transmission, telephone lines and wells.

18. Mitigation measures to eliminate/minimize those negative impacts have been proposed to bring them to an acceptable level through implementation of the Environmental Management and Monitoring Plans. Proper compensation will be given to the Project affectees in a judicious manner. Mitigation measures have been suggested for the pre-construction, construction and operational stages of the Project, taking into consideration the environmental impacts of the proposed Project.

- **Economic Assessment**

19. The Economic Assessment describes economic benefits of the proposed Project. Economic Internal Rate of Return (EIRR) is also provided. EIRR comes out as 15.91%, which is above 12% the assumed opportunity cost of capital in Pakistan.

- **Environmental Management Plan (EMP)**

20. The EMP provides an approach for managing and monitoring environment related issues and describes the institutional framework and resource allocation. An Environmental management and monitoring plan has accordingly been devised to monitor various activities during the construction and operational phases of the Project, considering all the sensitive issues during the execution. The EMP will be implemented by NHA with the assistance of consultants. NHA will depute Deputy Director Environment to deal with the environmental related issues. Total estimated environmental mitigation cost will be around Rs. 4058 Million.

- **Public Consultation and Information Disclosure**

21. Consultant’s EIA team identified the stakeholders of the proposed Project and discussed the Project with them during the detailed field visits. Their views and concerns were noted and have been incorporated in section 8 of this Report. After reviewing their

concerns, mitigation measures have been suggested for giving them the due compensation.

- **Conclusion**

22. The proposed Expressway will enhance the trade activities of the country and provide smooth and safe travelling corridor. The proposed Expressway will involve some negative environmental impacts, which are mostly related to pre construction and construction stages of the Project and are however manageable by properly implementing the EMP. No long-term and significant adverse environmental impacts are however envisaged for the operation stage of the Project. Hence, the Project is environmentally feasible provided that the mitigation measures are properly implemented during the Project execution.

SECTION 1

INTRODUCTION

1.0 General

23. National Highway Authority (NHA) plans to construct (E-4) Expressway from Faisalabad to Khanewal. To comply with Pakistan's environmental regulations as conceived in the Pakistan Environmental Protection Act (PEPA) 1997, NHA entrusted NESPAK with the assignment of carrying out an Environmental Impact Assessment Study of the proposed Expressway (E-4) Project.

24. This Report presents the Environmental Impact Assessment (EIA) Study of the proposed Expressway (E-4) Project. The Expressway will consist of a four-lane dual carriageway with the area reserved for plantation in between the carriageways. The reserved area will be used in future to provide additional lane on each carriageway to cope with the upcoming needs for enhanced transportation. The Right of Way (RoW) of the proposed Project is 100 meters and width of each lane will be 3.65 meters.

25. The construction of the proposed Expressway (E-4) will facilitate and enhance the trade activities in the country and will provide time saving and safe and speedy access to various parts of the country. E-4 is the extension of M-3 and will start from the end point of the existing Faisalabad – Pindi Bhattian Motorway (M-3) near Sargodha Road, Faisalabad. Figures 1.1 and 1.2 indicate the National Highway Network and location plan of the Project Area.

26. The proposed Expressway (E-4) is a part of the National Trade Corridor. The road will provide easy access to the traders and farmers for transportation of goods to other parts of the country by reducing the time required for transportation.

1.1 Proponent of the Project

27. National Highway Authority (NHA) is the proponent of the proposed Project with the following address:

National Highway Authority
27 Mauve Area, G-9/1,
Islamabad
Ph: 051-9260565

1.2 Overview of the Project

28. The length of this Expressway Project is about 184 Km starting from the end point of Faisalabad-Pindi Bhattian Motorway (M-3) near Faisalabad and ending at National Highway Multan- Khanewal Road (N-5). This Project section consists of the following major components:

- Construction of a 4 lane dual carriageway;
- Construction of Interchanges at various road crossings; and
- Construction of bridges at the Ravi River and Sadhnai Canal.

1.3 Scope of Study

29. The scope of the EIA Study aimed at the identification of the possible impacts of the proposed Project on its immediate surroundings on both short and long term basis. Then based on the nature and levels of those impacts, proper mitigation measures were delineated and cost for inclusion into this EIA Report. This report is due to be submitted for approval to Provincial Environmental Protection Agency (EPA) Punjab before 31st March 2007. The Punjab EPA will carry out a review within 90 days. After the approval of this Report, the Project Proponent and the Contractor will be bound to follow the recommendations of the Report during the execution of engineering activities on site.

30. In order to investigate the environmental, geological and social features of the Project Area, the Consultants carried out two detailed site visits for collecting primary and secondary data to identify and establish the Corridor of Impact (CoI) and various mitigations required to minimise the adverse impacts.

1.4 Project Categorization

31. Pakistan Environmental Protection Agency (Review of IEE/EIA) Regulations 2000, Schedule II, lists down the projects requiring an EIA study as under:

32. “The Projects in schedule-II are generally major Projects and have the potential to affect a large number of people. They also include Projects in environmentally sensitive areas. The impact of such Projects may be irreversible and could lead to significant changes in land use and the social, physical and biological environment.”

33. Schedule-II describes the requirements of EIA for transportation Projects as under:

34. “Federal or Provincial Highways or major roads greater than 50 Million Rupees in value. Maintenance (rebuilding or reconstruction of existing roads) is exempted from the requirement of an EIA”.

35. As per EPA Guidelines, the present Project is classified as “Schedule II” that requires an EIA study and approval from the concerned authority, prior to construction (Attached as Annexure -I).

36. Asian Development Bank (ADB) Guidelines classifies the projects requiring an EIA in Category A (OM 20) as under:

37. “Projects with potential for significant adverse environmental impacts. An environmental impact assessment (EIA) is required to address significant impacts”.

38. The present Project requires an EIA as it involves significant environmental impacts, i.e. resettlement of people and structures, cutting of trees, change in land use etc.

1.5 Standards and Guidelines

39. Environmental issues and control in Pakistan are governed by the Pakistan Environmental Protection Act, 1997. The necessary Guidelines and Procedures for preparing EIA Reports have been published by EPA in the form of “Pakistan Environmental Assessment Package”.

40. The applicable requirements of the Government of Pakistan and Asian Development Bank (ADB) that are to be met before commencement of the Project are as follows:

- Pakistan Environmental Protection Act (1997);
- Pakistan Environmental Assessment Procedures (1997);
  - Policy and Procedures for Filing, Review and Approval of Environmental Reports
  - Guidelines for the Preparation and Review of Environmental Reports
  - Sectoral Guidelines: Roads
- Pakistan Environmental Protection Agency (Review of IEE/EIA) Regulations (2000);
- National Environmental Quality Standards (2000) for discharges of municipal and industrial wastewater and gaseous emissions;
- The need for an EIA as part of the Government of Pakistan PC-1 planning approval process for this Project; and
- ADB Guidelines for Environmental Assessment.

1.6 Components of the Report

41. This EIA Report has been prepared following the Pakistan Environmental Protection Agency (EPA) Guidelines for environmental assessment and Asian Development Bank (ADB) Environmental Assessment Guidelines. The format of the Report consists of the following components:

Section 1: Introduction

42. This section represents an introduction of the entire EIA Report. It provides information about the Project location and its benefits to the public. It contains the scope of study and overview of the Project. The section also includes the Project categorisation as per EPA criteria.

43. Besides, it provides information about the standards and guidelines that have to be followed.

Section 2: Description of the Project

44. In this section salient features of the Project are presented. It provides information about the following:

a) Overview of the proposed Project;
b) Location of the Project;
c) Project components including geometric design standards;
d) Project Right of Way (RoW);
e) Construction material;
f) Schedule of construction;
g) Construction camps; and
h) Workforce and machinery requirements.

Section 3: Description of the Environment

45. It provides an overview of the present environment of the Project area/site. It discusses the following:

a) Methodology of the study;

b) Physical environment;
c) Ecological resources; and
d) Socio-economic environment.

Section 4: Alternatives

46. This section discusses the Alternatives of the proposed Project.

Section 5: Environmental Impacts and Mitigation Measures

47. This section provides the information on the anticipated environmental impacts and mitigation measures. It discusses the following:

a) Project corridor;
b) Pre construction/design phase;
c) Construction phase; and
d) Operation phase.

Section 6: Economic Assessment

48. This section describes both tangible and intangible benefits of the proposed Project. It consists of detailed economic analysis of the Project.

Section 7: Environmental Management Plan

49. This section describes the measures suggested for executing the Environmental Management Plan (EMP) at the Project site. It elaborates the following in detail:

e) Objectives of EMP;
f) Key Environmental and social components;
g) Role of functionaries;
h) Specific implementation responsibilities;
i) Environmental monitoring;
j) Environmental management plan;
k) Environmental mitigation cost;
l) Environmental technical assistance and training plan; and
m) Environmental monitoring, mitigation and training costs.

Section 8: Public Consultation and Information Disclosure

50. This section consists of the information based on public consultation and information disclosure to them about the Project. It comprises of the following:

n) Identification of the main stakeholders;
o) Details of scoping sessions;
p) Stakeholders' concerns;
q) Proposed measures for incorporating the stakeholders' concerns;
r) Village meetings; and
s) Future information disclosure plan.

Section 9: Conclusions

51. This section presents the conclusion of the whole study. It explains the following in detail:

t) Identification of the main issues and concerns;
u) Proposed mitigation measures;
v) Benefits of the Project; and
w) Surveillance and Monitoring of the Expressway after Construction.

SECTION 2

DESCRIPTION OF THE PROJECT

2.0 General

52. The Faisalabad-Khanewal Expressway (E-4) Project will be a crucial Expressway link as it will enable trade and transportation linkage among major cities of the country. The proposed Project will also facilitate residents of Faisalabad, Toba Tek Singh, Khanewal and Multan and will provide easy access towards Multan, Lahore and onward to Islamabad.

53. Prime objectives of the proposed Project are as follows:

- Enhance trade activities in the country;
- To provide in future the Trade linkage of Central Asian Republics with Pakistan.
- Provide safe, high speed and time saving corridor to the travellers;
- Enhance the efficiency of road network; and
- Reduce the number of accidents.

54. The traffic generation, annual incremental rate and increase in speed with/without proposed Expressway is enlisted in Tables 2.1, 2.2 and 2.3.

TABLE 2.1: Total Traffic Likely to Use Faisalabad-Khanewal Expressway (E-4)

Vehicles/Year	CARS	MINI BUSES	BUSES	LOADER PICKIPS	TRUCKS	TOTAL MOTORIZED TRAFFIC
2008	4069	3595	1570	1198	2395	12827
2009	4386	3851	1647	1274	2528	13687
2010	4709	4111	1726	1352	2663	14561
2011	5113	4421	1813	1442	2812	15601
2012	5523	4737	1900	1534	2964	16659
2013	5997	5105	2008	1642	3148	17900
2014	6484	5484	2118	1754	3336	19177
2015	6985	5873	2231	1868	3530	20487
2016	7583	6331	2351	1998	3741	22004
2017	8198	6802	2474	2131	3957	23562
2018	8678	7160	2556	2228	4107	24730
2019	9159	7519	2637	2326	4257	25898
2020	9639	7877	2719	2423	4408	27066
2021	10207	8284	2806	2531	4568	28396
2022	10775	8691	2892	2639	4728	29725
2023	11343	9097	2979	2747	4888	31054
2024	11911	9504	3065	2855	5048	32384
2025	12479	9911	3152	2963	5208	33713
2026	13138	10375	3242	3081	5379	35215
2027	13798	10840	3332	3199	5550	36718
2028	14457	11304	3421	3317	5721	38221
2029	15116	11769	3511	3435	5892	39723

2030	15776	12233	3601	3553	6063	41226

Source: NESPAK
Note: Total traffic includes both diverted plus generated traffic.

Table 2.2: Growth in Traffic Generation

Year	Generated Traffic (%)
2008	1%
2009	2%
2010	3%
2011	4%
2012	5%
2013	7%
2014	9%
2015	11%
2016	13%
2017 & onwards	15%

Source: NESPAK.

Table 2.3: Vehicle Operating Speeds (Km/h)

Description	Car	Mini Buses/ Coasters	Buses	Truck-Tractors
Without Project	55	50	45	40
With Project	120	110	110	110

Source: NESPAK.

55. Tables 2.1 and 2.2 clearly indicate that number of vehicles will increase every year and it will reach up to 41,226 by the year 2030. The increase in traffic volume will result in more travel time fuel consumption due to reduced traffic speed, traffic jams and accidents. The design of the proposed Expressway will be carried out on the basis of latest traffic counts. Therefore it is imperative to construct the proposed Expressway Project so that the future traffic and travel safety problems can be encountered.

2.1 Location of the Proposed Project

56. The proposed Project falls under the administrative jurisdiction of Faisalabad, Toba Tek Singh, Jhang and Khanewal Districts. The proposed Project will start at the end point of (M-3) near Faisalabad and will end at N-5 near Khanewal.

57. The cities and towns falling en-route the proposed Project are Faisalabad, Painsara, Gojra, Toba Tek Singh, Shorkot, Makhdoompur, Abdul Hakim, Kabirwala, and Khanewal. Presently the RoW of the proposed Project contains mostly agricultural land.

2.2 Project Components

58. The proposed Expressway Project components include construction of four lanes dual carriageway from Faisalabad to Khanewal and construction of ten Interchanges at different local road crossings. Two main Bridges will be constructed one at Sadhnai Spill Channel and the other on Ravi River. However twenty small bridges will be constructed on drain and canal crossings. The total width of both carriage ways including land reserved for plantation will be 31.8 meters. Nine meter wide section of land will be raised with plantation in between two carriageways and this section will be utilized in future to construct one lane of 3.65 meters on both

carriageways. The carriageway will include paved shoulders at inner and outer side. The outer shoulder of each carriageway will be 3 meters wide with 0.5 meter rounding and the inner side will be 0.6 meter..

59. The proposed project will be divided into four construction Packages

- Package-I: Faisalabad-Gojra Section(57 Km);
- Package-II: Gojra - Shorkot Section (62 Km);
- Package-III: Shorkot -Khanewal Section (65 Km); and
- Package-IV: Two Bridges – one at the Ravi River and the other at Sadhnai Canal.

2.2.1 Interchanges

60. The proposed Project will contain ten interchanges; these will be constructed at Faisaabad-Chiniot Road, Painsara-Jhang Road, Gojra-Jhang Road, Toba Tek Singh-Jhang Road, Toba Tek Singh-Warriam Road, Shorkot Cantt-Shorkot City Road, Bagar-Abdul Hakim Road, Makhdoompur-Kabirwala Road, Kabirwala-Khanewal Road and Khanewal-Multan Road. The interchange will be provided with two lanes each lane of 3.5 meters wide with one meter shoulder at outer sides.

2.2.2 Bridges

61. The proposed Expressway will cross two main surface water bodies i.e., Ravi River (chainage145+250) and Sadhnai Canal (chainage145+850). Two separate bridges will be constructed to run across these two water bodies. These bridges will be located near Abdul Hakim-Baghar interchange. In addition to the above, other small bridges will be constructed on the following canal and drain crossings:

- Khai Distributary, 8 m wide (at1+500);
- Drain, 15 m wide (at 6+650);
- Nasrana Distributary, 20 m wide (at 9+900);
- Paharang Drain, 30 m wide (at 10+500);
- Sem Nullah, 30 m wide (at 28+300);
- Jhang Branch Canal, 40 m (32+600);
- Dijkot Branch Drain, 40 m (43+700);
- Dhaular Distributary, 30 m (44+600)
- Nawabwala Distributary, 10 m (48+500);
- Titranwala Distributary, 20 m (54+250);
- Bhango Distributary, 20 m (73+500);
- Small Distributary, 3 m (80+000);
- Khewra Distributary, 3m (82+200);
- Distributary, 20 m (95+500);
- Trimo Link Canal, 150 m (111+000);
- Haweli Canal, 80 m (112+200);
- Darkhana Distributary, 3 m (131+350)
- Sadhnai Drain, Nakasu 250 m (140+00);
- Goraga Distributary, 20 m (144+900); and
- Canal, 8 m (169+600).

2.2.3 Flyovers

62. The Flyovers will be constructed at various road crossings. The link roads across the RoW of the proposed Project will pass through these flyovers. For these flyovers the width of the land strip shall follow the toe of embankment with a maximum width of 60 meters near flyover embankments and a minimum width of 30

meters near lower ends of the flyover ramps where it meets with the existing carriageway.

2.2.4 Rest Areas

63. Rest Areas will be provided after a certain distance on the proposed Expressway to facilitate travellers. For these rest area locations, a strip of 150 meters width and 200 meters length will be reserved on either side of the Expressway.

2.2.5 Service Area

64. These locations will be provided to facilitate travellers. The restaurants and Petrol pumps will be located there to provide comfort to people using the proposed Expressway. A strip of 250 meters width and 700 meters length will be reserved for the Service Area. The toilets in the service areas will be equipped with septic tanks of sufficient capacities. Sewage of the septic tanks will be disposed of at the designated waste disposal sites.

2.3 Project Right of Way

65. The Right of Way (RoW) of the proposed Expressway Project is 100 meters wide, while it will be 300 meters at the locations where interchanges will be constructed. Major construction work will generally remain confined within the RoW. About 4800 acres of land will be acquired for the proposed Project.

2.4 Construction Materials

66. The materials used in construction and up-gradation of the Expressway would include coarse aggregates (crush), fine aggregates (sand), soil, water, asphalt, reinforcement, cement etc. Almost all these raw materials are locally available in the country. The construction material quarries are already available in the area, which have been approved by the Mines and Mineral Department, Punjab. The construction material for E-4 will be procured from these approved quarries and no new quarry will be dug by the contractor.

(i) Crushed Aggregate

67. A well developed source of crushed aggregate is available at Chiniot and Sargodha. Several medium size crushers are exploiting these quarries. The quantities available are quite large; however, mining leases have already been obtained by various parties.

(ii) Fine Aggregate (sand)

68. This is also available in abundant quantity in the nearby areas of the proposed Project. While good quality sand is available in the river bed of Ravi and Chenab and it is the main source of superior sand for construction needs, the contractor shall explore other potential sources. In case there are no viable alternative locations, specific mitigation measures shall be developed and implemented by the contractor to ensure that impacts due to sand extraction from riverbeds are minimized. Permission from the Minerals Department of Punjab province shall also be secured by the contractor prior to sand extraction.

(iii) Sub-grade Material

69. Large quantity of sub-grade (soil) is abundantly available at various locations near the Project Site. Borrow pits of suitable material at a reasonable reach will be selected.

(iv) Embankment Material

70. The embankment material can be borrowed in huge quantities in the vicinity of the Project Area. In most cases, the contractors will lease private land in the vicinity on short term basis for the purpose of acquiring earth material, after the approval of NHA designated engineer.

(v) Water

71. Groundwater is available throughout the proposed Expressway alignment. Intensive pumping is done on large scale in the vicinity of the Project Area. The surface water present in the vicinity is generally of good quality. The surface water bodies such as Ravi River and canal water is available in Project Area. The quality of the ground and surface water has been analysed in the Project Area. The laboratory results (Annexure II) show that water from both the sources is suitable for all construction requirements.

(vi) Asphalt, Reinforcement and Cement

72. Asphalt, reinforcement and cement will be transported from Khoshab, D.G. Khan, Rawalpindi, Islamabad and Karachi etc.

2.5 Engineer's Cost Estimate

73. The Engineer's Cost Estimate for the proposed Project is presented in Table 2.4.

Table 2.4: Engineer's Cost Estimate

ENGINEER'S COST ESTIMATE
(Package I-IV)

BILLS	D E S C R I P T I O N	Amount Based on CSR 2006 (Rs.) Package-I	Amount Based on CSR 2006 (Rs.) Package-II	Amount Based on CSR 2006 (Rs.) Package-III	Amount Based on CSR 2006 (Rs.) Package-IV	Total Amount (Rs.) Packages I – IV
1	Earth Work	2,316,586,885.26	2,177,131,685.55	1,680,190,876.71	201,847,304.08	6,375,756,751.60
2	Sub Base & Base	1,572,995,596.92	1,728,153,189.46	1,735,350,876.60	44,975,977.71	5,081,475,640.69
3	Surface Course & Pavement	489,554,466.50	522,942,977.70	508,203,874.20	16,820,572.99	1,537,521,891.39
4	Structures	-	-	-	-	-
4A	Subways & Box Culverts	262,703,161.45	213,681,069.48	238,302,275.68	21,698,947.56	736,385,454.17
4B	Pipe Culverts	63,688,409.65	43,309,464.55	58,343,152.76	2,604,028.83	167,943,055.79
4C	Bridges	404,121,807.63	283,353,643.91	235,683,688.51	712,734,993.72	1,635,894,133.77
4C-A	Soil Investigation For Bridges	2,062,410.00	1,409,100.00	2,357,040.00	589,260.00	6,417,810.00
4C	Flyovers	1,124,305,222.10	332,467,066.54	546,550,371.60	-	2,003,322,660.24
4C-1	Soil Investigation For Flyovers	4,124,820.00	1,178,520.00	2,062,410.00	-	7,365,750.00
4C	Interchanges	824,917,975.18	496,154,011.33	301,488,539.14	-	1,522,566,525.65
4C-1	Soil Investigation For Interchanges	1,178,520.00	589,260.00	589,260.00	-	2,357,040.00
5	Drainage And Erosion Works	157,285,978.76	173,283,655.77	151,151,731.19	12,495,188.23	494,216,553.96
5A	Installation And Commissioning Of A Complete Pumping Stations	15,640,367.08	16,617,890.02	16,617,890.02	977,522.94	49,853,670.06

ENGINEER'S COST ESTIMATE
(Package I-IV)

BILLS	D E S C R I P T I O N	Amount Based on CSR 2006 (Rs.) Package-I	Amount Based on CSR 2006 (Rs.) Package-II	Amount Based on CSR 2006 (Rs.) Package-III	Amount Based on CSR 2006 (Rs.) Package-IV	Total Amount (Rs.) Packages I – IV
5B	Laying of Feeder Line, Mainline, and Submains Of Upvc Pipes	8,894,048.30	9,342,091.87	9,333,811.87	532,734.41	28,102,684.45
5C	Laying of UV Resistant Lope Drip Lines with 4 Ltr/Hr Drippers	8,951,112.17	9,372,156.44	9,372,156.44	302,208.08	27,997,733.13
5D	Trenching and Back Filling, Puncturing of Culverts/Utilities, Testing	2,264,606.37	2,376,464.63	2,378,464.63	119,243.40	7,140,779.03
5E	Ground Cover	6,440,000.00	6,842,500.00	6,842,500.00	402,500.00	20,527,500.00
5F	Operation & Maintenance	10,914,460.00	10,874,060.00	10,874,060.00	643,215.29	33,305,795.29
6	Ancillary Works	976,999,941.33	1,019,456,984.38	911,961,044.30	29,024,584.26	2,937,442,554.27
6A	Miscellaneous Works	153,315,000.00	156,315,000.00	156,315,000.00	3,105,000.00	469,050,000.00
7	General Items	83,860,000.00	83,860,000.00	72,860,000.00	64,240,000.00	304,820,000.00
		8,490,804,788.70	7,288,710,791.63	6,656,829,023.65	1,113,113,281.50	23,449,463,983.49

2.6 Construction Schedule

74. The implementation of the Project is expected to commence in the beginning of the year 2008 and the estimated completion date will be the end of 2010. At present, the Proposed Project is at the engineering design stage.

2.7 Construction Camps

75. Camp sites will be selected keeping in view the availability of an adequate area for establishing camp sites, including parking areas for machinery, stores and workshops, access to communication and local markets, and an appropriate distance from sensitive areas in the vicinity. Final locations will be selected by the contractor after approval from NHA.

76. The area requirement for construction camps will depend upon the deployed workforce and the type and quantity of machinery mobilized. In view of the area required, it will not be possible to locate camp sites within the ROW and the contractors will have to acquire land on lease from private landowners.

2.8 Workforce and Machinery Requirements

77. The workforce and the machinery requirements are presented in Tables 2.5 and 2.6 below:

Table 2.5: Workforce Requirement for Construction (Packages I-IV)

No.	Contractors Staff	Workforce Required
A. Managerial Staff		
1	Project Manager	1
2	Deputy Project Managers	4
3	Office Managers	4
4	Accountants	4
5	Purchasers	4
6	Quantity Surveyors	4
7	Computer Operators	4
B. Site Staff		
1	Material Engineers	2
2	Site Engineers	10
3	Surveyors	10
4	Foremen	12
5	Skilled Labourers	80
6	Semi-skilled Labourers	120
7	Labourers	200
Total		459*

***** This figure is valid in case of all the construction packages are initiated at the same time.

Table 2.6: Estimated Machinery Requirements (Packages I-IV)

S. No.	Machinery	Nos.
1	Dump trucks	20
2	Graders	8
3	Dozers (D-8)	8
4	Vibratory rollers	8
5	Water boozers	12
6	Loaders	8
7	Asphalt plant	2
8	Asphalt distributor	2
9	Crushing plant	2
10	Air compressors	2
11	Broomers	2
12	Asphalt Paver	4
13	PTR	4
14	Static steel tyred rollers	8
15	Sheep foot rollers	8
15	Generators (10 KV)	4
16	Concrete batching plant	2
17	Vibrators	12
18	Concrete transit mixers	4
19	Rig (and accessories)	4
20	Tri pod	4
21	Welding plants	8
22	Concrete Bucket & Funnel	1 (each)
23	P.C Girder launcher	1
24	Form work	4 sets

*****This figure is valid in case of all the construction packages are initiated at the same time.

SECTION 3

DESCRIPTION OF THE ENVIRONMENT

3.0 General

78. The existing environment in the Project Area has been studied with respect to physical, ecological, cultural and socio-economic aspects. The data presented in this section has been gathered during December 2006 to February 2007.

79. The direct "Corridor of Impact" (CoI) due to construction of the Expressway is 328 ft. (100 metres), which is within Right of Way (RoW) of the proposed Expressway Project. However effect of loads generating from the moving traffic can be felt beyond the designed RoW. Therefore indirect CoI is beyond the proposed RoW.

80. There is no any existing road along the proposed Expressway Project; therefore baseline environment of the Project Area is free from environmental pollution such as dust, noise or vehicular emissions. This will allow the determination of baseline conditions against which the incremental impact of the proposed Project can be assessed. Human impacts such as road safety, traffic noise, vehicular emissions and other types of associated pollution are taken into consideration for the operational stage of the proposed Project. These factors are therefore discussed as part of the environmental conditions in the Project Area.

3.1 Methodology

81. The existing information to establish a baseline of the Project Area was collected from different Government Departments/Public Sector agencies. Further, detailed field visits to the site were also carried out in order to have first hand information about the social and environmental conditions/issues of the Project Area.

82. The potential impacts of the proposed Project were ranked on the basis of their magnitude, severity and reversibility.

83. In order to assess the impacts of the proposed Project on the people living in the vicinity of the Project Area, detailed survey was conducted and existing environmental/socio-economic conditions and salient features of the area were duly observed. In addition, the relevant secondary data were also obtained from the District Census Reports for Faisalabad, Toba Tek Singh, Jhang and Khanewal. During the detailed site visit, relevant government agencies/ departments (Annexure III) were also consulted for the relevant data. To establish baseline ambient air, noise and surface and groundwater conditions of the area; air and water samples for laboratory analysis were collected from locations in all four districts, whereas noise levels were measured at various locations.

84. Locations for air quality, water quality and noise sampling were selected keeping in view their vulnerability to the proposed Project related impacts. These locations were distributed equally in all four districts.

3.2 Physical Environment

3.2.1 Meteorology

85. The climate of the Project Area touches two extremes, characterised by hot summers and mild winters. From April onwards, the summer season continues usually up to the middle of October after which it becomes cool and the day temperature also begins to recede. May, June and July are the hottest months. The winter season on the other hand starts from November and continues till March. December, January and February are coldest months.

86. The mean maximum and minimum temperature in summer are 41 ^{o}C and 27 ^{o}C respectively and in winter 19 ^{o}C and 4 ^{o}C respectively.

87. Table 3.1 shows the temperature, precipitation and relative humidity recorded at Faisalabad for the period of 30 years.

Table 3.1
Month-Wise 30 Year Mean Maximum and Minimum Temperature, Precipitation and Humidity Data (Faisalabad, Toba Tek Singh and Jhang)

Month	Mean Temperature (^{o}C)		Precipitation (Millimetres)	Relative Humidity (%)
	Maximum	Minimum		
January	19.4	4.1	11.5	66.0
February	21.9	7.1	20.1	61.2
March	26.7	12.3	25.7	58.2
April	33.5	18.0	16.9	46.5
May	38.4	22.7	16.1	37.5
June	40.5	26.9	27.9	41.7
July	37.1	27.0	115.0	61.5
August	36.1	26.6	89.8	65.9
September	35.7	23.7	28.6	59.9
October	33.0	17.0	3.8	54.7
November	27.2	10.1	3.0	62.7
December	21.4	5.1	8.6	66.5
Annual (Average)	30.9	16.7	372.3	56.8

Source: Data Processing Centre, Pakistan Meteorological Department, Karachi, 1961 – 90 (District Census Reports – Faisalabad, Toba Tek Singh and Jhang)

88. The above data represent the temperature, precipitation and relative humidity for Faisalabad, Toba Tek Singh and Jhang as they are close to one another therefore data given in District Census report is same. The mean maximum and minimum temperatures in June (the hottest month) are 40.5 ^{o}C and 26.9 ^{o}C respectively and in January (the coldest month), 19.4 ^{o}C and 4.1 ^{o}C respectively as per records for the 30 year period (1961-1990).

89. The Project Area has very few rainfalls. The summer season continues from July to September and the winter season from December to April. The bulk of monsoon precipitation occurs in July and August, with monthly averages of 115.0 and 89.8 mm respectively. Minimum rainfall occurs in the month of November, which is 3.0 mm.

Table 3.2
Month-Wise 30 Year Mean Maximum and Minimum Temperature, Precipitation and Humidity Data (Khanewal)

Month	Mean Temperature (^{o}C)		Precipitation (Millimetres)	Relative Humidity (%)
	Maximum	Minimum		
January	21.0	4.5	7.2	62.3
February	23.2	7.6	9.5	56.4
March	28.5	13.4	19.5	51.6
April	35.5	19.5	12.9	40.1
May	40.4	24.4	9.7	33.2
June	42.3	28.6	12.3	39.9
July	39.2	28.6	61.3	56.0
August	38.0	28.0	32.6	59.7
September	37.2	24.9	10.8	56.3
October	34.6	18.2	1.7	51.6
November	28.5	10.9	2.4	61.4
December	22.8	5.5	6.9	66.6
Annual (Average)	33.6	17.8	186.8	52.9

Source: Data Processing Centre, Pakistan (District Census Report Khanewal)

3.2.2 Air Quality

90. The air quality in the Project Area is mostly free from pollutants except dust on the roads where interchanges and flyovers are proposed. A lot of dust occurs due to dry atmosphere and the situation gets aggravated by the human activity. Large amount of suspended particulate matter (SPM) is generated when the vehicles move (to overtake other vehicles) on unpaved shoulders of these roads. The proposed Project will not cause any dust problem due to smooth road surface and paved shoulders.

91. For establishing baseline ambient air quality conditions, seven monitoring sites were selected. The air sample collection locations are as under:

1. Faisalabad-Sargodha Road (starting point of M4)
2. Painsera-Jhang Road (Chainage: 34+600)
3. Gojra-Jhang Road near Bhatta Stop (Chainage: 58+100)
4. Toba-Wariam Road (Chainage: 93+700)
5. Cantt. Road Shorkot near Shorkot Rice and General Mill (Chainage: 118+700)
6. Near Bank of Ravi River; (Chainage: 145+200) and
7. Khanewal-Multan Road, N-5 (Chainage: 184+000)

Table 3.3
Ambient Air Quality Monitoring

#	Parameter	Average Test Results at Sampling Locations							Unit	Duration (hours)	USEPA Standards
		Location 1	**Location 2**	**Location 3**	**Location 4**	**Location 5**	**Location 6**	**Location 7**			
1.	CO	1.20	0.33	0.70	0.40	0.58	0.33	1.04	ppm	24	35 (one hour average)
2.	NO_2	0.02	<0.01	0.02	<0.01	0.01	<0.01	0.02	ppm	24	0.053 (annual arithmetic mean
3.	SO_2	0.02	<0.01	0.01	<0.01	0.01	<0.01	0.01	ppm	24	0.14
4.	PM_{10}	**266.30**	142.66	**228.50**	111.52	135.24	142.66	287.80	$\mu g/m^3$	24	**150**
Location 1: Faisalabad – Sargodha Road						**Location 2:** Painsara – Bhawana Road					
Location 3: Gojra – Jhang Road (near Bhatta stop)						**Location 4:** Toba – Warriam Road					
Location 5: Shorkot City – Shorkot Cantt Road						**Location 6: Mozah Shahadat Kundala**					
Location 7: Khanewal-Multan Road											
Source: SGS Laboratory Test Results 2007											

92. Sampling locations were selected near existing road areas and calm places at agriculture fields. Sampling was conducted for 24 hour period. Samples were taken at downwind side and from 5 – 10 metres from the edge of the road. During sampling, average temperatures were 15 and 25^0C respectively. Sampling locations and laboratory reports are provided in Annexure II. Results of laboratory analysis of ambient air quality parameters are given in Table 3.3.

93. As ambient air quality standards have not yet been developed in Pakistan, therefore for comparison, USEPA standards are referred.

94. Table 3.3 indicates that the value of PM_{10} exceeds the USEPA Standard on :Faisalabad – Sargodha Road, Gojra – Jhang Road and Mauza Shahadat Kundala. This may be due to the PM_{10} emissions from the vehicular traffic and dispersion of dust (deposited on these roads) due to running of the vehicles.

3.2.3 Noise

95. As the existing status of the Project area is mostly agricultural fields and some road crossings therefore noise is serious issue only at road crossings. The average value of noise along the road crossings close to NEQS and WHO limits and is expected that in the construction and operation phase this will go beyond limits. Roadside noise levels were measured from the edge of the road (about 7.5 m from the source). Average noise level along the road is between 40 – 67 dB(A), whereas peak noise level is between 61 – 100 dB(A). Table 3.4 and 3.5 presents the maximum, minimum and average noise levels recorded at different locations. Average values for the section are all well within the NEQS i.e. 85 dB(A). However maximum noise levels are in proximity of the WHO Guideline value which is 70 dB(A).

Table 3.4
Noise Levels at Various Locations

Sr. No.	Time	Faisalabad Sargodha Road Noise Level dB(A)			Painsera-Bhawana Road Noise Level dB(A)			Gojra Jhang Road near Bhatta Stop Noise Level dB(A)			Toba-Jhang Road Noise Level dB(A)			NEQS dB(A)	WHO dB(A)
		Min.	Max.	Average	Min.	Max.	Average	Min.	Max.	Average	Min.	Max.	Average		
1	12:00	76.6	70.3	56.5	67.6	73.3	56.5	76.3	91.4	52.2	66.3	82.5	55.3	85 (7.5 from the source)	70 (for Industrial, commercial, shopping and traffic areas) 55 (for residential areas, schools and hospitals)
2	13:00	65.5	72.4	58.6	65.5	72.4	58.6	75.8	90.2	49.5	63.2	77.5	51.2		
3	14:00	78.8	92.8	60.8	65.4	77.4	47.8	72.1	88.2	50.0	65.3	79.7	50.2		
4	15:00	79.7	95.4	59.6	60.6	75.5	5.5	78.4	84.4	50.2	61.2	79.5	45.7		
5	16:00	77.6	93.2	58.5	63.3	72.3	53.4	76.2	91.0	50.3	60.1	73.2	44.5		
6	17:00	78.1	96.8	60.1	62.2	71.2	49.3	74.7	91.2	52.2	59.2	71.5	43.2		
7	18:00	70.6	80.4	55.7	65.8	62.1	50.0	76.3	90.5	49.5	59.7	70.5	43.7		
8	19:00	76.3	96.4	61.6	55.9	60.7	51.9	60.2	74.1	43.6	-	-	-		
9	20:00	80.0	98.5	64.7	57.9	63.3	49.1	65.0	79.0	40.0	-	-	-		
10	21:00	79.0	98.0	63.0	58.7	64.2	48.3	70.0	90.0	44.0	-	-	-		
11	22:00	89.0	99.0	59.3	61.6	64.0	47.7	62.1	77.0	48.0	-	-	-		
12	23:00	75.1	100.0	60.2	59.1	60.0	45.5	64.0	78.0	42.6	-	-	-		
13	24:00	77.3	87.1	62.7	55.2	59.0	43.9	70.4	82.0	52.3	-	-	-		
14	01:00	76.5	86.3	61.9	57.9	61.1	48.4	63.3	74.0	47.9	-	-	-		
15	02:00	83.7	85.4	63.0	59.8	62.4	45.2	64.4	84.0	42.1	-	-	-		
16	03:00	80.9	75.6	65.1	58.7	62.5	44.1	60.1	78.0	49.7	-	-	-		
17	04:00	81.8	72.6	67.7	54.0	64.2	45.7	65.0	82.1	50.9	-	-	-		
18	05:00	78.9	70.7	63.9	56.1	65.1	47.8	72.7	90.2	56.3	-	-	-		
19	06:00	79.0	65.5	62.3	63.3	67.0	48.9	72.1	86.6	53.5	-	-	-		
20	07:00	72.1	63.9	59.2	67.7	70.8	53.7	69.8	84.4	52.6	64.1	79.5	53.3		
21	08:00	75.3	77.2	60.4	68.8	69.7	51.1	77.3	92.4	55.1	64.5	80.1	54.2		
22	09:00	77.5	94.1	63.6	66.7	70.9	55.3	76.1	92.4	53.7	62.3	78.9	53.3		
23	10:00	80.7	95.6	65.1	67.6	70.3	56.5	76.3	91.4	52.2	58.3	74.5	50.3		
24	11:00	78.3	90.3	67.9	65.5	72.4	58.6	75.8	90.2	49.5	69.3	82.1	55.1		

Source: SGS Pakistan (Pvt.) Limited

Table 3.5
Noise Levels at Various Locations

Sr. No.	Time	Toba-Warriam Road Noise Level dB(A)			Mozah Shahadat Kundala			NEQS dB(A)	WHO dB(A)
		Min.	Max.	Average	Min.	Max.	Average		
1	12:00	76.6	91.4	64.7	47.8	65.0	52.5		
2	13:00	76.3	91.5	59.2	48.1	62.7	55.3		
3	14:00	76.6	90.8	64.7	49.5	60.9	54.2		
4	15:00	76.8	91.0	64.7	47.3	66.3	54.8		
5	16:00	78.3	91.0	66.7	46.7	65.1	53.1		
6	17:00	76.6	91.4	64.3	43.5	62.3	52.7		
7	18:00	75.3	89.2	62.2	42.1	60.3	50.2		
8	19:00	78.3	92.4	63.1	-	-	-		
9	20:00	75.1	89.6	67.4	-	-	-		
10	21:00	71.6	84.8	64.3	-	-	-		70 (for Industrial, commercial shopping and traffic areas)
11	22:00	76.1	92.4	61.4	-	-	-		
12	23:00	73.4	85.1	66.0	-	-	-	85 (7.5 m from the source)	
13	24:00	73.2	84.4	67.1	-	-	-		55 (for residential areas, schools and hospitals)
14	01:00	75.8	82.6	64.4	-	-	-		
15	02:00	77.6	90.0	70.2	-	-	-		
16	03:00	76.5	83.4	63.1	-	-	-		
17	04:00	74.0	80.1	60.0	-	-	-		
18	05:00	75.1	84.2	65.5	-	-	-		
19	06:00	73.3	80.1	62.1	-	-	-		
20	07:00	79.9	85.5	64.3	45.1	64.1	57.1		
21	08:00	70.3	83.2	66.7	44.9	63.3	52.4		
22	09:00	71.2	82.5	65.9	47.6	62.2	53.6		
23	10:00	73.7	85.5	67.2	52.7	61.6	54.7		
24	11:00	73.2	86.5	62.4	50.1	70.0	56.9		

3.2.4 Surface Water and Groundwater

96. The main sources of water in the Project Area are Ravi River and Chenab River. The canals and water courses system from these two sources is the main irrigation system in the Project Area. The Jhang Branch, Guggera Branch and Burala Branch are the major irrigation system for the Project area. This system irrigates the land of the Project Area in Faisalabad, Jhang and Toba Tek Singh districts, where as the Project Area in Khanewal district is irrigated through Sadhnai canal and Abdul Hakeem distributary. The Sadhnai canal and Abdul Hakeem Distributary are very important sources of irrigation in Khanewal district. The proposed Expressway will cross Ravi River and Sadhnai Canal at 145+250 Km and 145+900 Km respectively. Two bridges on these locations are also proposed to be constructed.

97. Jhang Branch, Guggera Branch and Burala Branch, Sadhnai Canal system and Abdul Hakeem distributary are the major irrigation source for all four districts. The land is also irrigated by tubewells in the Project Area.

98. Small scale waterlogging and salinity problems were also observed in the Project Area in Khanewal district, but none of these areas comes in the Expressway alignment. These waterlogged and saline areas are more than one kilometre far from the Expressway alignment.

99. Ground and surface water samples from the Project Area were collected and analysed in laboratory. According to the ground water results, most of the water in the area does not meet drinking water quality as prescribed in WHO standards. The concentration of Total Dissolved Solids (TDS), Chloride (Cl) and Sodium (Na) quite high and in Ameenpur, Faecal Coliform (E.Coli) was also found in ground water. The surface water in the Project Area is good for agricultural and all the parameters are within the limits prescribed in NEQS. The people of the Project Area use ground and surface water for their drinking and other needs of life. The surface and ground water present in the area will be used for construction works, however for drinking needs, filtered water will be provided to workers at those locations, where water is not suitable for drinking. The results of ground and surface water analysis are presented in Tables 3.6 and 3.7 respectively. Following are the surface water channels in the Project Area:

1. Jhang Branch Canal (32+600);
2. Dhaular Distributary m (44+600)
3. Nawabwala Distributary (48+500);
4. Titranwala Distributary (54+250);
5. Bhango Distributary (73+500);
6. Khewra Distributary (82+200);
7. Trimo Link Canal (111+000);
8. Haweli Canal (112+200);
9. Darkhana Distributary (131+350);
10. Goraga Distributary (144+900); and
11. Ravi River (145+250).

Table 3.6 – Surface Water Sampling						
Sr.No.	**Parameters**	**Ameen Pur near Check Post**	**Tama Bangla Canal (Gojra Jhang Road)**	**Toba Wariam Road Chak No.400**	**Bank of Ravi River (near Gas Station)**	**NEQS Limits**
A. Chemical Parameters						
1	pH (mg/L)	8.83	8.93	8.86	7.58	06-09
2	Biochemical Oxygen Demand (BOD_5)	7	9	12.5	29	80
3	Chemical Oxygen Demand (COD)	15	16	20	68	150
4	Total suspended solids (TSS)	20.5	31	45	323	200
5	Total dissolved Solids (TDS)	175.5	175	170	410	3500
6	Chloride (Cl)	10.64	10.64	9.75	60.8	1000
7	Fluoride (F)	ND	0.21	0.28	0.07	10
8	Dissolved Oxygen (DO)	4	4.5	5.6	11.2	-
9	Conductivity	309.5	293	288	595	-
10	Nitrates (NO_3)	4.2	4.3	4.3	0.1	-
11	Nitrites (NO_2)	ND	ND	ND	-	-
12	Sodium	7	7	8	1.0	-
13	Taste	Tasteless	Tasteless	Tasteless	-	-
14	Odor	Odorless	Odorless	Odorless	-	-
15	Total Alkalinity	115	110	125	-	-
16	Color	Colorless	Colorless	Colorless	-	-

17	Turbidity	10	15	28	-	-
18	Hardness	130	140	150	-	-
B. Micro-Biological Parameters						
1	Total Colony Count	TNTC/ ml	TNTC/ ml	780/ ml	-	*
2	Total Coli Forms	TNTC / 100 ml	TNTC / 100 ml	TNTC / 100 ml	-	*
3	Faecal Coliforms (E.Coli)	24/ 100 ml	6/ 100 ml	3/ 100 ml	-	*
4	Faecal Streptococci/Enterococci	Absent/ 100 ml	Absent/ 100 ml	Absent/ 100 ml	-	*

Table 3.7 – Ground Water Sampling

Sr.No.	Parameters	Faisalabad Sargodha Road	Painsera Bhawana Road	Gojra Jhang Road	Toba Wariam Road	Cantt Road Shorekot	Bank of Ravi River	Khanewal Multan Road	WHO Limits
A. Chemical Parameters									
1	pH (mg/L)	7.95	7.73	8.51	8.42	7.88	7.69	8.13	6.5 - 8.5
2	Total Dissolved Solids (TDS) (mg/L)	2023	369	3915	34.98	1495	243	947	1000
3	Chloride (Cl) (mg/L)	524.7	10.86	825.9	740.91	489.2	37.4	159.1	250
4	Hardness (mg/L)	330	300	137.5	90	465	155.5	366.7	NS
5	Nitrates (NO_3) (mg/L)	6.7	5.5	14	11	5.7	-	-	50
6	Sodium (mg/L)	541	16	1040	1090	286	-	-	200

7	Turbidity (NTU)	ND	ND	ND	ND	ND	4	22	5
8	Fluoride (F) (mg/L)	0.91	0.31	1.04	0.54	0.6	-	-	1.5
9	Nitrites (NO_2) (mg/L)	ND	ND	ND	ND	ND	-	-	3
10	Arsenic (As) (mg/L)	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	0.01
B. Micro-Biological Parameters									
1	Total Colony Count	TNTC/ ml	3510/ ml	TNTC/ ml	TNTC/ ml	1812/ ml	-	-	*
2	Total Coli Forms	01/100 ml	Absent/100 ml	Absent/100 ml	TNTC/ 100 ml	53/100 ml	-	-	*
3	Faecal Coliforms (E.Coli)	Absent/100 ml	Absent/100 ml	Absent/100 ml	Absent/100 ml	Absent / 100 ml	-	-	*
4	Faecal Streptococci/Enterococci	Absent/100 ml	Absent/100 ml	Absent/100 ml	Absent/100 ml	Absent / 100 ml	-	-	*

3.2.5 Topography and Geology

100. Topography of the Project Area is totally flat with mild slope from North to South. Project Area is 500 metre above the mean sea level. The soil of all four districts is fertile. The soil in the Project Area is rich alluvial loam. In Jhang district soil is part of Sandal Bar except rock that is not in Project Area. The sand is abundant in Ravi and Chenab river bed and this sand is superior for building material.

3.2.6 Seismicity

101. According to the seismic zoning map of Pakistan, the Project Area lies in Zone 1 of Modified Mercalli (M.M.) intensity scale, i.e. minor damage. Distant earthquakes may cause damage to structures with fundamental period greater than 1.0 second, corresponds to intensity V and VI of the M.M. scale as given in Fig. **3.1**.

3.2.7 Agriculture and Crop Pattern

102. Agriculture along E-4 is predominantly irrigated agriculture. The Project Area depends on perennial canals from Sagir Head Works and Abdul Hakeem Head Works. The shortage of water is generally experienced in winter and in sowing season it greatly hampers Kharif cultivation.

103. The Project Area of E-4 Expressway passes through four districts. Cropping patterns in these districts are different from each other. In Faisalabad Sugarcane and Fodder is Kharif crop. In Toba Tek Singh Sugarcane, Maize, and Rice are Kharif crops. In Khanewal district Kharif season crops are Cotton, Rice and Sugarcane. Wheat is predominantly Rabi season crop of all areas. Table 3.8 represents the major crops and respective Tehsils of the Project Area. Cotton is also grown in some areas of Khanewal and Toba Tek Singh. Vegetables are grown in some areas of Faisalabad and Toba Tek Singh. Citrus orchards are found in district Toba Tek Singh and mango orchards are found in district Khanewal.

Table 3.8
Major Crops/ Cropping Pattern in the Project Areas

S. No.	Tehsil	Cropping Pattern	
		Rabbi	Kharif
1	Faisalabad	Wheat, Fodder	Sugarcane, Fodder, Rice, Potato
2	Gojra(District Toba Tek Singh)	Wheat, Vegetables	Sugarcane, Cotton, Fodder, Potato
3	Toba Tek Singh	Wheat, Fodder	Sugarcane, Cotton, Fodder
3	Shorkot	Wheat, Fodder	Rice, Sugarcane, Cotton
4	Kabir wala (District Khanewal)	Wheat, Gram	Rice, Cotton, Fodder, Vegetable
5	Khanewal	Wheat, Gram	Cotton, Rice, Sugarcane, Maize

Courtesy: Agriculture Extension Departments (Faisalabad, Toba Tek Singh, Jhang and Khanewal)

3.2.8 Industrial and Commercial Activities

104. The route of E-4 has been designed through agriculture fields therefore chances of commercial units along the route are negligible. Faisalabad the starting point of E-4 is famous all over the world for its textile industries but no textile unit is presently situated along the route. In districts of Toba Tek Singh and Jhang, very little commercial units i.e. only a

few sugar mills and spinning units but none of them are along the RoW of the proposed Project. In Khanewal district Roshe Power Plant, a hatchery and pesticide factory in the vicinity of the route where the route crosses Kabirwala-Khanewal road.

3.3 Ecological Resources

3.3.1 Flora

105. The Project Area falls under the Tropical Thorn Forest however, the natural vegetation has been replaced by the agricultural crops. Major crops grown in the area include wheat, oilseeds and fodder during winter, and sugar cane, maize, rice, fodder, and cotton in summer.

(i) Trees: Citrus and guava orchards are common towards the north eastern side, replaced by mango orchards towards south western end. Tree plantation campaigns have motivated the farmers to grow trees along the field borders or along the water channels. A total of 18000 trees were estimated to be growing in the project area. Shisham (Dalbergia sissoo) and Kikar (Acacia nilotica) are the main species. Other species growing in the area are Eucalypts (Eucalyptus camaldulensis), Semul (Bombax ceiba), Bakain / Dharek (Melia Azedarac), Jaman (Syzigium cumini), Sukh chain (Pongamia glabra), Mulberry (Morus alba), Beri (Ziziphus mauritiana) and Khajoor (Phoenix dactylifera). Roadside plantations running parallel or across the project area include Shisham, Kikar, Farash (Tamarix aphylla) and Eucalyptus. Bohr (Ficus bengalensis), Neem (Azadiracta indica), Ber and Bakain are commonly planted at the farm houses.

(ii) Natural Vegetation: Natural vegetation including Karir (Capparis aphylla), Aak (Calotropis procera), Kana (Saccharum bengalensis), Khabbal (Cynodon dactylon), Lamb (Aristida depressa), Gorkha (Lasiurus sindicus) is present only in the graveyards or at open areas along the existing roads and canals. Mesquit (Prosopis glandulosa) has invaded many open areas. Koondar (Typha angustata) grows along water ponds and wet places.

3.3.2 Fauna

i) Mammals

106. Naturally occurring mammals have also been eradicated with the removal of natural Tropical Thorn Forests only the agriculture associated species remain. Jackal (Canis aureus), Mongoose (Herpestes edwardsi and H. javanicus), Jungle cat (Felis chaus), Hedgehog (Hemiechinus collaris) and Five striped Palm squirrel (Funambulus pennantii) commonly occur. Porcupine (Hystrix indica) also occurs in the area. Small mammals including Bandicoot or Indian mole rat (Bandicota bengalensis), Soft furred rat (Millardia meltada), Field mouse (Mus musculus), Indian gerbil (Tatera indica), and House shrew (Suncus murinus) are the common pests of agricultural crops.

107. Domestic livestock include buffalo, cattle, goats and sheep. Donkeys are kept to pull carts in the area. Some farmers are also engaged in horse breeding. Camel may be found occasionally. Livestock are mainly farm fed. Goats and sheep herds may be raised by feeding on wastelands.

ii) Reptiles

108. Cobra (Naja naja), Saw scale viper (Echinus carinatus), Russell's viper (Daboia russelii russelii) Du-muhi (Eryx johnii) and Striped keelback (Amphiesma stolatum) are

known to occur in the area. House gecho (Hemidactylus brooki) is common. Common tree lizard (Calotes versicolor versicolor) may also occur in orchards. Monitor Lizard (Varanus bengalensis) and Fat tailed lizard (Uromastix hardwickii) occur in open areas. Two species of fresh water turtles viz., Indian soft–shell (Aspideretes gangeticus), and Indian flapshell (Lissemys punctata andersoni) have been reported. They are usually present near the ponds, canals and in the fields during the wet season.

iii) Amphibians

109. Bullfrog (Hoplobatrachus tigerinus), Pahari tidda maindak (Fejervarya limnocharis) and Indus valley toad (Bufo stomaticus) are also present in the area.

iv) Birds

110. Because of intensive agriculture pesticide use is a common practice. This has impacted the bird populations adversely. Black and Grey partridges (Francolinus francolinus and F. pondicerianus), are the worst hit as they are also hunted and captured to be kept as pets. Species known to occur in the area are: Cattle egret (Bubulcus ibis), pond heron (Ardeola grayii), Common and Bank myna (Acridotheres tristis and A. ginginianus), Red vented bulbul (Pycnonotus cafer), Jungle babbler (Turdoides striatus), Blyth's reed warbler (Acrocephalus dumetorum), Indian great reed warbler (A. stentoreus), Black kite (Mivus migrans), Black shouldered kite (Elanus caeruleus), Koel (Eudynamys scolopacea), Black drongo or King crow (Dicrurus macrocercus) Common crow (Corvus splendens), and house sparrow (Passer domesticus). Common quails (Coturnix coturnix) visit the area on their spring and winter migration.

3.3.3 Wetlands

111. There are no wetlands of significance in the vicinity of the Project Area. Sidhnai Barrage on the Rive Ravi is located about 4 km from the alignment of the Project Area near Abdul Hakim, but the wetland hardly ever gets the migratory waterfowl. Migratory waterfowl may however visit in small numbers the bed of River Ravi crossing the Project Area near Abdul Hakim during winter.

112. The Proposed road section also crosses canals and distributaries. Such areas do not support any populations of waterfowl; however canalside plantations support the population of song birds, species as already described.

3.3.4 Aquatic Biota

113. Aquatic fauna reported from the rivers and canals of the Project Area is mainly fish, which include the carp fishes viz., mori (*Cirrhinus mrigala*), thaila (*Catla catla*), rohu (*Labeo rohita*), silver carp (*Hypophthalmichthys molitrix*), gulpham (*Cyprinus carpio*), grass carp (*Ctenopharyngodon idella*) catfishes viz., malli (*Wallago attu*), khagga (*Rita rita*), macchva (*Bugarius bugarius*), sanghara (*Mystus sienghala*) and exotic now naturalized tilapia species (Tilapia mozambica, T. nilotica, T. nilotica).

114. The welfare of fish depends on the availability of food which occurs in the form of invertebrate groups including Rotifers (*Brachionus, Synchaeta, Asplanchna*), Oligochaetes (*Stylaria, Nais*), Crustaceans (*Daphnia magna, D. longispina, Cyclops* sp.) and insects belonging to groups like Ephemeroptera, Plecoptera, Odonata, Megaloptera, Trichoptera, Diptera, Hemiptera and Coleoptera. The fauna is similar to that found in the fish farms established in central Punjab and in standing water.

115. The aquatic flora in the Project Area consists of species usually found in the standing water along the canals and fish ponds including *Typha angustata, Polygonum flaccidum, Vallisneria spiralis, Potamogeton graminea, P. crispus, Hydrilla verticillata, Monochoria vaginalis.* No rare or endangered species occur in the Project Area.

3.3.5 Sensitive Areas

116. The nearest Protected Areas in the vicinity of the Project Area are Shorkot and Khanewal Irrigated Forest Plantations both located eight and ten kilometers from the alignment of the Project Area. Figure 3.2 shows locations of protected plantation along the E-4 alignment.

117. Shisham and Eucalyptus are grown as commercial crops. Both the plantations have been declared as Wildlife Sanctuaries. Black and Grey partridges, song birds, birds of prey, Wild boar, Jackal, Wild cat, Desert hare, Mongoose and Porcupine commonly occur. Cobra, Viper, Krait and Coluberids are the snakes. Hunting is not allowed in the Wildlife Sanctuaries but poaching is not uncommon.

i) Wildlife Sanctuaries: The Wildlife Sanctuaries are too far away from the Project Area to be affected in any significant manner.

ii) Archaeological site: There are no known sites of Archaeological or Cultural importance located within 1 Km of the Project Area.

iii) Wet Lands: There are no major wet lands in the Project Area. Small ponds were however observed to be scattered along the entire route of the Project.

3.3.6 Endangered Species

118. There are no faunal or floral species included in the Red Data Book of IUCN. Population of all bird species including black and grey partridges has however been reduced due to pesticide sprays on agricultural crops. Shisham trees have been dying off mainly because of drought conditions and may be due to some unknown disease which has not as yet been identified hence the number of Shisham trees has greatly been reduced in recent years. Eucalyptus has been blamed for transpiring excess water from the aquifer and as a result Government as a policy matter has forbidden it's planting on good lands especially along irrigated agricultural lands. Its planting in waterlogged and saline areas is advocated. Such areas hardly exist in the Project Area.

3.4 Socio-economic Environment

119. Expressway passes from rural areas of the Punjab and socio cultural conditions of all districts are almost same. Most of the people living in the surrounding villages are farmers, *Punjabi* is their mother tongue. In some areas *Saraiki* is also spoken as mother tongue. In almost all areas dress patron is same, *Shalwar kameez* and *dothi kurta* are the common dresses of males and females. Some modern young males also wear pants and shirts. The history of colonization exercised a profound influence on socio-economic pattern of the areas. People belong to different races but due to frequent inter-marriages, these castes have intermingled and it is now difficult to distinguish their entity and thus tribal system is no more dominated in the culture. In fact a common culture has emerged. Most of the people are engaged in agriculture or agro based businesses. Almost all the land holders have landholding size around 10 Acres therefore they belong to lower middle class. The information given in this section is collected in the socioeconomic survey conducted between January 2007 and February 2007.

3.4.1 Demographic Profile

(a) Faisalabad Tehsil

120. Total population of Faisalabad Sadar Tehsil was 924,110 with a growth rate of 1.94% as recorded in 1998 Census. Population composition was 108 females as compared to 100 males. 97% of the population resided in rural areas and just 3% lived in rural areas. Average household size was 7.4.

(b) Gojra

121. This Tehsil had a population of 495,096 with a growth rate of 1.94%, as recorded in 1998 Census. Population composition was 105 females compared to 100 males. 24% population resided in urban areas and 76% lived in rural areas. Average household size was 7.2.

(c) Toba Tek Singh

122. Total population of the Tehsil was 617,035 with a growth rate of 2.07% as recorded in 1998 Census. Population composition was 107 females compared to 100 males. 90% of population resided in rural areas and just 10% lived in urban areas. Average household size was 5.6.

(d) Shorkot

123. Tehsil had a population of 670,255 with a growth rate of 2.23% as recorded in 1998 Census. Male to female ratio was 108:100. Eighty five (85) % of population resided in rural areas and 15% lived in urban areas. Average household size was 6.9.

(e) Kabirwala

124. Total population of the Tehsil was 659,612 with a growth rate of 2.19% as recorded in 1998 Census. Population composition was 107 females compared to 100 males. 15% population resided in urban areas and 85% lived in rural areas. Average household size was 7.3.

3.4.2 Settlement Patterns

125. E-4 starts from Faisalabad distric and Ends in Khanewal district. It passes from tehsil areas of Faisalabad, Gojra, Toba Tek Singh, Shorkot, Kabirwala and Khanewal. In tehsils of Faisalabad, Gojra and Toba Tek Singh, people live in villages and a few people live in their farm houses (Bhanis, Deras), therefore very few house and civic structures is coming in the Row. On the other hand in tehsils of Shorkot, Kabirwala and Khanewal, there is no formal pattern of villages establishing and people make their homes in their agriculture lands which is colloquially called Dera or Bhani, in this portion of road many houses and residences are coming in the RoW.

3.4.3 Races and Tribes

126. The population of these all districts is derived from Semitic or from indo-Aryan races. Most of these tribes are predecessors of different tribes who came with different attackers from Afghanistan and Central Asia and remained here. In colonial age British government developed canal command systems in these districts and did first land reforms in 1902. At that time British government allotted agricultural land to different farmer tribes and settled them here by bringing them here from different central districts of the combined Punjab like

Sialkot, Amratsar, Gurdaspur, Gujranwala, Gujrat and other areas. At the time of partition in 1947 (the largest migration of human history) many refugees from Indian Punjab also settled in these areas. These tribes who came here from different regions were also of same clan who used to already live here. By living here side by side from centuries, homogeneity of culture and races has been developed among these people because of blood relations with each other. Generally these tribes can be divided in two classes, farmer tribes and non farmer tribes. Farmer's tribes are those who are mainly involved in farming and non farmer's tribes are those who are engaged in allied agro professions.

3.4.4 Indigenous People

127. Although people living around the project areas belong to different races and tribes and have different cast pattern but there is no community identified who has close culture, close economy and close community (Confined to a limited area). Therefore no any indigenous community exists and there is no danger of elimination or affecting negatively of any community by the proposed project execution.

3.4.5 Caste System

128. Project Area lies in rural areas of the Punjab. Following caste and tribes were identified during the field survey.

Table 3.9
List of Different Castes in Respective Tehsils

S. No.	Tehsils	Castes
1	Faisalabad	Sayyed, Jatt, Arain, Malik, Rajput,Sheikh
2	Gojra	Sayyed, Jatt, Arain, Malik, Rajput, Sheikh
3	Toba Tek Singh	Sayyed, Jatt, Arain, Malik, Rajput, Sheikh
4	Shorkot	Sayyed, Naul, Supra, Sheikh
5	Kabirwala	Sayyed, Haraj, Gill, Mohanas, Wahlas, Noon, Rajput Sanghara, Bandash, Mughal, Sheikh
6	Khanewal	Sayyed, Haraj, Gill, Sanghara, Bandash, Mughal, Sheikh

Source: EIA Field Survey Team (NESPAK)

3.4.6 Religion

129. Religion plays a vital role in people's life. Majority of the Project Area population is Muslim. Cultural festivals are mostly related with religious traditional events. The visit to shrines (termed as Ziarat) is a very common among people. Only minority identified are Christian in the areas which are less than 1 percent.

3.4.7 Socio-economic Survey

130. The information regarding socio-economic conditions is derived from primary and secondary sources. Methodology adopted for survey was based on collection of comprehensive information by utilization of all available resources with time effectiveness. The detailed socioeconomic survey was conducted from 19.01.2007 to 27.01.2007 to analyse the socioeconomic impacts and the concerns of the people of the Project Area. Following methodology was opted for socioeconomic survey, census of all affectees and development of baseline socio-economic conditions.

3.4.8 Methodology

131. To study the socioeconomic condition of the project area all available resources were utilized for this purpose first of all reconnaissance survey was conducted by the Consultant

team. Then a comprehensive field survey was carried out afterward. During this survey, primary data was collected through following data collection tools:

(i) Village Profile
(ii) Household census survey
(iii) Survey of all commercial structures
(iv) Socio-economic survey
(v) Women survey

132. Village profile, which contained comprehensive socio-economic information regarding village was filled for all the villages situated along the route. Household survey forms and commercial forms were filled by all the houses and commercial units which were falling within the RoW. To develop the socio-economic baseline, socio-economic survey and women survey were carried out from 200 males and 100 females randomly from all areas along the Project route.

133. Beside this primary information collected directly from the field. Information from secondary sources was also collected. For this purpose all available documents were studied i.e. (District Population Census Reports 1998 for the concerned districts, Design utility folders, prepared by the design Engineering consultants, IUCN literature and Asian Development Bank Guidelines for socio-economic survey. Meetings were done with the officials of revenue, agricultural and irrigation departments; feed back of all these meetings is also kept in view in study of socio-economic environment.

3.4.9 Analysis of the Respondents

134. Totally 200 questionnaires were filled from males and 100 from females at different locations in the Project Area. In these respondents people from all walks of life was included like residents of surrounding localities, passengers, key influential persons, protagonists of the village communities, women and all possible potential stakeholders. These respondents were representative of all walks of life with different professional back grounds. These people are also consulted regarding problems forecasted by them by the construction of E-4. Beside this focus group sessions were also carried out in the villages adjacent to the RoW to know the view point of general public.

3.4.10 Population Composition

135. Following population composition: male to female population ratio is based on the finding of data collected from the field.

Table 3.10
Population Composition

S. No.	Tehsils (Talukas)	Male(%age)	Female(%age)	Total
1	Faisalabad	52	48	100
2	Gojra	49	51	100
3	Toba Tek Singh	51	49	100
4	Shorkot	52	48	100
5	Kabirwala	52	48	100
6	Khanewal	51	49	100

Source: EIA Field Survey Team (NESPAK)

3.4.11 General Profile

136. Out of the 200 male respondents, 71% were married, 29% were unmarried, 55% were literate, 45% were illiterate, 63% were employed and 37% were unemployed (including students). Table 3.11 presents the general demographic profile of the Project Area.

Table 3.11
General Profile of Male Respondents

S. No.	Respondents	No.	Percentage (%)
1	Married	142	71
2	Unmarried	58	29
3	Literate	111	55
4	Illiterate	89	45
5	Employed	126	63
6	Unemployed	74	37

Source: EIA Field Survey Team (NESPAK)

137. Out of the 100 female respondents, 67% were married, 31% were unmarried, 31% were literate, 69% were illiterate, 26% were employed and 74% were unemployed (including students). Table 3.12 presents the general demographic profile of the Project Area.

Table 3.12
General Profile of Female Respondents

S. No.	Respondents	No.	Percentage (%)
1	Married	67	67
2	Unmarried	33	33
3	Literate	31	31
4	Illiterate	69	69
5	Employed	26	26
6	Unemployed	74	74

Source: EIA Field Survey Team (NESPAK)

3.4.12 Respondents' Age Group

138. Respondents were selected from various age groups. 18% of the respondents were less than 25 years old, 20% belonged to age group between 26 to 35 years, 22% fell in the age group between 36 to 45 years, 20% between 46 to 55 years and 20% of the respondents were more than 56 years old. Table 3.12 presents the distribution of respondents according to age group.

Table 3.13
Respondents' Age Group

S. No.	Age Group	Both Sexes	Percentage	Male	Percentage	Female	Percentage
1	15-25	54	18	40	20	14	14
2	26-35	60	20	34	17	26	26
3	36-45	66	22	38	19	28	28
4	46-55	60	20	36	18	24	24
5	56-65	60	20	52	26	8	8
		300	**100**	**200**	**100**	**100**	**100**

Source: EIA Field Survey Team (NESPAK)

3.4.13 Education Level

139. Literate respondents had different education levels. Out of 142 literate respondents: 30% had primary level of education, 28% had education up to Matriculation and 24% had qualification up to intermediate and 26% were graduate or postgraduate. Educational status of the respondents is shown in the Table 3.14.

Table 3.14
Educational Status

S. No.	Education level				
1	Respondents	Primary	Middle/ Secondary	Intermediate	Graduation/ Post Graduation
2	Male	32	32	27	20
3	Female	10	8	7	6
Total		**42**	**40**	**34**	**26**
Percentage		**30**	**28**	**24**	**18**

Source: EIA Field Survey Team (NESPAK)

3.4.14 Social Amenities

140. During socio-economic survey to develop the social baseline of the Project Area, the respondents were inquired about the utilities in their homes. Almost all the respondents had electricity in their homes whereas 95% had the facility of water supply in their homes. On the other hand 54%, 23% and 15% of the respondents respectively had the facility of sewerage system, landline phone and Sui gas at their homes. Table 3.15 presents the social amenities available in the area.

Table 3.15
Social Amenities

S. No.	Social Facility	Number	Percentage (%)
1	Electricity	190	95
2	Sewerage(open Drains)	109	54
3	Telephone(Land Line)	46	23
4	Water Supply	30	15
5	Sui Gas	17	9

Source: EIA Field Survey Team (NESPAK)

3.4.15 Professional Status

141. Table 3.16 presents the professional status of the respondents. 29 % of the respondents were farmers. Among the respondents “economically active”, 29 % were farmers, 16 % were businessmen and 10 % were labourers. 17% respondents were engaged in allied agriculture professions, like cattle farming, milk selling etc., 17% respondents were unemployed.

Table 3.16: Professional Status

S. No.	Profession	Number of Respondents	Percentage (%)
1	Agriculture	58	29
2	Business	33	16
3	Labor work	19	10
4	Service	14	7
5	Agro based Business	42	21
6	unemployed	34	17
		200	**100**

Source: EIA Field Survey Team (NESPAK)

3.4.16 Household Income Levels

142. During the socio-economic survey, respondents were inquired about their total monthly income from all sources. Table 3.17 shows the income levels of the respondents. Majority of the respondents i.e. 23% had their income ranging between Rs.10000-15000/month. 19% had income below Rs.5000/month. 22 % respondents belonged to the income group ranging between Rs.5000-10000/month, 19% between Rs.15,000 to 20,000/month and just 17% had an income more than Rs.25,000/month.

Table 3.17: Income Levels

S. No.	Monthly Income Group (Pak Rs.)	Number	Percentage
1	1,000-5,000	39	19
2	5,000-10,000	44	22
3	10,000-15,000	46	23
4	15,000-20,000	38	19
5	25,000+	33	17
		200	100

Source: EIA Field Survey Team (NESPAK)

3.4.17 Land Holding

143. During the survey it was identified that about 29% of the respondents belonged to the agricultural sector and some of those respondents had leased out their lands as a second business/ source of income. Majority of the respondents had very small land holdings; almost 83% of the respondents had landholdings of less than 10 acres. Only 2% had landholdings of more than 20 acres. The land holding status of the respondents is shown in Table 3.18.

Table 3.18: Land Holding

S. No.	Land in Acres	No.	Percentage (%)
1	1-5	30	52
2	5-10	18	31
3	10-15	6	10
4	15-20	3	5
5	20+	1	2
		58	**100**

Source: EIA Field Survey Team (NESPAK)

3.4.18 Borrowing Status

144. During the public consultation it was identified that a reasonable proportion of the respondents, i.e. 37 % had borrowed money from different sources such as Agriculture Bank, feudal lord, or relatives. Table 3.19 shows the barrowing status of the respondents.

Table 3.19: Borrowing Capacity

S. No.	Borrowing Status	Number	Percentage (%)
1	Under debt	81	37
2	Without any debt	119	63
		200	**100**

Source: EIA Field Survey Team (NESPAK)

3.4.19 Housing Characteristics

145. 29% of the respondents live in kacha houses, 45% respondents have semi pacca houses and 26% live in kacha (mud) houses. Table 3.20 shows the characteristics and percentage of houses in the Project Area.

Table 3.20: Types of Construction

S. No.	Construction Type	Number	Percentage
1	Kacha	58	29
2	Semi Pacca	90	45
3	Pacca	52	26
		200	**100**

Source: EIA Field Survey Team (NESPAK)

3.4.20 Gender Component

146. Gender is a critical issue that is connected to any sustainable development process, which is usually perceived as woman specific issues. In order to assess the socio-economic condition of the women of the area, a Gender component survey was conducted by taking a reasonable sample of women. A total of 100 women from the project area were interviewed by the female staff, so that they could feel comfortable. Regarding the level of awareness about the project, mostly the women were aware about the construction of Road project.

147. Table 3.21 shows the condition of women surveyed according to the table 23% women surveyed had access to school 45% had access to college level education and only 32% ladies had access to university level education this shows that they were free in getting education if they like and these educational facilities were in their surrounding. On the other hand 26% women consult leady health visitor, 18% consult government doctor, 32% consult private doctor and 24% consult quacks in case of sickness.

Table 3.21: Social Condition of Women of the project Area

Age	Access to Education Facility			Access to Health Facility			
	School	College	University	Lady Health Visitor	Govt Doctors	Private Doctors	Quacks
16-25	12	11	6	6	4	4	2
26-35	8	6	5	5	2	4	4
36-45	2	11	7	7	6	6	4
46-55	1	9	8	5	2	10	6

56& above	-	8	6	3	4	8	8
	23	**45**	**32**	**26**	**18**	**32**	**24**
	23	**45**	**32**	**26**	**18**	**32**	**24**

Source: EIA Field Survey Team (NESPAK)

3.4.21 Culture and Tradition

148. The food of the inhabitants is very simple. Maize, wheat and rice are eaten in the project area. The use of Desi ghee and lassi is very popular in the rural area. Milk is also available in sufficient quantity. The people of the area are fond of meat especially various forms of beef. The use of ornaments among the females is also common. The females decorate themselves with ear-ring and bangles with rare use of cuba (egg like cups), connected by chains or a flat circle shaped gold hanging on fore-head.

3.4.22 Education Facilities

149. Educational facilities in the Project Area are not inadequate, but quality of education is not up to the merit. Respondents showed their apprehensions about the quality of education. In total 103 villages situated along the road totally 88 government schools for boys and 98 schools for girls beside this there was 92 private schools were also found in these villages during field survey. Table 3.21 below shows the status of educational institution along the CoI.

Table 3.21: Education Facilities in the Project Area

S. No.	Govt. Schools	Male	Female	Private School (Male+Female)
1	Primarry	54	61	58
2	Middle	25	27	26
3	High	9	10	8
Total		88	98	92

Source: EIA Field Survey Team (NESPAK)

3.4.23 Roads and Communication

150. Communication network is a fundamental prerequisite for economic activity to take place. The surrounding villages of the project area are well connected with main road and district headquarters through metalled roads.

3.4.24 Concerns Regarding the Project

151. During the field survey people were inquired about their views regarding the proposed Project. People have positive thinking and hopes about the project but fears and doubts for unforeseen issues are also in their minds. Almost all the people showed their concerns regarding the proposed Project. Respondents had multiple choices and they gave more than one response. The frequency of the responses of the respondents is shown in Table 3.22 below.

Table 3.22: Stakeholders Concerns

S. No.	Concerns	No. of Respondents
1	Livelihood will be disturbed in case loSingh agriculture land and businesses	287
2	People will never given judicious	273

S. No.	Concerns	No. of Respondents
	compensation against land acquired	
2	Residential area will be affected	102
3	No compensation payment is given to affectees, especially tenant	162
4	Jobs will not be provided to local people during construction	130
5	Privacy will be disturbed due to construction work	132

Source: EIA Field Survey Team (NESPAK)

3.4.25 Resettlement Issue

152. During the detailed field visit resettlement issues were critically observed. During the survey it was identified that designer has tried to avoid the settlements. During the detailed field visit it was found no archaeological site or graveyard, no any other structure of religious value or cultural importance is going do be demolished due to the execution of the proposed project. Only one Jamia mosque in Shorkot tehsil adjacent to a farm house needs relocation. Almost 200 house and 20 shops will need relocation for execution of the project. 80% of these houses are pacca (cement and brick masonry) and 20% of these house are made of mud and bricks.

3.4.26 Non-Governmental Organizations (NGO's)

153. In these districts and particularly in rural areas of these districts no international NGO's is working. The only non government organization working in these rural communities is Punjab Rural Support Programme. The main focus of this organization is on agriculture, health and infrastructure.

SECTION 4

PROJECT ALTERNATIVES

4.0 General

154. It is very important to evaluate different alternatives to arrive at the best possible option. Different alternatives were taken into consideration at the design stage of the proposed Project and they are briefly described in the following paragraphs; Annex 1 also presents the different options considered for the road project.

4.1 Alternative-1: No Project

155. According to the Traffic Projection Survey (refer to Tables 2.1, 2.2 & 2.3), it is estimated that in the future years, large number of people will be using the Faisalabad-Khanewal Expressway (E-4). According to the survey, total daily traffic will increase and attain rate of 7.49 per cent per year up to the year 2010 and it will be 7.08 per cent up to the year 2020. At the start of operation of the proposed Project, it is estimated that there will be approximately 13,035 vehicles using the proposed Expressway Project.

4.2 Alternative-2: Pindi Bhattian to D.G. Khan Expressway (NHA Selected Alternative) - Expressway Length 370 kms (approximately)

156. This Corridor was preferred by National Highway Authority. From Pindi Bhattian, it passes well to the north and west of Faisalabad, and then south westwards past Jhang about 15 kms to the north west of that town. It then leads straight to the City of Shorkot and crosses the River Chenab on a new bridge near the existing pontoon bridge. From this bridge, it leads south west across the Thal Desert to the River Indus approximately 25 kms downstream of the Taunsa Barrage. Having crossed the River Indus, it skirts the west and south of D.G. Khan allowing for future connections to Gawadar, Karachi etc.

4.3 Alternative 3: Pindi Bhattian to D.G. Khan Expressway (Punjab Government Selected Alternative) - Expressway Length 375 kms (approximately)

157. The Corridors preferred by NHA and the Government of Punjab are co-incident from Pindi Bhattian to Shergarh in the Thal Desert. From Shergarh, the option selected by the Government of Punjab follows the right bank of the River Chenab passing Muzaffargarh to the north-west and crossing the River Indus 15 kms south of the existing bridge. The suggested alignment then swings to west 20 kms south west of D.G. Khan.

4.4 Alternative 4: Pindi Bhattian to D. G. Khan Expressway (BCEOM and NESPAK Selected Alternative) – Expressway Length 405 kms (approximately)

158. This Corridor was proposed by BCEOM (French Engineering Consultants) and NESPAK (a joint venture). It was divided into the following three Sections and in each section (with the exception of Section 3) four alternatives were taken into consideration.

Section 1: Pindi Bhattian – Shorkot Cantonment

159. Within Section 1, the following four possible alternatives were considered as A, B, C and D:

- Alternative A passes west of Faisalabad and then swings west towards Jhang before turning south to Shorkot Cantonment;
- Alternative B follows the same route as Alternative A as far as Faisalabad and then takes a shorter direct route to Shorkot Cantonment;
- Alternative C from Pindi Bhattian passes Faisalabad to the east and then turns sharply to the west to join Alternative B; and
- Alternative D follows the same route as Alternative C to Faisalabad and then takes a shorter direct route to Shorkot Cantonment.

Section 2: Shorkot Cantonment – Muzaffargarh

160. Within Section 2, the following four possible alternatives (A, B, C, D) were considered:

- Alternative 'A' strikes west from Shorkot Cantonment to cross the River Chenab downstream of the existing pontoon bridge to the west of the City of Shorkot. It then passes through the thinly populated area referred to as the Thal Desert before turning south to the west of Multan. This alternative avoids a crossing over the River Ravi.
- Alternative 'B' strikes south from Shorkot Cantonment crossing the River Ravi near the existing bridge and then swinging south west to pass to the north and west of Multan near the airport.
- Alternative 'C' follows the same route as Alternative B but continues south passing to the north of Khanewal and south and east of Multan.
- Alternative 'D' takes a south to south easterly direction from Shorkot Cantonment crossing the River Ravi upstream of the existing bridge and continuing south of Khanewal to join Alternative C to the south-east of Multan.

Section 3: Pindi Bhattian – Shorkot Cantonment

161. This section crosses both the River Chenab and River Indus. The constrains imposed by these major physical features are such that it was felt that advantage had to be taken of the existing investment in, for instance, the extensive training works. No alternatives are therefore proposed. The only feasible route is along the existing corridor.

162. All the above Sections and the corresponding alternatives were compared on the basis of these criteria i.e. length, traffic, hydrology and major bridges. The results obtained through the comparative analysis indicated Corridor C as preferred alternative in Sections 1 and 2. In Section 3, only the existing corridor was considered and was retained.

4.5 Alternative 5: Sheikhupura – Multan – D. G. Khan Expressway

163. The Sheikhupura – Multan – D.G. Khan section of Pakistan Expressway would start from Lahore – Islamabad section of Expressway in the vicinity of the city of Sheikhupura and move in the south-westerly direction, crossing Sheikhupura – Pindi Bhattian Road on the eastern side of Farooqabad Town. The existing Lahore – Sheikhupura – Faisalabad Road is crossed by the Project Expressway on the eastern side of the town of Manawala. Traversing through the agricultural areas, the alignment passes almost midway between the city of Faisalabad and Jaranwala Town. Passing south of Faisalabad and after crossing over the Faisalabad – Dijkot Road, the alignment takes west wardly turn to bypass the town of Gojra from north-western side. After crossing Jhang – Toba Tek Singh Road, it passes almost midway between Shorkot City and Shorkot Cantonment avoiding the sensitive defence related area. The River Ravi is proposed to be crossed between old Sidnahi and New Sidnahi barrage where river bed is well-defined, stable and straight. Passing almost midway between Khanewal and Kabirwala, the alignment crosses over National Highway (N-5) near Khanewal before moving further towards the city of Multan. While passing south of Multan, various radial roads such as Multan – Jahania, Multan – Dunyapur, Multan – Bahawalpur (N-5), and Multan Shujahabad are crossed over by this Expressway. Between Multan and D.G. Khan, the Expressway are east-west, crossing the Rivers Chenab and Indus 8-10 kms downstream of the existing bridge.

164. The total Expressway length has been calculated as 402 kms approximately and divided into four sections as described below:

- From M-1 near Sheikhupura to Faisalabad – Dijkot Road, length 103 kms (approximately)
- From Faisalabad – Dijkot Road to Shorkot – Shorkot Cantt, length 102 kms (approximately)
- From Shorkot – Shorkot Cantt Road to Multan – Bahawalpur Road, length 112 kms (approximately)
  - From Multan – Bahawalpur Road to D.G. Khan – Karachi Road (N-55), length 85 kms (approximately)

4.6 Alternative 6: Faisalabad – Khanewal Expressway (E-4)

165. This option was selected by considering the factors such as low resettlement cost, less environmental damage and mitigations cost, high speed, safe, shorter distance and the linkage with existing Pindi-Bhatiyan-Faisalabad Motorway. As this Expressway Project consists of complete new alignment therefore there will be no disruption to the existing traffic system during construction. The construction of the proposed Expressway will lessen the burden of the existing Faisalabad-Khanewal road and will also decrease travel time for non-stop travellers from Faisalabad to Khanewal and other cities close to interchanges. It will also minimise resettlement of structures and other utilities. Provision of new Interchanges at various road crossings will facilitate the traffic joining Expressway and leaving it. In addition to the preferred Faisalabad to Khanewal alignment, another option which runs from Faisalabad to Muzaffargarh was proposed. The latter, however, was not selected since it traverses remote and wilderness areas where there is lesser number of road users, and it traverses mostly sandy and marshy areas. Adjustments to the selected E-4 alignment (Faisalabad to Khanewal) were made during the initial design stage to

avoid socio-economic, religious and cultural impacts. Below are the specific locations and corresponding sensitive sites that were avoided:

- Km 000+000: Mosque
- Km 002+000: Graveyard
- Km 058+671 to km 063+027: Christian Colony
- Km 148: Shrine
- Km 176+300 to km 179+639: Data Agro Seed factory (only source of quality seeds supply in the area, supplies processed crop seeds to the local farmers)
- Km 184:Graveyard

4.7 Project Alternatives and Impacts on Environment, Social and Economic Conditions

166 All the above mentioned alternatives were considered with respect to their impacts on environment, social and economic conditions. Table 4.1 presents summary of these alternatives and their respective impacts.

Table 4.1

Comparative Analysis of Different Project Alternatives

Project Alternatives	Impacts		
	Environmental	**Social**	**Economic**
Alternative 1: No Project	Increased air and noise pollution due to traffic jams on the existing Faisalabad – Khanewal Road – Higher emissions of CO, NO_x, SO_x, PM_{10}, Volatile Organic Compounds (VOC), and Photochemical Oxidants will affect the environment in the following ways: ▪ Damage to plants by choking the leaf pores and restricting photosynthesis; ▪ Impairment of atmospheric visibility affecting transportation safety; ▪ Deterioration of aesthetic quality of atmosphere, land and water; ▪ Soiling of materials, physical properties and infrastructure; ▪ Chlorosis and Plasmolysis in plants; ▪ Damage to materials and property, by acid rains, resulting from oxidation of sulphur oxides to sulphuric acid, after reacting with water vapours; ▪ Formation of photochemical oxidants; ▪ Damage to materials and property, by acid rains, resulting	▪ Longer travelling times ▪ Traffic accidents ▪ Health impacts due to air and noise pollution caused by increased traffic load on the existing Faisalabad – Khanewal Road	The increased traffic load on the existing Faisalabad – Khanewal Road in future will not only cause traffic jams but also deteriorate its condition thus affecting trade activities in different parts of the country. This will be a major economic impact. Other associated impacts include increased fuel cost and wear and tear of vehicles.

Project Alternatives	Impacts		
	Environmental	**Social**	**Economic**
	from oxidation of oxides of nitrogen to nitric acid, after reacting with water vapours; ▪ Retardation of growth in plants; ▪ Leaf discoloration and cell collapse in plant; and ▪ Damage to rubber, textiles, paints and other materials.		
Alternative 2: Pindi Bhattian – D.G. Khan Expressway (National Highway Authority Alternative) – 370 kms	▪ It will pass through the unproductive Thal Desert for a distance of 75 kms. ▪ Positive impacts on air and noise during the operation phase	▪ Little land acquisition and compensation. ▪ Considerable distance from N5, being at the closest a distance of 45 kms away from Multan. ▪ It will not provide easy or short length access to Multan, Muzaffargarh and Khanewal.	▪ It can open-up new areas for Industrial Development subject to the provision of necessary infrastructure support. ▪ This route would include two of the most expensive and time-consuming bridge river crossings over the Indus and Chenab, which could jeopardize the implementation schedule. ▪ Less attractive to intercity traffic. ▪ Having crossed the River Indus, it skirts the west and south of D.G. Khan allowing for future connections to Karachi, Gawadar etc.
Alternative 3: Pindi Bhattian – D.G. Khan Expressway (Punjab Government Alternative) – 375 kms	▪ It will pass through the inexpensive Thal Desert area for a distance of 75 kms immediately west of the Chenab River. ▪ Positive impacts on air and noise during the operation phase	▪ It is well away from N-5. ▪ No easy or short access to Khanewal.	▪ It can open up new areas for possible development. ▪ This alignment will pass closer to both Multan and Muzaffargarh at 20 kms and 10 kms respectively. ▪ It will demand a new link road to Multan and for this purpose requiring a new bridge over the Chenab River ▪ It will demand three expensive

Project Alternatives	Impacts		
	Environmental	**Social**	**Economic**
			bridges over crossings. ▪ Less attractive for the development of inter-city traffic. ▪ Technical risks on these river crossings could jeopardize the overall implementation schedule.
Alternative 4: Pindi Bhattian - D.G. Khan Expressway (BCEOM-NESPAK alternative) – 405 kms	Positive impacts on air and noise during the operation phase	▪ The proposed will pass closer to the major population centres throughout the province of Punjab and ease their links with the capital Islamabad. ▪ This Expressway Corridor will serve the maximum number of potential Expressway users. ▪ It will provide a by-pass route to the towns of Faisalabad and Multan. ▪ The likely impact on acquisition and compensation for agricultural lands is more than for Alternatives 2 and 3.	▪ It will promote the most economical bridge over crossings in terms of both capital expenditure and time of construction period. ▪ This Expressway Corridor will best serve the present inter-city traffic and will allow for the development of services once constructed. ▪ By locating the proposed M1 (referred to as Lahore – Islamabad Motorway in 1992) and M3 (referred to as Pindi Bhattian – D.G. Khan Motorway in 1992) Expressway interchange at 15 kms short of Pindi Bhattian and passing south of Faisalabad, it will make this corridor more attractive for Lahore to Faisalabad traffic. ▪ It will not be the shortest route from Islamabad to Karachi.
Alternative 5: Sheikhupura – Multan-D.G. Khan Expressway (BCEOM-NESPAK alternative) – 402 kms	▪ It will traverse through the flat agricultural areas where numerous villages are located. The proposed alignment will help in maintaining sufficient desired distance from the villages all along the alignment and thus results in minimum disturbance to	▪ The Expressway alignment has been fixed keeping in view the extent of the existing urban areas and possible future extensions in foreseeable future. ▪ After crossing Jhang – Toba Tek Singh Road, it will pass almost midway between Shorkot city and Shorkot cantonment avoiding the sensitive	▪ Combination of the already planned interchange on Sheikhupura – Gujranwala road with the new interchange required for this Project will result in a very complicated and expensive arrangement.

Project Alternatives	Impacts		
	Environmental	**Social**	**Economic**
	the village life. ▪ The alignment will be aesthetically pleasing and will blend well with topography. ▪ Positive impacts on air and noise during the operation phase	defense related area. ▪ The city of Sheikhupura itself is on the southern side not very far from M1 (referred to as Lahore – Islamabad Motorway in 1992) alignment, which makes it difficult to create another take off point for the project expressway because otherwise built up area shall have to be acquired. ▪ The expressway end point has been selected on Indus Highway (N-55) about 8 kms south of D.G. Khan well clear of existing urban area and to allow for future expansion of the city.	
Alternative 6: Faisalabad – Khanewal Expressway (E-4) – 184 kms	▪ Positive impacts on air and noise during the operation phase ▪ Less environmental damage. ▪ Less mitigation cost	▪ It will reduce traffic congestion and travel time by providing safe and good quality route for movement of people and goods. ▪ It will minimise resettlement of structures and other utilities.	▪ The Expressway will enhance economic development by providing high speed safe trade corridor for the movement of goods and passengers to and from other areas of the Province. ▪ Less fuel consumption ▪ Less wear and tear ▪ Due to shorter route comparatively less resettlement of structures ▪ Comparatively low resettlement cost.

4.8 Selection of the Preferred Alternative

167. The alternatives (2-5) were studied in the year 1992 for the Motorway (M-3) from Pindi-Bhattian to D. G. Khan (later named as Sheikhupura – Multan - D.G. Khan Expressway). Frequent changes have been made ever since. M-1 (formerly used for Lahore – Islamabad Motorway) was replaced with M-2. M-1 is now meant for Islamabad – Peshawar Motorway, which is under construction these days. M-3, being approved by NHA, was supposed to start from Sheikhupura and end all the way up to D. G. Khan. But later on, the former M-3 (Pindi Bhattian to D.G. Khan Motorway) was confined to Pindi Bhattian – Faisalabad Motorway with modifications in the design especially in the Section between Pindi Bhattian to Faisalabad. E-4 (the preferred alternative) is a part of the formerly known M-3 Project (Pindi Bhattian to D.G. Khan), and it will start from Faisalabad and end at Khanewal while traversing along a number of cities such as Gojra, Toba Tek Singh, Shorkot Cantt and Kabirwala. Minor modifications have been made especially near Faisalabad and rest of the route follows the same route as approved by NHA under the M-3 Project (Sheikhupura – Multan – D. G. Khan). As already discussed, most of the alternatives are merging at Gojra. Through the construction of E-4, the route from Faisalabad to Gojra will be the shortest. The major reason for changes in the design was to reduce cost by shortening the length and minimizing resettlement.

SECTION 5

ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

5.0 General

168. This section identifies the overall impacts of construction/operation works on the physical, biological and socio-economic environment of the Project Area. This assessment also includes the impact of traffic volume due to improved road conditions. In addition, it also narrates the measures that will mitigate the Project's adverse environmental effects.

Following is a description of the perceived environmental impacts (positive/negative) of the proposed Project with their proposed mitigation measures.

5.1 Project Corridor

169. The Project corridor is delineated according to two criteria: right of way (RoW); which the NHA is legally entitled to, and Corridor of Impact (CoI), i.e. the width of the corridor that will be impacted, directly or indirectly, by the proposed Project during the construction and operational phases.

a) Project Right of Way (RoW)

170. The proposed Project corridor will have a well defined RoW that will be 100 meters (328 ft) for the entire length of the Expressway except interchanges where RoW will be 300 meters (984 ft). Major construction works will generally remain confined within the RoW. All the infrastructure and commercial activities within the existing or proposed RoW need to be relocated as they will have direct impact of the Project.

b) Corridor of Impact (CoI)

171. The corridor of the proposed Impact (CoI) was delineated as the extent, which has direct or indirect impact of Project. Direct impacts of the Project are relocation of houses, utilities and air and noise pollution impact on workers during construction. All direct impacts are constrained within the RoW. Indirect impacts, caused by noise, dust emissions, camp sites and borrow sites could be beyond the RoW. The direct CoI of the surface water bodies will be confined within the RoW of the proposed Project and will be temporary only for the construction period.

5.2 Pre-Construction/Design Phase

172. Following is the brief description of impacts envisaged during the Pre-construction/ Design Phase:

5.2.1 Topography

173. The topography in the Project Area will change to some extent because of construction of the proposed Project related structures such as embankments, culverts etc. Visual changes to the topography would be permanent and minor negative in nature. However, the aesthetic elements (such as plantation) should be incorporated in the design to overcome the impacts.

5.2.2 Soil Erosion and Contamination

174. Soil erosion will take place around road cuttings and embankments, which will be mitigated by incorporating the following measures in the design:

- The provision for vegetation with a fast growing crop and a native seed mix immediately after fill placement to prevent scour and to encourage stabilization will be made in the design. Use of stone pitching or riprap will also be provided in the design at appropriate places especially around flyovers, bridges, culverts;
- Provision for rip-rap in discharge zones from drainage structures will be made in the design to reduce erosion;
- Down drains/chutes will be lined with rip-rap/masonry or concrete to prevent erosion;
- Side slopes will be adjusted to a gradient necessary to reduce erosion potential or, if steeper, stabilized, covered with riprap or other material to prevent soil erosion; and
- The proposed Project Site, through which the alignment is proposed, will be investigated for the presence of naturally occurring contaminants such as asbestos, arsenic; likelihood of erodibility of soil; contours, terrain stability, slope gradient; physical and chemical properties of soil such as soil depth, particle size distribution, permeability, dispersibility, pH, salinity; and likelihood of seismic activity. If any contaminated soils are found, they shall be removed and deposited in a sealed pit in an area agreed with the concerned authority. The seismic factor shall also be considered at the design stage.

5.2.3 Land Acquisition and Resettlement

175. The major issue in the proposed Project will be land acquisition and resettlement. This will result in landlessness, homelessness, joblessness, marginalization, loss of access to common property resources, food insecurity, morbidity and mortality, and social disarticulation due to land acquisition and severance (blocking access across it due to be being fenced on both sides). Though, effort has been made to avoid relocation of houses while selecting the alignment of the proposed Expressway. Even then the land acquisition and resettlement will take place for those affected by loss of agricultural land (most of the owners with small landholdings) and associated infrastructures (farm houses, tube wells, poultry farms etc.).

176. The proposed Expressway will be constructed on a new alignment for which about 4794 acres of land will be acquired. The current land acquisition process and procedures are not adequate enough to ensure fair and justifiable compensation to the affectees. Serious negative impacts may result if proper mitigation measures are not adopted.

177. The most significant impact of the Project is the taking of about 4794 acres of agricultural land out of production. The loss in production can be met with by increasing the yield from fields in the agricultural sector. Orchards lost to the Project will also have to be raised by the private owners of land. However the owners of land whose land is to be acquired and the neighbouring farmers can be helped to gain access to modern technology to increase production from their land. Similarly the deficiency in livestock feed/fodder will have to be met from the adjoining areas.

178. This impact would be permanent and major negative in nature and the mitigation measures will involve careful alignment and route selection by the designer to minimise the impact. Also adequate budget will be provided in the Project cost for the

compensation to the affected people as per Land Acquisition Act, 1894 and ADB's Resettlement Guidelines for the lost assets and restoration of their livelihoods.

179. Entire Expressway Project will be fenced except at the interchanges; therefore, it will not cause substantial increase in the price of land. It is expected that land values will increase near interchanges. This Impact would be a minor positive in nature.

180. During the field visits to the Project Area, resettlement issues were critically observed. During the route survey care was taken to avoid the settlements. About 200 mud/ brick structures will be demolished. During field visits, it was found that no archaeological site or graveyard, nor any other structure of religious value or cultural significance is going to be demolished due to the execution of the proposed Project. Only one Jamia Mosque at Shorkot Tehsil adjacent to a farm house needs to be relocated.

181. The mitigation measures include:

- Developing proper judicious compensation package for affectees;
- Developing plan for the new construction of affected mosque i.e. Jamia Masjid Shorkot.
- Giving compensation amount before the affectees shifting; and
- Providing underpasses at the existing crossings that movement across the Expressway is not halted.

5.2.4 Flora

182. It has been estimated that a total of 18,000 trees will be felled from the agricultural fields in the Project Area. This loss will be compensated by planting strips on both sides of the expressway which, on an average, are estimated to be about 25 meters wide.

183. NHA will be responsible for the compensatory tree planting program in coordination with the Forest Department, while the local community (especially women) will be encouraged to participate. Compensatory Planting shall be done in rows (avenues). Eight avenues with a row to row distance of 3 meters shall be planted for a length of 50 km near the habitations and four avenues with row to row distance of 6 meters in the rest of the 134 km long strip thus covering the whole length of the Expressway section. A total of 623,984 (311,992 in each strip on both sides of the road) saplings shall be planted. Planting should go hand in hand with the construction of the road structure. Planting of this nature and extent shall be a huge task and will have to be outsourced. The executing agency is advised to plan in advance for the procurement of planting stock in consultation with the Provincial Forest Department. Permission from the Forest Department will also have to be sought for cutting trees from the roadside or along the water courses if these fall within the ROW. Planting should be done as soon as the construction of the road is completed. Maintenance is the key to the establishment of the plantation. Regular monitoring of plantation should be carried out by the executing agency. Any failures should be immediately beaten up. 25% is the usual percentage provided for beating up of failures.

184. After the Project Area is fenced, the natural vegetation shall establish itself. The indigenous trees most suited to the tract like Shisham, Kikar, Bakain, Dharek, Siris (*Albizzia procera*), Farash, Sukh chain, Jaman, Bohar, Peepal (Ficus reliogosa), Gullahr (*Ficus glomerata*), Sohanjana *(Moringa oleifera*), Karir and Wan (*Salvadora oleoides*) are helpful in providing shade, ground cover, aquifer recharge, and habitat (including shelter and food) for the wildlife. The compact plantations shall be effective

live screens against night glare, dust, noise and pollutant emissions. These vegetated strips shall develop into a complete ecosystem. Flowering and fruiting shrubs can be planted along the road to beautify the landscape. Planting should however be done keeping in view the principles of landscape designing.

- A total of 623,984 (311,992 in each strip on both sides of the road) sapling trees will be planted
- Raised Median will be planted with grasses and shrubs which may not attain height more than two meters. This planting could provide an effective protection against night glare besides beautifying the area;
- The compact plantation will be done on both sides;
- Regular monitoring of plantation will be carried out by the Forest Department and any failures will be immediately beaten upto 25%;
- The indigenous trees most suited to the tract like Shisham, Kikar, Bakain, Dharek, Siris (*Albizzia procera*), Farash, Sukh chain, Jaman, Bohar, Peepal (Ficus reliogosa), Gullahr (*Ficus glomerata*), Sohanjana *(Moringa oleifera*), Karir and Wan (*Salvadora oleoides*) will be planted;
- If a tree of rare species is growing within the ROW and is required to be removed, it will not be felled but uprooted and transplanted in close consultation with the Forest Department;
- All old and mature trees falling in the 25 meter wide proposed planting strips will be saved. Effort should be made to save as many trees as possible even if they are young or poll stage. Proper irrigation and maintenance of plants should be ensured;
- An awareness campaign targeted on the neighbourhood farmers will be carried to popularize the planting of trees, and saplings should be provided on subsidized costs; and
- Organic farming will be encouraged to minimize the use of chemical fertilizers and pesticides.

5.2.5 Change in Hydrologic Regime

185. As the proposed Expressway does not pass through any flood prone areas therefore, no change in hydrological regime will occur. The Expressway will cross the Ravi River and Sadhnai Canal, while this crossing will be carried out by bridges therefore no change in water flow pattern will be caused. For the crossing of canals and drains small bridges will be constructed. For the crossing of water courses, culverts and other possible arrangement will be done. The direct CoI of the surface water bodies will be confined within the RoW of the Project, and it will be minor and temporary in nature.

186. Possible impacts are temporary and minor negative, however following mitigation measures will be incorporated:

- Proper design of bridges on Ravi River and Sadhnai canal to accommodate design flows;
- Small bridges will be constructed on canals and drains coming in the RoW;
- Provision of box culverts to control flood damages and provision of safety of embankments; and
- Provision of sufficient sizes of drains to take design flows.

5.2.6 Waterlogging and Salinity

187. Almost 3-5% of the land along the Proposed Project corridor Section was seen affected by waterlogging and salinity. The waterlogged areas are more than 1 km far

from the proposed Expressway therefore it is obvious that it will not affect the proposed Project. However to keep effective drainage system, pipe and box culverts at suitable location will be provided in the design.

5.2.7 Restricted Access Problems

188. As the Proposed Expressway will be fenced therefore the communities along the alignment will face crossing problems. This is a major negative impact due to the proposed Project. To mitigate this impact, underpasses and flyovers will be provided in the design at the shorter distances and at places wherever there are existing crossing paths.

5.2.8 Public Utilities

189. Due to the proposed Project, public utilities will be affected creating disruption of public services and inconvenience to the local residents. This impact is temporary and may be considered as moderately negative in nature. Mitigation measures will include:

- Provision in the design and budget for the relocation of the existing utility infrastructures wherever required; and
- All public utilities (e.g. water pipes, power/ telephone lines likely to be affected by the proposed Expressway will be relocated well ahead of time before the actual commencement of the construction work.

5.2.9 Noise Problems

190. Fast movement of vehicles on the Proposed Expressway will create excessive noise for the communities along the alignment which will be a cause of disturbance for them. This will be a moderate negative impact. To mitigate this impact noise barriers will be constructed wherever there will be populated area within 500 meters along the route by thick plantation or constructing sound barriers wherever possible. Provision of thick plantation of about 25 kms for each side will be provided.

5.3 Construction Phase

191 Following is the brief description of impacts envisaged during the Construction Phase:

5.3.1 Topography

192. As a result of construction, topography of the Project Area will be changed. One of the important activities during construction will be the cutting and dismantling of existing infrastructure and borrow areas that will have impact on the topography of the Project Area.

193. This impact is temporary and minor negative in nature. Mitigation measure for this impact is proper landscaping. All the affected areas will be restored to their original levels.

5.3.2 Borrow/ Open Pits

194. Borrow/ open pits and its excavation activities may result in land disputes, soil erosion, loss of potential cropland, loss of vegetation, landscape degradation, and damage to road embankments.

195. Borrow/ Open pits may also become potential sources of mosquito breeding and may prove hazardous to human beings, livestock and wildlife. This will also degrade hygienic condition of the Project Area.

196. This impact is permanent and moderate negative in nature. Mitigation measures will include:

- Necessary permits will be obtained for any borrow pits from the competent authorities;
- In borrow pits, the depth of the pits will be regulated so that the sides of the excavation will have a slope not steeper than 1: 4;
- Borrow pits will be properly drained in order to avoid ponding of water;
- Borrow pits will be fenced to avoid any accident;
- Soil erosion along the borrow pit will be regularly checked to prevent/ mitigate impacts on adjacent lands;
- In case borrow pits are filled with water, measures have to be taken to prevent the creation of mosquito-breeding sites; and
- Borrow pits will be used for construction waste, but during the excavation, top 20 cm soil cover should be preserved for vegetation after the filling of the pits. This is the best way to restore the flora of that area.

5.3.3 Air Quality

197. Air quality may be affected from the following sources:

- Construction machinery;
- Hydrocarbons from asphalt plants and vehicular traffic;
- Dust emissions due to movement of construction machinery on earthen service roads.

198. Impacts of air emissions may be carried over long distances depending upon the wind speed, direction, temperature of the surrounding air and atmospheric stability. Emissions from crushers and quarry sites can cause health impacts, i.e. coughing, flue, difficulty in inhaling, irritation in eyes and reduction in visibility. This impact is temporary and major negative in nature.

199. Mitigation measures will include:

- Dust control by equipping asphalt hot mix and batching plants with fabric filters or wet scrubbers to reduce the level of dust emissions;
- Asphalt hot mix and batching plants will be located 1 Km away from the residential areas, schools and hospitals;
- Surface treating or overlaying diversion tracks with shingle, and sprinkling water across diversion tracks;
- Ensuring that haul trucks carrying aggregate fill materials are kept covered with canvass sheet to help contain construction material being transported between sites;
- Enforcing the NEQS applicable to gaseous emissions generated by construction vehicles, equipment and machinery;
- Dust mask will be provided to the workers. Proper dust collection system should be ensured at crushers and continuous sprinkling of water; and
- Air Quality Monitoring will be carried out as per schedule given in Environmental Monitoring Plan

5.3.4 Construction Waste Disposal (Wastewater, Oil, Solid Waste etc.)

200. Due to construction activities waste will be generated at construction and contractors camp site. The construction waste will include wastewater, oil spillage from machinery and solid waste etc. This will result in unhygienic conditions, health risk to work force and general public at the camp site.

201. Following are the types and sources of construction waste:

- Oil, grease etc. from construction machinery;
- Solid waste from waste construction material and food;
- Wastewater from washing and sprinkling; and
- Sanitary waste from staff toilets.

202. This impact is temporary and moderate negative in nature. Mitigation measures will include:

- Wastewater effluent from contractor's workshop and equipment washing yards would be passed through gravel/ sand beds to remove oil/ grease contaminants before discharging it into natural streams;
- Waste will be disposed at designated sites and no waste will be disposed in the productive agricultural field;
- The hazardous waste will be transported to nearby incineration facility;
- Solid Waste generated during construction will be safely disposed in approved and demarcated waste disposal sites and the contractor will not dispose waste into productive agricultural lands and will also provide a proper waste management plan;
- Sanitary wastes generating from staff and labour camps must be disposed of in environment friendly manner, i.e. provision of septic tank etc. for toilet wastes; and
- Aggregate waste material of existing road will be reused in up-gradation of road.

5.3.5 Siting of Construction Camps and Other Facilities

203. The precise locations for construction camps and other facilities such as workshops, equipment washing yards, borrow pits, quarries, crushing plants, asphalt plants, batching plants, construction material storage areas, haul routes and disposal sites for construction waste will be finally decided by NHA in consultation with Contractors. However, the siting of these facilities may cause a number of issues such as loss of plantation and vegetation, permanent physical and visual impact on the area, siltation and pollution risks if construction materials are extracted from the River Chenab bed. The impacts of these facilities would be temporary and moderate negative in nature, which can be mitigated by adopting the following measures:

- The construction camps and workshops shall not be located in sensitive areas and shall not be within 500 meters distance from the existing settlements;
- Efforts will be made to minimize vegetation loss while making site arrangements for construction camps and other facilities;

- Cutting of trees shall be prohibited by contractor(s) and workers near camp sites failing which three new trees will be planted by the Contractor(s) for each tree cut;
- The crushing plants shall not be located in environmentally sensitive areas or existing settlements;
- The sites for borrow pits shall be located in non-productive barren lands (present in Shorkot Tehsil), nullahs and publicly recognized waste lands. Such sites shall be selected on the basis of type of soil strata, depth of water table, ground topography, prevalent vegetation state etc. and shall not be located within 100 meters from RoW of the proposed Project. They shall be prohibited where they might interfere with the existing or designed drainage pattern. As mentioned earlier, the contractor shall first explore suitable sources of sand other than the Ravi and Chenab riverbeds. The Contractor(s) shall also ensure that borrow pits are left in a tidy state with stable side slopes and proper drainage in order to avoid creation of stagnant water bodies, which are favorable places for mosquito breeding. The depth of construction materials such as gravel removed from the River bank shall be kept one tenth of the total width of the River and this activity shall not interrupt the River flow or undermine the River banks;
- Asphalt hot mix and batching plants shall not be located within 1000 meters of the existing settlements and shall be located sufficiently away from agricultural activities, industrial establishments and sensitive areas including, but not limited to, educational and health facilities;
- Only licensed quarry operations will be used for material sources. If licensed quarries are not available then the contractors may be made responsible for setting up their dedicated crusher plants at approved quarry sites;
- The construction material storage areas shall not be located in sensitive areas and shall be sheltered or sited within hoardings;
- The Contractor(s) shall use the selected routes for transport of construction materials. Any damage caused to these routes by overloading or heavy vehicles shall be borne by the Contractor(s);
- Landowners shall be compensated according to the terms of lease agreements negotiated with them for constructing camps and other facilities; and
- The sites for camps and associated facilities shall be reinstated by the Contractor(s) after decommissioning of the proposed Project.

5.3.6 Soil Erosion and Contamination

204. The proposed Project is planned to be constructed on already fertile soil, which will be lost if not stripped, stored and reused properly. Soil erosion generally takes place where ground cover is removed and inadequately re-established. Due to construction of the proposed Project, soil erosion and contamination may take place around borrow pits, road cuttings, embankments, construction camps, workshop areas, equipment washing yards, asphalt plants, batching plants, fuel and chemical storage areas, etc. Soil erosion and contamination may affect the road stability, increased flood risk (by more rapid and higher levels of runoff), silting up of water bodies, landscape value and in worst cases may reduce the economic productivity of land and biodiversity in the Project Area. The impacts of soil erosion and contamination would be temporary and moderate negative. The following mitigation measures are proposed to alleviate or avoid these impacts:

- Non-productive barren lands (present in Shorkot Tehsil), nullahs and publicly recognized waste lands shall be used for borrowing materials;
- Borrowing material will be used after the approval of Soil Quality Engineer;

- The excavation of earth fill shall be limited to an approximate depth of 50 to 100 cm;

205. In case the use of agricultural land is unavoidable, the top 30 cm of the plough layer shall be stripped off and stockpiled. Where deep ditching is to be carried out, the top 1 meter layer of the ditching area shall be stripped and stockpiled for redressing the land after the required borrow material has been removed;

- Drainage interception ditches shall be built around the borrow pits to prevent surface run off causing erosion during the rainy season;
- The denuded ground cover shall be re-vegetated as soon as possible following fill placement to facilitate regeneration of a stabilizing ground cover;
- The road embankments and road cuttings shall be vegetated with a fast growing crop and a native seed mix immediately after fill placement to prevent scour and to encourage stabilization. Use of stone pitching or riprap shall be made at appropriate places especially around overpasses, bridges, culverts;
- Discharge zones from drainage structures shall be furnished with rip-rap to reduce erosion;
- Down drains/chutes shall be lined with rip-rap/masonry or concrete to prevent erosion;
- Side slopes shall be adjusted to a gradient necessary to reduce erosion potential or, if steeper, stabilized, covered with riprap or other material to prevent soil erosion;
- Construction shall be restricted to dry season to avoid soil erosion;
- Soil erosion checking measures such as the formation of sediment basins etc, shall be taken;
- Soil contamination by bitumen, fuel and chemical storages shall be minimized by siting them on an impervious base within an embanked area and secured by fencing. The base and walls of the embankment shall be impermeable and of sufficient capacity to contain 110 per cent of the total volume of stored fuels and chemicals; and
- The disposal of waste asphalt shall be made in approved locations such as borrow pits or natural depressions and shall not be within the RoW. Unless located in areas with impervious soils, encapsulation with pre-laid impervious liners including walls and capping is required with the objective to prevent water percolating through the waste materials and leaching toxic chemicals into the surrounding soils. On completion of disposal at the site, the area shall be capped with a compacted thickness of at least 0.5 meters of impermeable soil covered with at least 200 mm of top soil and shall be finally landscaped.

5.3.7 Noise

206. Noise is one of the most pervasive environmental problems in the urban areas especially on the road side. Noise pollution will be due to increase in mobility and construction activity. However, this impact will be temporary but moderate negative in nature. All mitigation measures mentioned below should be taken in order to minimize the impacts of noise in the Project Area. These measures include, but are not limited to the following:

- Selection of latest equipment and plant with reduced noise level ensured by suitable in-built damping techniques and appropriate muffling devices;
- Confining excessively noisy work to normal working hours in the day;
- Providing the construction workers with suitable hearing protection like ear cap, ear muffs etc.;

- Avoiding heavy machinery like percussion hammers and pneumatic drills, especially during night time;
- Locating the rock crushing, concrete mixing and material shipment yards away from residential areas, particularly schools, hospitals and nursing homes; and
- Noise quality monitoring will be carried out as per schedule given in Environmental Monitoring Plan.

Table 5.1
Maximum Limits of Noise Levels

Noise Level dB (A)	Situation
194	Lung damage
180	Ear drum rupture
150	Absolute limit with ears protected
150	Maximum of instantaneous noise
135	Absolute maximum with ears unprotected
100	Prolonged noise causing permanent damage
90	Factory work for an 8-hour day, 5 days a week
*85	Ear protection should be worn
80	Noise on building or construction sites
70	Normal road traffic near residential areas

Source: *"Environmental Degradation"* by Engr. Col. Mumtaz Hussain
* Above 85 dB(A) ear protection devices should be worn.

Table 5.2
General Noise Levels of Machinery and Equipment

S. No.	Equipment	Noise-Level in dB (A)
1	Earth Moving Machinery	75-85
2	Material Handling Equipment	75
3	Stationary Equipment	75
4	Tools, Hammers and Drivers	80-95

Source: The General Services Administration, Construction Noise Specification, USEPA 1972

Table 5.3
Construction Equipment Noise Levels

S. No.	Equipment	Observation Point to the Source (meters)	Noise dB(A)
1	Wheeled loading	5	90
2	Grader	5	90
3	Vibration pavement roller	5	86
4	2-wheel vibration pavement roller	5	81
5	3-wheel pavement roller	5	81
6	Tire pavement roller	5	76
7	Bulldozer	5	86
8	Wheeled pneumatic dredger	5	84
9	Sprayer	5	87

10	Power generator	5	98
11	Impact drill	5	87
12	Impact pile driver	5	112
13	Truck	5	92
14	Concrete mixer	5	91
15	Concrete pump	5	85
16	Mobile lift	5	96
17	Pneumatic hammer and rock crusher	5	98
18	Breaker	5	84
19	Pneumatic spanner	5	95

Source: Guangzhou City Center Inner Ring Road Project, Environmental Assessment Report (1997)

5.3.8 Surface and Groundwater

207. Surface water might get contaminated due to the disposal of construction waste generated due to the Project activity; this contamination will not only endanger the aquatic life but will also result in jeopardizing the health of natives that use this water for meeting domestic requirement. The impact on these water bodies will be only for the period of construction and will vanish as the construction work is over. In addition to that, construction waste, if left unattended will result in forming leachate which will percolate through the soil strata and will reach underground water table and hence, will end up contaminating it.

208. This impact is temporary and minor negative in nature. Following are the mitigation measures:

- The surface and groundwater reserves will be adequately protected from any source of contamination such as the construction and oily waste that will degrade its potable quality;
- The proponent will ensure that the construction work is confined within the RoW and water bodies are prevented from pollution during construction;
- Proper care will be taken during construction of Expressway above or near the water channels so that no damage could be made during construction activities;
- During construction, any damage to irrigation channels shall be immediately repaired by the contractors. Damages shall be compensated, as appropriate.
- The solid waste will be disposed of in designated landfill sites to sustain the water quality for domestic requirements;
- Regular water quality monitoring according to determined sampling schedule;
- The contractor will ensure that construction debris do not find their way into the rivers, drainage or irrigation canals which may get clogged;
- Work on irrigation canal areas will be kept to a minimum, protective walls be constructed;
- To maintain the surface water flow/drainage, proper mitigation measures will be taken along the road, like drainage structures in urban areas;
- Prohibit washing of machinery and vehicles in surface waters, provide sealed washing basins and collect wastewater in sedimentation/retention pond;
- Construction work close to the streams or other water bodies will be avoided, especially during monsoon period; and
- Wastes will be collected, stored and taken to approved disposal site.

5.3.9 Flora and Fauna

209. It has been estimated that a total of 18000 trees will have to be felled from the agricultural fields in the Project Area. This loss will be more than compensated by planting strips on both sides of the expressway which, on an average, is estimated to be about 25 meters wide. After the project area is fenced, the natural vegetation shall establish itself. The indigenous trees most suited to the tract like Shisham, Kikar, Bakain, Dharek, Siris (*Albizzia procera*), Farash, Sukh chain, Jaman, Bohar, Peepal (*Ficus reliogosa*), Gullahr (*Ficus glomerata*), Sohanjana *(Moringa oleifera*), Karir and Wan (*Salvadora oleoides*) could be planted. These trees shall be helpful in providing shade, ground cover, aquifer recharge, and habitat (including shelter and food) for the wildlife. Following mitigations will be adopted:

- The compact plantations will be effective live screens against night glare, dust, noise and pollutant emissions. These vegetated strips shall develop into a complete ecosystem. Flowering and fruiting shrubs can be planted along the road to beautify the landscape. Planting should however be done keeping in view the principles of landscape designing;
- A raised median will be planted with grasses (turfing) and shrubs which may not attain height more than two meters. This planting could provide an effective protection against night glare besides beautifying the area;
- All old and mature trees falling in the 25 meter wide proposed planting strips will be saved. Effort will be made to save as many trees as possible even if they are young or poll stage. Proper irrigation and maintenance of plants will be ensured;
- An awareness campaign targeted on the neighbourhood farmers shall be run to popularize the planting of trees; and
- Organic farming will be encouraged to minimize the use of chemical fertilizers and pesticides.

210. Black and Grey Partridges are the only huntable species that might occur in the Project Area. Their hunting is allowed as per legislation during the hunting season to a fixed bag limit in open areas on Sundays and holidays. Any hunting outside of this is liable to be checked by the Wildlife Department staff. However such hunting shall hardly impact the wildlife populations in the area.

211. No rare or endangered aquatic faunal or floral species occur in the area. The Provincial Fisheries Department auctions fishing rights in the rivers and canals. The water reservoirs like Sidhnai are stocked with carp fingerlings. The canals are not stocked but the fish stock from the rivers escapes to canals. Fishing is not allowed without a permit and any illegal catch is liable to be punished. Reports about illegal fishing in these areas are almost non-existent. Occasional cases may be reported which may not have any significant impact on the biodiversity of the wetlands.

212. The Project will pose minor negative impact on the fauna present in the area. There is no presence of any game reserve or wild life sanctuary along the proposed alignment, therefore no negative impact will happen. However following mitigation measures will be taken:

- Illegal animal and fish hunting will not be allowed and punishment will be enforced in case of violation;
- Wildlife Department will check and confirm that no hunting is made;
- New and good condition machinery with minimum noise will be used in construction;

- Noisy work will not be carried out in night time so that there should be no disturbance to local birds and animals;
- Contractor will ensure that the no hunting, trapping of animal will be carried out during construction; and
- Borrow pits will be fenced so that no animal can fell into these.

5.3.10 Social and Cultural Problems

213. Due to construction of the proposed Project, exit/entry problems for the residents/ movement of the people to the mosque/shrines may be disturbed. However, the major issue in the proposed Project is land acquisition, which will take place in the project affected areas. This will result in loss of agricultural land, infrastructure (farm houses, tube wells, poultry farms), livelihood, loss of fertile plough layer at camp sites and associated facilities (workshops, asphalt plants etc.).

214. National Environmental Policy of the Government of Pakistan emphasizes on the achievement of environmental sustainability and poverty reduction to enhance the economic growth. Increased economic activity in the Project Area by involvement of local people in the Project related activity. Local labour will be hired, which will provide them an opportunity to develop their skills and capacities. After serving in this Project, the local can utilize their skills in future endeavours.

215. As a result of Expressway Project, prices of lands near interchanges and service areas will increase that will be a positive thing for the local people. After the construction of interchanges and service areas, local people will get a chance to open shops and hotels in its vicinity. This will provide them earning opportunities, which will enhance economic profile of the area. This is a minor positive impact.

216. Change in local lifestyle and culture may occur when the local and migrant workers will come in contact during the construction works. This impact is permanent and minor positive. Those impacts can be mitigated by adding appropriate clauses in the construction contract to avoid any law and order situation.

217. Regarding the resettlement issue It is required that these settlements should be relocated and handled in such a way that those affectees might not be turned into poor or vulnerable groups. These issues are discussed in detail in Resettlement Action Plan.

218. People will face minor exit/entry problems during the construction activities. Only one mosque will fall in the RoW and that is Jamia Masjid (main mosque) situated in Tehsil Shorkot. The impact of construction on entry/exit problem is of minor nature as there is no major shrine located in the immediate vicinity of RoW.

219. This impact is temporary and minor negative in nature. Mitigation measures will include:

- Timely completion of the construction work and provision of alternative routes during the construction;
- Providing alternative ways in order for the local people to perform their routine tasks;
- Timely and adequate compensation package to the Project Affected Persons (PAPs);
- Adding appropriate clauses in the construction contracts to avoid any law and order situation;
- Timely and full public consultation and announcement of mobilizing equipment;

- Establishment of formal links with affected communities;
- Plan for social grievance redress mechanisms;
- Seek assistance from and cooperation with local NGOs;
- Familiarize outside labourers on local etiquettes;
- Local labour shall be employed with an agreed ratio (>75%) for construction works;
- An agreed minimum unskilled labour employment for women with equal remuneration as men agreed at an early stage; and
- The drinking water requirement shall be met preferably by resorting to other sources rather than using the community resources.

5.3.11 Traffic Management

220. Due to construction activities traffic management may be a problem in the Project area. This may result in traffic jams and cause inconvenience to the people passing through the road crossings at proposed interchanges due to movement of vehicles carrying construction materials.

221. This impact is temporary and minor negative in nature and can be mitigated by providing proper alternative traffic management plan during construction of the proposed Expressway. Interchanges will be constructed in a way that traffic flow is not disturbed; alternative routes will be clearly defined. Proper traffic management with marking should be done on the road crossings near proposed interchanges.

5.3.12 Utilities

222. Various utilities such as electrical poles, transmission lines, telephone lines and wells are situated within the RoW of the proposed Expressway. These utilities will be relocated before the start of construction activities. These utilities if not handled properly will cause difficulties to the peoples of Project Area. To handle this problem following mitigation measures should be taken:

- Strengthening of utilities, wherever required; and
- Close coordination with the concerned departments to curtail inconvenience to the residents of the Project area

5.4 Operational Phase

5.4.1 Noise

223. Due to increase in traffic volume, noise is expected to increase. As presently project area is free from noise pollution therefore this impact is permanent and major negative in nature. Coordination with local authorities may also be undertaken to enforce a ban on the use of horns in the vicinity of schools, mosques, hospitals and residential areas.

5.4.2 Deterioration of vehicles

224. The proposed Expressway, due to smooth road surface will result in less wear and tear of vehicles; it will also result in less fuel consumption. This impact is permanent and major positive in nature.

5.4.3 Soil Erosion and Contamination

225. During the operational phase, soil erosion may take place at different road structures (bridges, embankments, culverts etc.), which may increase the flood risk by rapid flash of storm-water runoff and also undermine these structures. Soil contamination can take place on border areas by road runoff containing heavy metals (e.g. lead). If these areas are used for growing vegetables for human consumption, it can have adverse impacts on human health. The research has shown that the increase in heavy metals is generally limited to a narrow border along the edge of the road and concentrations rapidly fall away with distance from the hard shoulder. The following mitigation measures are proposed to reduce the impacts on soil:

- In case soil erosion takes place, proper remedial measures will be undertaken to stop future impacts of loss of soils and the associated impacts caused by soil erosion; and
- Vegetation for human use should be banned within the proposed RoW.

5.4.4 Road Safety

226. The increased vehicular movement and speed may result in road safety issues like traffic accidents. The accidents may also be due to tiredness. The impacts on road safety would be permanent and moderate negative. They will be mitigated by enforcing speed limits and imposing penalties on the traffic violators. Rest areas will also be provided for those in need for rest during travel. Traffic signs will be provided to facilitate road users about speed limits, rest areas, eating establishments etc. Warning messages such as "*speed thrills but kills*" or "*better late than never*" etc. will also be displayed at appropriate locations to aware drivers about likely accidents due to overspeeding. All the lanes, median, sharp bends will be reflectorized to facilitate travellers in the night time. Proper lighting arrangement on the proposed Expressway will be done at required places.

5.4.5 Landscaping

227. The settlements in the immediate vicinity of the proposed Expressway will be directly affected due to this Project, which would be minor negative impact and can be mitigated by tree plantation along the proposed Corridor. It would also serve as physical barrier between the road and the existing settlements as well as future developments.

5.4.6 Land Use

228. The proposed Project will induce land use changes in the form of development of commercial establishments (restaurants, petrol and gas filling stations), educational institutes etc. The existing settlements will be shifted due to resettlement and the agricultural land will be changed into Expressway, with heavy traffic passing on it. The changes in land use may affect the land value, which will vary depending upon the location. The impacts on land use would be permanent and both moderate negative especially for those whose land values have not increased and medium beneficial for businessmen and those having escalated land values (especially near interchanges). However, all the facilities with the exception of restaurants and petrol/gas filling stations likely to pop up in the future will be prohibited within the RoW. The permission will be sought from the concerned authority for the development of any establishment along the proposed Project corridor.

5.4.7 Air Quality

229. The existing status of the project area is that there are agricultural fields due to this no or minor air pollution in the Project Area. Therefore this impact is permanent but minor negative.

230. Mitigation measures will include:

- Setting up of system to monitor air quality along the Project Area in accordance with acceptable International standards;
- Monitoring emissions of vehicles as per NEQS;
- Trees will be planted along the fence of the proposed Expressway, these will work noise barrier. For suitable plantation Forest Department will be consulted.

5.4.8 Time Saving

231. Due to increase in speed and undisturbed flow of traffic, travelling time will be saved to reach destination. Trade will improve due to better transport opportunities. This impact is permanent and major positive in nature.

5.4.9 Socio-economic Conditions

232. The operation of the proposed Expressway would lead to opening up markets to rural economic activities by reducing the production and transportation cost thereby stimulating agricultural production. The proposed Project will promote better business opportunities such as new petrol pumps and hotels. This impact is permanent and major positive in nature.

233. This would be a high beneficial impact but at the same time, it would be major negative for those who cannot access the Expressway except from interchanges. To overcome this problem, interchanges at the existing important routes will be provided in the design.

5.4.10 Water Quality

a) Surface Water

234. The surface water bodies may get flooded and polluted due to uncontrolled release of contaminated storm-water/road runoff from road surfaces. The pollutants associated with the road-runoff include: (a) hydrocarbons such as fuel and polycyclic aromatic hydrocarbons from wear and tear of the road surface, tyres, lubricants leaking from vehicles and from unburnt fuels; (b) heavy metals including cadmium, copper, zinc, iron derived from unburnt fuels, corrosive products from vehicles, wear and tear of tyres and road surfacing. Some heavy metals are largely soluble (copper for example) and insoluble (zinc for example); and (c) suspended solids including insoluble heavy metals as colloidal materials. The worst contamination generally takes place during the first flush of runoff from roads after a spell of dry weather. The level of pollution is directly related to the traffic volume.

235. The pollution risk from accidental spillage may increase moderately. In the long run, the increased traffic volume of traffic and faster traffic speeds would increase the risk of accidental spillage, which could have medium adverse impact on surface water quality. The natural drainage of road runoff across embankments or discharge of runoff into water bodies from large area of carriageway may have medium adverse

impacts on ponding and the flood risk to downstream locations. The following mitigation measures are proposed to attenuate surface water quality related impacts:

- In order to discharge rapid removal of storm-water/road runoff, cross slopes and longitudinal drainage will be provided in the design. Well-designed cross drainage structures limit ponding across embankments;

- Proper drainage system with sedimentation ponds and oil separators will be provided to avoid contamination by run-off and oil spills, especially drainage will be provided for oil spills near water channels to prevent any contamination;

- Retention basins with reedbeds provided in the design will improve the quality of polluted storm-water/road runoff;

- Cleaning of drainage structures will be carried out in case they are blocked by debris etc.;

- Drainage and collection structures on the road project, particularly in areas near the river and irrigation canals, shall be designed such that spills of hazardous materials shall not result to contamination of these watercourses

- Prior to operation, an emergency response plan for spills of hazardous materials and oil will be prepared.

- The surface water quality monitoring will also be carried out at defined intervals and for environmental quality monitoring parameters suggested in the Environmental Monitoring Plan. If these parameters are above the prescribed limits, suitable control measures will be taken.

b) Groundwater

236. Groundwater may get polluted due to contaminated road runoff on earthen shoulders and embankments planted with grasses. However, the areas in the immediate vicinity of the proposed Expressway will be avoided for vegetation due to the risk of contamination. Groundwater quality monitoring will be carried out as per schedule suggested in the Environmental Monitoring Plan.

SECTION 6

ECONOMIC ASSESSMENT

6.0 General

237. This section includes the overall economic benefits in relation to environmental costs resulting due to implementation of the proposed project.

6.1 Economic Benefits

238. The economic benefits resulting due to the implementation of the proposed Expressway Project will include:

i) Decreasing the vehicle operating cost and travel time costs due to better/ improved road facility, reduced traffic congestion, uninterrupted and smooth traffic flow;

ii) Improvement in the trade opportunities in country;

iii) Decrease in travelling costs and vehicles maintenance costs

iv) Uplift in the overall economy of the Punjab Province and

v) Improvement in the commercial activity in the Project Area, resulting in economic uplift of the people of the Project Area.

6.2 Environmental Costs

239. The total environmental cost has been worked out to be Rs. 3,969.199 million (US $ 66.187 million). This includes Rs. 3,864.969 million (US $ 64.42 million) as Land Acquisition and Resettlement Cost, Rs. 97.5 million (US $ 1.625 million) as mitigation cost, Rs. 6.53 million (US $ 0.109 million) as Monitoring Cost, and Rs. 0.2 million (US $ 0.033 million) for training cost. The environmental costs have been added to the Project Investment cost of 23,549.46 million (US $ 392.491 million). The total investment costs in financial terms thus come out to be Rs. 27,518.66 million (Us $ 458.644 million). This cost has been converted into economic terms as Rs. 24,766.79 million by applying SCF (Standard Conversion Factor) of 0.90.

240. Annual Operation and Maintenance (O&M) cost and overlaying costs have been worked out as Rs. 58.874 million and 2980.014 million respectively. Both expressed in economic terms are as Rs. 52.987 million and 2682.013 million respectively.

241. Economic Internal Rate of Return (EIRR) has been thus worked out, against total cost of Rs. 24846.59 million, as 15.91%, which is well above 12% the assumed opportunity cost of capital in Pakistan, thus rendering this Project economically viable for implementation.

SECTION 7

ENVIRONMENTAL MANAGEMENT PLAN

7.0 General

242. This section provides an approach for managing and monitoring environment related issues and describes the institutional framework for environmental management and resource allocations to be carried out by the National Highway Authority (NHA) for mitigating negative impacts of the proposed Faisalabad-Khanewal Expressway (E-4) Project.

7.1 Objectives of Environmental Management Plan (EMP)

243. The EMP will help the NHA, address the upcoming adverse environmental impacts of the proposed Expressway Project, enhance the Project's overall benefits and introduce standards of good environmental practices. The primary objectives of the EMP are to:

1. Define the responsibilities of the Project proponents in accordance with the three Project phases (design, construction and operation);
2. Facilitate the implementation of the mitigation measures by providing the technical details of each Project impact, and proposing an implementation schedule of the proposed mitigation measures;
3. Define a monitoring mechanism and identify monitoring parameters to ensure that all proposed mitigation measures are completely and effectively implemented;
4. Identify training requirements at various levels and provide a plan for the implementation of training sessions;
5. Identify the resources required to implement the EMP and outline corresponding financing arrangements; and
6. Providing a cost estimate for all proposed EMP actions.

7.2 Key Environmental and Social Components

244. The key environmental and social issues associated with this Project are as follows:

1. Resettling commercial structures owned by squatters presently operating within the proposed construction limit of the project corridor;

2. Appropriately locating temporary construction camps, asphalt plants, and waste disposal sites, and the environmental impact of operating these facilities;

3. Regulating the procurement of borrow material and topsoil erosion during construction;

4. Avoiding the obstruction of Expressway drainage system during construction and operation;

5. Enhancing and maintaining avenue tree plantation along the entire length of the project corridor;

6. Minimizing the impact on cultural sites or structures and community-owned assets during construction and operation; and

7. Ensuring pedestrian and traffic safety during construction and operation.

7.3 Role of Functionaries for Implementation of EMP

7.3.1 General

245. This sub section describes the methodology required for the implementation of EMP in conjunction with the NHA, Design Consultants, EIA Team, Supervision Consultants and Contractors. The executing agency of the Project will be National Highway Authority (NHA). General Manager (NHA/ADB) will be the overall Incharge of the Project. The GM (NHA/ADB) will delegate the supervisory responsibilities of the Project to the Project Director who will have professional staff supported by a team of consultants including Environmental Monitoring Specialists/Consultants. The EMP will be made a part of the contract agreement and the contractor will ensure that all Project activities during construction stage are in compliance with the EMP and NEQS. Detailed responsibilities of the contractor is presented in Section 7.3.6.

246. Environmental Protection Agency (EPA) Punjab will act as the overall regulatory body. The specific roles of key functionaries are described hereafter.

247. The Organizational setup of the management plan is shown in Fig. 7.1.

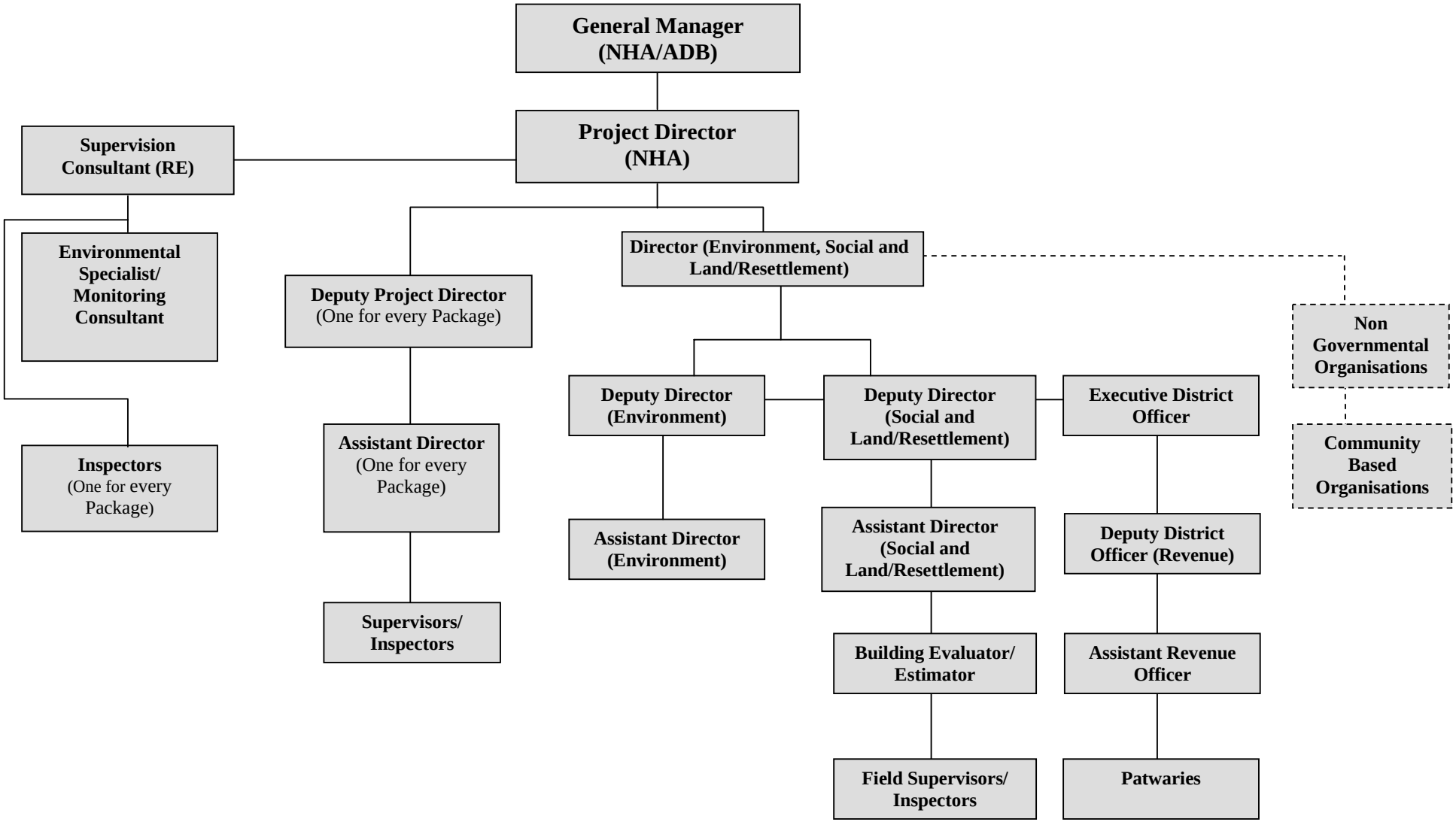


Fig. 7.1: Organisation Chart for Construction, Environmental Management and Resettlement Action Plan

7.3.2 National Highway Authority (NHA)

a) Project Director

248. The Project Director (NHA) will be responsible for the successful implementation of the Project. He will be assisted by the Supervision Consultants. The Project is divided into four Packages. Project Director will have four Deputy Directors; one for every Package.

b) Director (Environment, Social and Land/Resettlement)

249. The Director (Environment, Social and Land/Resettlement) will be the overall Incharge for handling the NHA's obligations with respect to the EMP. The Director (Environment, Social and Land/Resettlement) will depute one Deputy Director (Environment) for the Project, who will be responsible for ensuring that the provisions of the EMP are implemented. In addition, the Deputy Director (Environment) will also coordinate with the EPA Punjab, provincial Agriculture, Forest and Wildlife departments, NGOs/ CBOs and other public/ private sector organisations.

250. Deputy Director (Environment) will be assisted by Assistant Director (Environment) for the execution of Environmental Management Plan (EMP) for each Package of the Project.

251. Deputy Director (Social and Land/Resettlement) will be responsible for the land acquisition and resettlement related issues.

252. Executive District Officer (E.D.O Revenue) will be assisted by D.D.O (Revenue), Assistant Revenue Officer and Patwaries in assessing the award price for land acquisition to the affectees.

7.3.3 EIA Consultants

253. EIA consultants will prepare a comprehensive EIA and EMP of the Project in compliance with Pak EPA and ADB Guidelines.

7.3.4 Design Consultants

254. The design consultants will ensure that all the mitigation measures committed for the design phase are incorporated in the design and included in the contract documents.

7.3.5 Supervision Consultants

255. Supervision Consultants appointed by the GM (NHA/ADB) will be headed by a "Project Manager", who will be an Engineer. He along with his team will supervise the Project contractors to ensure quality of work and fulfilment of contractual obligations. The Supervision Consultants (SC) will provide one Environmental Specialist/ Monitoring Consultant (MC) who will:

1. Ensure that all the environmental and social parameters/provisions comply with the applicable standards;
2. Ensure that day-to-day construction activities are carried out in an environmentally sound and sustainable manner;
3. Organise periodic environmental training programmes and workshops for the Contractors' staff and NHA site staff in consultation with the NHA; and

4. Develop “good practices” construction guidelines to assist the Contractors and NHA staff in implementing the EMP.

7.3.6 Construction Contractor

256. EMP will be made a part of the contract agreement and the contractor will ensure that all Project activities during construction stage are in compliance with the EMP and NEQS. Beside this, contractor will develop a separate detailed EMP, which will contain management plans for aggregate/borrow pit, spoil, construction camp, traffic, revegetation and waste generated during construction activities consistent with EMP.

7.4 Specific Implementation Responsibilities

257. This section describes the implementation and supervision responsibilities for the different phases of the Project.

7.4.1 Design Phase/ Pre-Construction Phase

258. The Director (Environment, Social and Land/Resettlement), NHA and his staff with the assistance of EIA consultant are responsible for ensuring that the Project design and specifications adequately reflect the EMP and the Resettlement Policy Framework (RPF). He will ensure the Project’s compliance with environmental regulations and donor requirements; and ensure stakeholder participation in the Project design. The NHA (through the Director for Environment, Social and Land/Resettlement) shall ensure that appropriate environmental assessment, along with formulation of mitigation measures and a monitoring program, is undertaken should there be changes in the project design and specifications.

259. The responsibilities of Director (Environment, Social and Land/Resettlement) may be briefly described as follows:

1. To coordinate with regulatory agencies including EPAs, EIA consultant, local NGOs, that could assist the NHA in independent reviews of environmental and social compliance;
2. To supervise environmental and social assessment reports, and provide substantial inputs and guidance to the EIA consultant;
3. To get the approval of EIA from the EPA Punjab; and
4. To ensure that the design consultant has incorporated all the mitigation measures proposed for the design phase in the design and included in the contract documents.

260. Specifically, before the start of the Project, the NHA’s Deputy Director (Social and Land/Resettlement) will ensure that the following activities are carried out in a transparent manner and according to the acceptable standards:

1. Identifying and verifying Project affected persons (PAPs) on the basis of specified documents;
2. Identifying which public facilities and utilities need to be relocated;
3. Identifying alternative resettlement sites for PAPs outside the RoW;
4. Carrying out a consultation and dissemination campaign with regard to compensation procedures, entitlement packages, and proposed alternative resettlement sites;
5. Preparing individual entitlement files;
6. Preparing and approving compensation budgets;
7. Ensuring that an adequate notice period is given to PAPs before shifting; and

8. Providing shifting assistance to displaced squatters and to assist squatter-owners to salvage their facilities as per ADB Guidelines.

7.4.2 Construction Phase

261. Should there be any complaints arising from the implementation of the Project, NHA shall conduct site inspections and appropriate sampling to validate claims. Based on the findings, mitigation measures during the construction and operational phases will be implemented by the contractor and NHA, respectively. The NHA will appoint Supervision Consultants, who along with the Deputy Director (Environment) will oversee the working of contractor in accordance with the EMP.

- The Supervision Consultant will liaise with the Project staff to monitor environmental compliance during the construction;
- He will supervise the construction and provide technical support to help ensure compliance with the EMP;
- The Supervision Consultants will assess the environmental impact of Expressway construction;
- He will monitor the progress of work and adherence of the contractor to the EMP and Resettlement Action Plan; and
- He will direct the Contractor to work in such a manner that all Project activities are in compliance with the EMP and NEQS.

7.4.3 Operation Phase

262. The Deputy Director (Environment) and his staff will be responsible for the following:

1. Coordinating with the operational staff working under the Regional General Manager to monitor environmental compliance during Expressway operation;
2. Advising on, and monitoring tree plantations along the Expressway;
3. Reporting on the progress of environmental compliance to the federal and EPA Punjab;
4. Assessing the long-term environmental impacts of Expressway operation;
5. Sustaining a working partnership among the NHA, Punjab EPA, Agriculture, Forest and Wildlife departments of Punjab, NGOs and other related public private sector organizations; and
6. Reporting to Director (Environment) about progress of the work.

7.5 Environmental Management Plan

263. The Environmental Management Plan based on the mitigation measures (indicated in Section 5 of this Report) is presented in Table 7.1 below.

Table 7.1 (a): Environmental Management Plan (Design/ Pre-Construction Phase)

No.	Aspect	Project Impact	Mitigation Measures	Responsibility		Cost
				Implementation	Supervision	
1	Topography	▪ Change in topography due to construction-related structures such as bridges, embankments etc; and ▪ Visual changes to topography.	Provision for plantation in the design	Design Consultants (DC)	NHA	The cost for tree plantation, estimated at USD 1.2 M, will be included in the total Project cost.
2.	Soil Erosion	Road stability, increased flood risk (by more rapid and higher levels of runoff), silting up of water bodies, landscape value and in worst cases may reduce the economic productivity of land and biodiversity in the Project Area	Plantation and stone pitching or rip-rap on embankments and around bridges, flyovers etc.	DC	NHA	The cost for tree plantation is included above (USD 1.2 M) whil the cost for grass turfing is about USD 0.46 M. Stone pitching and provision of rip-rap are included in the total Project cost.
3.	Land Acquisition and Resettlement	▪ Loss of 4,794 acres of agricultural land; and ▪ Resettlement of Affected Persons (APs).	▪ Careful alignment and route selection by the designer to minimise resettlement; ▪ Developing proper judicious compensation package for affectees; and ▪ Prior to site works, payment of fair compensation to affected people based on the Land Acquisition and Resettlement Plan shall be made.	DC,	NHA	The cost of land acquisition and relocation estimated for this Project is USD 64.4 M
4.	Flora	Cutting of 18,000 trees of different species	▪ A total of 623,984 (311,992 in each strip on both sides of the road) sapling trees will be planted ▪ Raised Median will be planted with grasses and shrubs which may not attain height more than two meters. This planting could provide an effective protection against night glare besides beautifying the area; ▪ The compact plantation will be done on both sides; ▪ Regular monitoring of plantation will be carried out by the forest	DC, NHA	NHA	Refer to costs indicated under items 1 and 2 (tree planting and grass turfing.

			department and any failures will be immediately beaten upto 25%; ▪ The indigenous trees most suited to the tract like Shisham, Kikar, Bakain, Dharek, Siris (*Albizzia procera*), Farash, Sukh chain, Jaman, Bohar, Peepal (*Ficus reliogosa*), Gullahr (*Ficus glomerata*), Sohanjana *(Moringa oleifera*), Karir and Wan (*Salvadora oleoides*) will be planted; ▪ If a tree of rare species is growing within the ROW and is required to be removed, it will not be felled but uprooted and transplanted in close consultation with the Forest Department; ▪ All old and mature trees falling in the 25 meter wide proposed planting strips will be saved. Effort should be made to save as many trees as possible even if they are young or poll stage. Proper irrigation and maintenance of plants will be done; ▪ An awareness campaign targeted on the neighbourhood farmers will be carried to popularize the planting of trees, and saplings should be provided on subsidized costs; and ▪ Organic farming will be encouraged to minimize the use of chemical fertilizers and pesticides.			
5.	Change in Hydrologic Regime	Flooding in waterlogged areas	▪ Provision of box culverts to control flood damages and provision of safety of embankments; and ▪ Provision of sufficient sizes of drains to take design flows.	DC	NHA	The cost for culverts is part of civil works.
6.	Restricted Access	Blockade of access across the proposed Expressway because of its being fenced on both sides	Provision of flyovers and underpasses at the existing passages	DC	NHA	The cost for flyovers and underpasses will be included in the total Project cost.

7.	Public Utilities	Inconvenience caused by disruption of public utilities	▪ Provision in the design and budget for the relocation of the existing utility infrastructures wherever required; and ▪ All public utilities (e.g. water pipes, power/ telephone lines likely to be affected by the proposed Expressway will be relocated well ahead of time before the actual commencement of the construction work.	DC	NHA	The cost for relocation of the existing utility infrastructures will be included in the total Project cost.
8.	Seismicity	Seismic activities may damage structures	▪ Project structures shall be designed consistent with seismic codes for the area.	DC	NHA	

Table 7.1 (b): Environmental Management Plan (Construction Phase)

No.	Aspect	Project Impact	Mitigation Measures	Responsibility		Cost
				Implementation	Supervision	
1	Topography	Cutting and dismantling of existing infrastructure	Proper landscaping	Construction Contractors (CC)	Supervision Consultants (SC), NHA	No additional payment will be made to the contractor for these mitigation measures estimated at USD 50,000. The contractor will include their costs in other items of work in the BOQ.
2	Borrow/ open pits	▪ Land disputes, soil erosion, loss of potential cropland, loss of vegetation, landscape degradation, and damage to road embankments; and ▪ Borrow and open pits are potential sources of mosquito breeding and may prove hazardous to human beings, livestock and wildlife.	▪ Necessary permits will be obtained for any borrow pits from the competent authorities; ▪ No excavations allowed within a distance of 100 metres of the RoW; ▪ In borrow pits, the depth of the pits will be regulated so that the sides of the excavation will have a slope not steeper than 1: 4; ▪ Soil erosion along the borrow pit should be regularly checked to prevent/ mitigate impacts on adjacent lands; ▪ In case borrow pits are filled with water, measures have to be taken to prevent the creation of mosquito-breeding sites; Borrow pits will be properly drained in order to avoid ponding of water; ▪ Borrow pits will be fenced to avoid any accident; ▪ Borrow pits will be used for construction material landfill or fish ponds, but during the excavation, top 20 cm soil cover should be preserved for vegetation after the filling of the pits. This is the best way to restore the flora of that area. ▪ Prior to any site works, contractor	CC	NHA, SC	No additional payment will be made to the contractor for these mitigation measures estimated at USD 100,000. The contractor will include their costs in other items of work in the BOQ.

No.	Aspect	Project Impact	Mitigation Measures	Responsibility		Cost
				Implementation	Supervision	
			will prepare a detailed EMP which will also contain borrow pit/ open pits management plan.			
3	Air Quality	Air quality will be affected by fugitive dust emissions from construction machinery, asphalt plants and vehicular traffic. Emission may be carried over long distances depending upon the wind speed, direction, the temperature of the surrounding air etc.	▪ Dust control by equipping asphalt hot mix and batching plants with fabric filters or wet scrubbers to reduce the level of dust emissions; ▪ Sprinkling of water across diversion tracks. Ensuring that haul trucks carrying asphalt concrete mix and/ or aggregate fill materials are kept covered with tarpaulin to help contain construction material being transported between sites; and ▪ Enforcing the NEQS applicable to gaseous emissions generated by construction vehicles, equipment and machinery.	CC	NHA, SC, EPD Punjab	No additional payment will be made to the contractor for these mitigation measures estimated at USD 50,000. The contractor will include their costs in other items of work in the BOQ.
4	Construction waste disposal (Wastewater, oil and solid waste etc.)	Unhygienic conditions, health risk to work force	▪ Wastewater effluent from contractors workshop and equipment washing yards will be passed through gravel/ sand beds to remove oil/ grease contaminants before discharging it into natural streams; ▪ Training of work force in the storage and handling of materials and chemicals that can potentially cause soil contamination; ▪ Solid waste generated during construction and in camp sites will be properly treated and safely disposed of in demarcated waste disposal sites; and ▪ Debris generated by dismantling of existing pavement structures will be recycled subject to the suitability of the material.	CC	SC, EPA Punjab	No additional payment will be made to the contractor for these mitigation measures estimated at USD 100,000. The contractor will include their costs in other items of work in the BOQ.

No.	Aspect	Project Impact	Mitigation Measures	Responsibility		Cost
				Implementation	Supervision	
			▪ Prior to site works, the contractor will prepare a detailed EMP which will also contain construction waste (solid and liquid) management plan.			
5.	Construction Camps and Other Facilities	Loss of plantation and vegetation, permanent physical and visual impact on the area, social disturbance for nearby community	▪ The construction camps and workshops will not be located in sensitive areas and prevented within 500 meters distance from the existing settlements; ▪ Whole working area will be fenced and no unauthorized person will be allowed to enter the work area; ▪ All construction staff will be provided with Personnel Protective Equipment (PPEs) ▪ Efforts will be made to minimize vegetation loss while making site arrangements for construction camps and other facilities; ▪ Cutting of trees shall be prohibited by contractor(s) and workers near camp sites failing which three new trees will be planted by the Contractor(s) for each tree cut; ▪ The crushing plants shall not be located in environmentally sensitive areas or near existing settlements; ▪ The sites for borrow pits shall be located in non-productive barren lands (present in Shorkot Tehsil), nullahs and publicly recognized waste lands. Such sites shall be selected on the basis of type of soil strata, depth of water table, ground topography, prevalent vegetation state etc. and shall not be located within 100 meters from RoW of the proposed Project. They shall be prohibited where they might interfere with the existing or	CC	NHA & SC	No additional payment will be made to the contractor for these mitigation measures estimated at USD 10,000. The contractor will include their costs in other items of work in the BOQ.

No.	Aspect	Project Impact	Mitigation Measures	Responsibility		Cost
				Implementation	Supervision	
			designed drainage pattern. ▪ The contractor shall first explore suitable sand sources other than the Ravi and Chenab Rivers. In case there are no viable alternative locations, specific mitigation measures shall be developed and implemented by the contractor to ensure that impacts due to sand extraction from riverbeds are minimized. Permission from the Minerals Department of Punjab province shall also be secured by the contractor prior to sand extraction. ▪ The Contractor(s) shall ensure that borrow pits are left in a tidy state with stable side slopes and proper drainage in order to avoid creation of stagnant water bodies, which are favourable places for mosquito breeding; ▪ When materials such as sand and gravel are removed from riverbanks, the depth of extraction shall be kept at a reasonable level to ensure stability and minimal erosion. This activity shall not interrupt the river flow or undermine the river banks; ▪ Asphalt hot mix and batching plants will not be located within 1000 meters of the existing settlements and shall be located sufficiently away from agricultural activities, industrial establishments and sensitive areas including, but not limited to, educational and health facilities; ▪ The construction material for E-4			

No.	Aspect	Project Impact	Mitigation Measures	Responsibility		Cost
				Implementation	Supervision	
			will be only be taken from approved quarries and no new quarry will be dug by the contractor; ▪ The construction material storage areas shall not be located in sensitive areas and shall be sheltered or sited within hoardings; ▪ The Contractor(s) will use the selected routes for transport of construction materials. Any damage caused to these routes by overloading or heavy vehicles will be borne by the Contractor(s); ▪ Landowners shall be compensated according to the terms of lease agreements negotiated with them for constructing camps and other facilities; ▪ The sites for camps and associated facilities shall be reinstated by the Contractor(s) after decommissioning of the proposed Project, and ▪ Contractor will prepare a detailed EMP which will also contain construction camp management plan.			
6.	Soil Erosion and Contamination	Road stability, increased flood risk (by more rapid and higher levels of runoff), silting up of water bodies, landscape value and in worst cases may reduce the economic productivity of land and biodiversity in the Project Area.	▪ A reinstatement/revegetation management plan shall be developed by the contractor prior to any site works. ▪ Non-productive barren lands (available in Shorkot Tehsil)in broken terrain, nullahs and publicly recognized waste lands shall be used for borrowing materials; ▪ Borrowing material will be used with the approval from Soil Quality Engineer;	CC	NHA, SC	No additional payment will be made to the contractor for these mitigation measures estimated at USD 40,000. The contractor will include their costs in other items of work in the BOQ.

No.	Aspect	Project Impact	Mitigation Measures	Responsibility		Cost
				Implementation	Supervision	
			▪ The excavation of earth fill shall be limited to an approximate depth of 50 to 100 cm; ▪ In case the use of agricultural land is unavoidable, the top 30 cm of the plough layer shall be stripped off and stockpiled. Where deep ditching is to be carried out, the top 1 meter layer of the ditching area shall be stripped and stockpiled for redressing the land after the required borrow material has been removed; ▪ Drainage interception ditches shall be built around the borrow pits to prevent surface run off causing erosion during the rainy season; ▪ The denuded ground cover will be re-vegetated as soon as possible following fill placement to facilitate regeneration of a stabilizing ground cover; ▪ The road embankments and road cuttings will be vegetated with a fast growing crop and a native seed mix immediately after fill placement to prevent scour and to encourage stabilization. Use of stone pitching or riprap will be made at appropriate places especially at overpasses, bridges, culverts; ▪ Discharge zones from drainage structures will be furnished with rip-rap to reduce erosion; ▪ Down drains/chutes shall be lined with rip-rap/masonry or concrete to prevent erosion; ▪ Side slopes shall be adjusted to a gradient necessary to reduce erosion potential or, if steeper,			

No.	Aspect	Project Impact	Mitigation Measures	Responsibility		Cost
				Implementation	Supervision	
			stabilized, covered with riprap or other material to prevent soil erosion; ▪ As much as possible, construction will be restricted to dry season to avoid soil erosion; ▪ Soil erosion checking measures such as the formation of sediment basins etc, will be taken; ▪ The proposed Project Site, through which the alignment is proposed, will be investigated for the presence of naturally occurring contaminants such as asbestos, arsenic; likelihood of erodibility of soil; contours, terrain stability, slope gradient; physical and chemical properties of soil such as soil depth, particle size distribution, permeability, dispersibility, pH, salinity; and likelihood of seismic activity. If any contaminated soils are found, they shall be removed and deposited in a sealed pit in an area agreed with the concerned authority. The seismic factor shall also be considered at the design stage; ▪ Soil contamination by bitumen, fuel and chemical storages shall be minimized by siting them on an impervious base within an embanked area and secured by fencing. The base and walls of the embankment shall be impermeable and of sufficient capacity to contain 110 per cent of the total volume of stored fuels and chemicals; and ▪ The disposal of waste asphalt shall be made in approved locations			

No.	Aspect	Project Impact	Mitigation Measures	Responsibility		Cost
				Implementation	Supervision	
			such as borrow pits or natural depressions and shall not be within the RoW. Unless located in areas with impervious soils, encapsulation with pre-laid impervious liners including walls and capping is required with the objective to prevent water percolating through the waste materials and leaching toxic chemicals into the surrounding soils. On completion of disposal at the site, the area shall be capped with a compacted thickness of at least 0.5 meters of impermeable soil covered with at least 200 mm of top soil and shall be finally landscaped.			
7.	Noise	Physiological and psychological impacts	▪ Selection of latest equipment and plant with reduced noise level ensured by suitable in-built damping techniques and appropriate muffling devices; ▪ Confining excessively noisy work to normal working hours in the day; ▪ Providing the construction workers with suitable hearing protection like ear cap, ear muffs etc.; ▪ Avoiding heavy machinery like percussion hammers and pneumatic drills, especially during night time; ▪ Locating the rock crushing, concrete mixing and material shipment at least 500 m away from residential areas, particularly schools, hospitals and nursing homes; and ▪ Noise quality monitoring will be carried out as per schedule given in	CC	NHA, SC, EPA Punjab	No additional payment will be made to the contractor for these mitigation measures. The contractor will include their costs in other items of work in the BOQ.

No.	Aspect	Project Impact	Mitigation Measures	Responsibility		Cost
				Implementation	Supervision	
			Environmental Monitoring Plan.			
8.	Surface and Groundwater	▪ Surface water might get contaminated due to the disposal of construction waste generated due to the Project activity; this contamination will not only endanger the aquatic life but will also result in jeopardizing the health of natives that use this water for meeting domestic requirement; and ▪ In addition to that, construction waste, if left unattended will result in forming leachate which will percolate through the soil strata and will reach underground water table and hence, will end up contaminating it.	▪ The workforce shall be trained on proper storage and handling of materials and chemicals; ▪ Work camps shall be provided with toilets and septic tanks; ▪ Proper drainage system with sedimentation ponds and oil separators will be provided to cope with the rain water and oil spills, especially drainage will be provided for oil spills near water channels to prevent any contamination; ▪ Washing of machinery and vehicles in surface waters shall be prohibited. Sealed washing basins shall be provided and wastewater shall be collected into a sedimentation/retention pond. ▪ The proponent will ensure that the construction work is confined, as much as possible, within the RoW and water bodies are prevented from pollution during construction; ▪ Proper care will be taken during construction of Expressway above or near the water channels to avoid or minimize damage; ▪ Work on irrigation canal areas will be kept to a minimum, protective walls be will be re-constructed. Any damage/ disturbance made to the irrigation channel will be reinstated immediately during construction; ▪ Regular water quality monitoring shall be conducted according to determined sampling schedule; ▪ The contractor shall ensure that construction debris do not find their	CC	NHA, SC, EPA Punjab	No additional payment will be made to the contractor for these mitigation measures estimated at USD 25,000. The contractor will include their costs in other items of work in the BOQ.

No.	Aspect	Project Impact	Mitigation Measures	Responsibility		Cost
				Implementation	Supervision	
			way into the drainage or irrigation canals which may get clogged; ▪ To maintain the surface water flow/drainage, appropriate drainage structures shall be installed; ▪ Construction work close to the streams or other water bodies will be avoided, especially during monsoon period; ▪ Wastes will be collected, stored and taken to the approved disposal site.			
9.	Flora and Fauna	▪ Loss of 4794 acres of agricultural land ▪ Cutting of 18,000 trees due to Project related construction activities. ▪ Hunting and fishing	▪ A tree-cutting permit shall be secured by the contractor prior to removal of vegetation. For every tree felled, four trees will be planted to compensate for the loss in vegetation. Planting shall be undertaken on a 25 m strip of land on both sides of the road. Selection of appropriate species and the design of the planting and maintenance program shall be carried out by the contractor in close consultation with the Forestry Department. ▪ Flowering and fruiting shrubs will be planted along the road to beautify the landscape. ▪ Raised Median will be planted with grasses (turfing) and shrubs which may not attain height more than two meters. ▪ All old and mature trees falling in the 25 meter wide proposed planting strips will be saved. Effort should be made to save as many trees as possible even if they are young or poll stage. Proper	NHA	NHA, SC, Forest Department and Wildlife Department	As indicated above, the cost for tree plantation is about USD 1.2 M while the cost for grass turfing is about USD 0.46 M.

No.	Aspect	Project Impact	Mitigation Measures	Responsibility		Cost
				Implementation	Supervision	
			irrigation and maintenance of plants should be ensured; ▪ An awareness campaign targeted on the neighbourhood farmers should be run to popularize the planting of trees, and saplings should be provided on subsidized costs; and ▪ Organic farming should be encouraged to minimize the use of chemical fertilizers and pesticides. ▪ Illegal wildlife hunting and fishing will not be allowed and corresponding penalty shall be enforced in case of violation; ▪ Wildlife department will check and confirm that no hunting is made; ▪ New and good condition machinery with minimum noise will be used in construction; ▪ Noisy work will not be carried out in night time so that there should be no disturbance to local birds and animals; ▪ Contractor will ensure that the no hunting, trapping of animal will be carried during construction; and ▪ Borrow pits will be fenced so that no animal can fell into these.			
10.	Social and Cultural Problems	▪ Exit/entry problems for the residents/ movement of the people to the mosque/shrines may be disturbed; and ▪ Serious law and order situation due to interaction of workforce with the local communities. ▪ Livelihood problem due to loss of agricultural land	▪ Workers will be encouraged to be sensitive toward local customs and traditions to minimize social friction. ▪ Providing alternative ways in order for the local people to perform their routine tasks; ▪ Adding appropriate clauses in the construction contracts to avoid any law and order situation;	CC, NHA	NHA and SC	No additional payment will be made to the contractor for these mitigation measures. The contractor will include their costs in other items of work in the BOQ.

No.	Aspect	Project Impact	Mitigation Measures	Responsibility		Cost
				Implementation	Supervision	
			▪ As for as possible local communities will be hired for construction works; ▪ Local labor shall be employed with an agreed ratio (>75%) for construction works. Women will be hired (10-20% of total labor requirements) as unskilled labor; remuneration shall be equal to that of men. ▪ Women shall be encouraged to participate in tree planting and maintenance to be funded under the project.			
11.	Traffic Management	Traffic jams causing inconvenience to the people	▪ Alternative traffic routes shall be provided during construction, and adequate warning signs installed at the approach to road crossings from both directions. ▪ Traffic management shall be undertaken in coordination with the local traffic police department.	CC, NHA, Local Traffic Police Department	NHA and SC	No additional payment will be made to the contractor for these mitigation measures. The contractor will include their costs in other items of work in the BOQ.
12.	Public Utilities	Construction activities will result in relocation of various utilities within the RoW, including electrical poles, transmission and telephone lines	▪ Utilities such as water pipes, power and telephone lines that will be affected by the Project shall be relocated well ahead of the actual commencement of construction. This activity shall be done in coordination with the concerned departments. Close coordination with the concerned departments to curtail inconvenience to the residents of the Project area	NHA and Local Concerned Departments.	NHA and SC	No additional payment will be made to the contractor for these mitigation measures. The contractor will include their costs in other items of work in the BOQ.
13.	Public Safety	Risk of drowning due to presence of water-filled borrow pits Safety risks due to construction works	▪ Borrow pits shall be dewatered and fences shall be provided, as appropriate. ▪ The general public/local residents shall not be allowed in high-risk areas, e.g., excavation sites and	CC	NHA and SC	No additional payment will be made to the contractor for these mitigation measures estimated at USD 10,000. The contractor

No.	Aspect	Project Impact	Mitigation Measures	Responsibility		Cost
				Implementation	Supervision	
			areas where heavy equipment is in operation. ▪ Work area will be fenced to avoid unauthorized entry.			will include their costs in other items of work in the BOQ.
14	Health and Safety of Workers	Health risks due to unsafe working conditions	▪ Basic medical care shall be provided at camp sites. ▪ Workers shall be provided with a potable water supply. ▪ Appropriate protective equipment shall be provided. ▪ Designated staff shall be provided with basic medical training. ▪ Work camps shall be provided with facilities to ensure the safety of workers, e.g., fire-fighting equipment, adequate storage for hazardous materials, and contingency measures in case of accidents. ▪ Awareness campaigns/ orientation shall be implemented to educate workers on AIDS and other communicable diseases.	CC	NHA and SC	No additional payment will be made to the contractor for these mitigation measures estimated at USD 75,000. The contractor will include their costs in other items of work in the BOQ.

Table 7.1 (c) Environmental Management Plan (Operation Phase)

No.	Aspect	Project Impact	Mitigation Measures	Responsibility		Cost
				Implementation	Supervision	
1.	Noise	Physiological and psychological	▪ Height of walls surrounding schools and mosques may also be increased and other suitable measures may be implemented based on noise monitoring results during operation. ▪ Coordination with local authorities may also be undertaken to enforce a ban on the use of horns in the vicinity of schools, mosques, hospitals and residential areas.	NHA		Depending on the monitoring results, specific costing will be done.
2.	Deterioration of Vehicles	Less wear and tear due to improved road condition	-	-		
3.	Soil Erosion and Contamination	▪ Flood risk by rapid flash of storm-water runoff, undermining of the structures such as bridges, flyovers and slope instability causing damage to the Expressway; and ▪ Soil contamination due to Wastewater arising from Service Areas.	▪ Drainage facilities shall be regularly cleaned to ensure that these are free from obstruction; ▪ Roadside tree plantations shall be maintained. Vegetation for human use will be banned within the proposed RoW ; and ▪ Toilets at the service areas will be equipped with septic tanks, and the waste will be disposed at designated sites.	NHA	NHA & NH&MP	The cost for these mitigation measures, estimated at USD 80,000/yr., will be included in the total Project cost.
4.	Road Safety	Road safety issues like accidents	▪ Speed limits shall be imposed. ▪ Rest areas shall be provided. ▪ Traffic signs shall be provided to warn road users about speed limits, rest areas, eating establishments etc. ▪ Lanes, median, and sharp bends shall be reflectorized to improve road visibility at night time. ▪ An emergency response plan for spills of hazardous materials and oil will be prepared prior to operation.	NHA	NHMP	The cost for these mitigation measures estimated at USD 5,000 will be included in the total Project cost.

No.	Aspect	Project Impact	Mitigation Measures	Responsibility		Cost
				Implementation	Supervision	
			Proper lighting shall be provided along the project road.			
5.	Landscaping	Solid waste along the Expressway	▪ Provision of solid waste collection bins/containers at appropriate places ▪ Regular disposal of solid waste into approved sites.	NHA		The cost for these mitigation measures estimated at USD 3,000 will be included in the total Project cost.
6.	Land Use	Development of commercial establishments (restaurants, petrol and gas filling stations), educational institutes etc., which may affect the land value	Seeking permission from the concerned authority for future development	NHA	Development Authority	The cost for these mitigation measures will be included in the total Project cost.
7.	Air Quality	Change in air quality with the passage of time	▪ Setting up of system to monitor air quality along the Project Area in accordance with acceptable International standards; and ▪ Tree-lined strips of land on both sides of the road shall be provided and maintained to help reduce particulate matter and gaseous emissions reaching roadside settlements.	NHA	EPA Punjab	The cost air quality monitoring is estimated at USD 5,800/yr. (see Table 7.2: Operation Phase)
8.	Time Saving	Reduced travel time, which will be permanent moderate positive impact	-	-		
9.	Socio-economic Conditions	▪ Opening up markets to rural economic activities by reducing the production and transportation cost thereby stimulating agricultural production ▪ In-accessibility except from interchanges	▪ Providing interchanges at appropriate locations ▪ Keeping underpasses in operation condition by regular maintenance ▪ Persons from local communities will be hired for operation and maintenance work subjected to their competence.	NHA		The cost for these mitigation measures will be included in the total Project cost.

Note: DC (Design Consultant), CC (Construction Contractor), SC (Supervision Consultant), NHA (National Highway Authority), NHMP (National Highway & Motorway Police)

7.6 Environmental Monitoring

264. This section provides a monitoring plan that identifies the roles and responsibilities of Project staff involved in environmental and social monitoring and lists the parameters that will be used in the monitoring process.

7.6.1 Objectives

265. The main objectives of the pre-construction, construction and operation phase monitoring plans will be to:

- Monitor the actual impact of the works on physical, biological and socio-economic receptors within the Project corridor for indicating the adequacy of the EIA;
- Recommend mitigation measures for any unexpected impact or where the impact level exceeds that anticipated in the EIA;
- Ensure compliance with legal and community obligations including safety on construction sites;
- Monitor the rehabilitation of borrow areas and the restoration of construction campsites as described in the EMP; and
- Ensure the safe disposal of excess construction materials.

266. The main objectives of monitoring during the operation phase will be to:

- Appraise the adequacy of the EIA with respect to the Project's predicted long-term impacts on the corridor's physical, biological and socio-economic environment;
- Evaluate the effectiveness of the mitigation measures proposed in the EMP and recommend improvements, if and when necessary;
- Compile periodic accident data to support analyses that will help minimise future risks; and
- Monitor the survival rate of avenue plantations.

7.6.2 Monitoring Roles, Responsibilities and Schedules

267. The Project staff engaged in social and environmental monitoring is listed below, followed by descriptions of the monitoring responsibilities specific to each post:

- DD (Environment)
- Supervision Consultants

268. Overall monitoring plan is shown in Table 7.2.

a) Deputy Director (Environment)

269. The Deputy Director (Environment) will have overall responsibility for Environmental Monitoring and Evaluation (M&E). This includes the following:

1. Ensuring the availability of human and material resources required for environmental monitoring;

2. Generating periodic monitoring reports and disseminating these among the management and appropriate staff members;

3. Ensuring that the required environmental training is provided to the staff concerned; and

4. Contracting out external monitoring to independent firms and ensuring that periodic environmental audits are carried out.

270. The DD (Environment) and his team will also be responsible for:

1. Carrying out visits to the construction sites to review the environmental performance of the contractors; and

2. The status of the Project's consultation strategy.

b) Supervision Consultant

271. Supervision Consultant will involve the Environmental Expert/ Monitoring Consultant and Resident Engineer. The Resident Engineer will overlook the performance of contractor to make sure that the contractor is carrying out the work in accordance with EMP. The Monitoring Consultant (MC) on the other hand will carry out the environmental monitoring and report to DD (Environment) for adequacy of the monitoring program as specified in EMP. The MC will also induct a Technical Training Consultant to educate the Contractor's and NHA's staff.

7.6.3 Monitoring Parameters

a) Environmental Monitoring Parameters

272. The following environmental parameters will be monitored at locations identified during the construction phase (e.g. location of asphalt plants, construction camps. etc.).

- Ambient Air Quality (NO_x, SO_x, CO, PM_{10}, Hydrocarbons, Smoke)
- Water Quality
  Groundwater Quality (Total Coliforms, Fecal E. Coli, Total Colonial Count, Fecal Enterococci, pH, TDS, Total Hardness, Nitrate, Chloride, Sodium)
  Wastewater Quality (pH, DO, TSS, Alkalinity, BOD_5, COD, Turbidity)
- Noise Levels

b) Social Monitoring Parameters

273. Social monitoring will be carried out based on the following indicators:

- Number of PAPs to be resettled/ relocated/ provided livelihood assistance where required;
- Availability and adequacy of alternative resettlement sites for PAPs (by number and type);
- Inventory and valuation of PAPs' affected assets;
- Pre- and post-resettlement incomes of PAPs;
- Notice period given to PAPs before shifting them from their original locations within the RoW;
- Number of vulnerable PAPs compensated under the EMP;
- Verification of shifting assistance provided to displaced squatters and to squatter-owners allowed to salvage their facilities;
- Number and nature of consultations carried out, as well as targeted stakeholders;
- PAPs' perspectives on compensation procedures, entitlement packages, and proposed alternative resettlement sites;

- Record of any problems due to restricted access to the Expressway during construction and whether ramps/ diversions have been provided where required;
- Number of grievances recorded and redressed;
- Number of public facilities and utilities to be relocated;
- Number of mosques/ shrines/ graves to be relocated (if any) and corresponding contribution of affected communities and NHA; and
- Verification of relocation of mosques/ shrines/ graves.

7.6.4 Reporting Structure and Outcomes

274. Progress reporting will be the overall responsibility of the Project Director who will provide inputs to the Supervision Consultants for submission to GM (NHA/ADB). The Supervision Consultants will be responsible for submitting a monthly environmental/ social report for the Project to GM (NHA/ADB). In addition, the DD (Environment) will prepare a quarterly report encompassing environmental concerns, and following review by the Director (Environment, Social and Land/Resettlement) he will submit the report to the EPA Punjab.

Table 7.2 Environmental Monitoring Plan

Project Stage	Parameters	Details of Location	*Standards/ Guidelines	No. of Samples	Frequency	Responsibility	Duration	Cost (Rs.)
Pre-Construction Stage								
	|Ambient Air Quality (CO, NO_x, SO_x, PM_{10})	7.5 metres from the edge of pavement downwind at seven selected locations	USEPA Standards	7	Once @ Rs.50,000/ location	NHA	Continuous for 24 hours or one full working day	350,000/-
	Groundwater Quality (Total Coliforms, Fecal E. Coli, Total Colonial Count, Fecal Entercocci, pH, TDS, Total Hardness, Nitrate, Chloride, Sodium) Surface Water Quality (pH, DO, TSS, Alkalinity, BOD_5, COD, Turbidity)	Community groundwater sources near the edge of the RoW at 7 selected locations along the proposed Expressway	▪ WHO Drinking Water Quality Guidelines (2004) ▪ NEQS (2000)	7 for groundwater and 4 for surface water	Once @ Rs. 10,000 /-per sample	NHA		110,000/-
	Noise Levels on dB(A) Scale	Seven locations: 15 meters from the edge of the pavement, at sensitive locations like basic health unit, school, madrassa and residential/ commercial area.	WHO Noise Guidelines	7	Once @ Rs. 1,500/- per point	NHA	24 hours @ 15 seconds interval over 15 min every hour, then averaged	10,500/-
							TOTAL	**470,500/- (US$ 7,841.667)**
Construction Stage								
	Air Quality (PM_{10}, Hydrocarbons) All relevant stack emissions (CO, NO_x, SO_x, Smoke)	40 metres from hot mix plants	USEPA, WHO, NAAQS	4 (1 in each section)	Bi-annually @ Rs. 70,000/- for four years	Contractor	Continuous for 24 hours or one full working day	2,24,000/-
	PM_{10}	In active construction area	USEPA, WHO, NAAQS	4 (1 in each section)	Monthly @ Rs. 10,000 for four years	Contractor	Continuous for 24 hours or over one full	1,920,000

Project Stage	Parameters	Details of Location	*Standards/ Guidelines	No. of Samples	Frequency	Responsibility	Duration	Cost (Rs.)
							working day	
	Water Quality Groundwater Quality (Total Coliforms, Fecal E. Coli, Total Colonial Count, Fecal Enterococci, pH, TDS, Total Hardness, Nitrate, Chloride, Sodium) Wastewater Quality (pH, DO, TSS, Alkalinity, BOD_5, COD, Turbidity)	Four locations - near edge of the RoW and community groundwater source All project-related wastewater discharge locations including camp sites, asphalt plants and workshops (four locations)	WHO Drinking Water Quality Guidelines (2004) NEQS (2000)	4 for groundwater and 4 for wastewater (1 for groundwater and 1 for surface water in each section)	Bi-annually @ Rs. 10,000	Contractor		640,000/-
	Noise Levels on dB (A) Scale	At equipment yard and construction site and during pile driving 7 meters from noise source	WHO Noise Guidelines	4 (1 in each section)	Monthly @ Rs. 1,500 per point for four years	Contractor	24 hours @ 15 seconds interval over 15 min every hour, then averaged	288,000/-
		Not less than one location 15 meters from the edge of pavement and at locations of all potentially affected sensitive receptors		7				504,000/-
							TOTAL	**5,592,000/-** **US $ 93,200/-**
Operation Stage								
	Ambient Air Quality (CO, NO_x, SO_x, PM_{10})	7.5 metres from the edge of pavement downwind at seven selected locations	USEPA Standards	7	Once @ Rs.50,000/ location	NHA	Continuous for 24 hours	350,000/-
	Groundwater Quality (Total Coliforms, Fecal E. Coli, Total Colonial Count, Fecal Entercocci, pH, TDS, Total Hardness,	Community groundwater sources near the edge of the RoW at 7 selected locations along the proposed Expressway	▪ WHO Drinking Water Quality Guidelines (2004)	7 for groundwater and 4 for Wastewater	Once @ Rs. 10,000 per sample	NHA		110,000/-

Project Stage	Parameters	Details of Location	*Standards/ Guidelines	No. of Samples	Frequency	Responsibility	Duration	Cost (Rs.)
	Nitrate, Chloride, Sodium) Surface Water Quality (pH, DO, TSS, Alkalinity, BOD_5, COD, Turbidity)		▪ NEQS (2000)					
	Noise Levels on dB(A) Scale	Seven locations: 15 meters from the edge of the pavement, at sensitive location like basic health unit, school, madrassa and residential/ commercial area.	WHO Noise Guidelines	7	Once @ Rs.1,500/- point	NHA	24 hours @ 15 seconds interval over 15 min every hour, then averaged	10,500
							TOTAL	**470,500/-** **US $ 7,841.667/-**
							Total Monitoring Cost	**6,533,000/-** **US $ 108,883.3 /-**

7.7 Environmental Mitigation Cost

275. To minimise the negative impacts arising due to increased vehicular activity on the road, the mitigation measures could be:

(i) Tree plantation (number of trees planted will be 4 times the number of trees cut) for reducing the air pollution along with the excessive noise; and

(ii) Plantation of excessive trees along the Project Section.

276. Table 7.3 gives the mitigation cost for Planting and Maintenance. Two strips of 25m width have been planned to be reserved for planting on both sides of the expressway (Faisalabad – Khanewal section = 184 km long). Planting shall be done in rows (avenues). Eight avenues (row to row distance = 3m) shall be planted for a length of 50 km near the habitations and four avenues (row to row distance = 6m) in the rest of the 134 km long strip.

Number of plants in eight avenue/ rows of 50 km = 16,666 x 8 = 133,328

Number of plants in four avenue/ rows of 134 km = 44,666 x 4 = 178,664

Number of plants in one strip = 311,992

Number of plants in one strip = 623,984

Number of Avenue miles (500 plants in on avenue mile) to be planted = 1,250
Beating up of failures (25% of the plants planted) Avenue miles = 312

Table 7.3
Mitigation Cost on Planting and Maintenance

#	Year	Planting cost (Rs. Per Av. Mile)	Avenue Miles	Amount	
				Pak Rs.	US $
1	1	25,000 ($ 416.6)	1,250	31,250,000	520,833.3
2	1	(for beating up failures) 25,000 ($ 416.6)	312	7,800,000	130,000
3	2	10,000 ($166.6)	1,250	12,500,000	208,333.3
4	3	7,500 ($ 125)	1,250	9,375,000	156,250
5	4	4,000 ($ 66.7)	1,250	5,000,000	83,333.3
6	5	3,000 ($ 60)	1,250	3,750,000	62,500
		TOTAL		**69,675,000**	**1,161,250**

277. Table 7.4 gives the mitigation cost for grass turfing and planting with shrubs and climbers. Raised Median shall be planted with grasses (turfing) and shrubs which may not attain height more than two meters. A large variety of shrubs and stout climbers is available and choice can be made out of these. Kener (*Nerium oleander*) and Bouganvillea are two examples. This planting could provide an effective protection against night glare besides beautifying the area.

The width of the median = 7 m

Length of the expressway section = 184 km

Area of the median = 130 ha

Table 7.4
Cost on Grass Turfing and Planting with Shrubs and Climbers

#	Year	Planting cost (Rs. Per Hectare)	Area (Ha)	Amount	
				Pak Rs	US $
1	1	75,000 ($ 1250)	130	9,750,000	162500
2	1	75,000 ($ 1250), beating up failures, turfing (25%)	32.5	2,475,000	41250
3	2	30,000 ($ 500)	130	3,900,000	65000
4	3	30,000 ($ 500)	130	3,900,000	65000
5	4	30,000 ($ 500)	130	3,900,000	65000
6	5	30,000 ($ 500)	130	3,900,000	65000
7		**Total**		**27,825,000**	**463750**

7.8 Environmental Technical Assistance and Training Plan

278. An environmental and social training and Technical Assistance (TA) programme will be carried out to build the NHA's capacity to effectively implement this EMP, as well as to facilitate the improved environmental management of future Expressway Projects by increasing the environmental and social awareness of NHA staff in general. The NHA with the collaboration of Monitoring Consultants (MC) will arrange the environmental training sessions for their staff. The objective of these sessions will be to help establish appropriate systems, and to train senior NHA staff responsible for managing environment, operations, and planning, who can then impart training at a broader level within and outside the NHA (i.e., the training of trainers). The Consultants will organize training courses for NHA staff, in specialized areas such as air and noise pollution monitoring; develop environment operation manuals in consultation with the NHA's Environmental wing. The details of this training program are presented in Table 7.4

Table 7.4
Personnel Training Programme/ TA Services

Provided by	Contents	Trainees/ Events	Duration
Monitoring consultants/ organizations specializing in environmental management and monitoring	Short seminars and courses on: Environmental laws and regulations daily monitoring and supervision	Three seminars for NHA Project staff	2 days
Monitoring consultants/ organizations specializing in social management and monitoring	Short seminars and courses on: Social awareness	Three seminars for Project staff dealing in Social/lands matters	2 days
Monitoring consultants/	Short lectures relating to	Two seminars for	2 days

organizations specializing in Occupational, health and safety issues	Occupational Safety and Health	contractor's staff	

7.9 Environmental Monitoring, Mitigation and Training Costs

279. For an effective implementation of environmental mitigation measures, it is very important to provide sufficient funds for the implementation of environmental mitigation measures, monitoring, training and land acquisition and resettlement (including damages). National Highways Authority (NHA) is committed to implement all mitigation measures given in this report and will provide required funds in this regard. The summary of total environmental costs is given in Table 7.5, which amounts out to be Rs. 3,969.199 million (US $ 66.187).

Table 7.5 Summary of Environmental Costs

#	Description	Cost (Millions)	
		Pak Rs.	US $
1.	Environmental Mitigation Cost	97.50	1.625
2.	Environmental Monitoring Cost	6.53	0.109
3.	Environmental Training Cost	0.2	0.033
4.	Land Acquisition and Resettlement Cost	3,864.969	64.42
	TOTAL	**3,969.199**	**66.187**

SECTION 8

PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

8.0 General

280. This section deals with the information disclosure to the public and consultation sessions held with the different stakeholder groups that are likely to be affected by the implementation of the proposed Project. The consultation process was carried out as per the guidelines of ADB and EPA.

281. This consultation process had the following objectives:

1. Share information with stakeholders on proposed improvement works and expected impacts on the physical, biological and socio-economic environment of the Project corridor;
2. Understand stakeholders' concerns regarding various aspects of the Project, including the existing condition of the Expressway, upgrading requirements, and the likely impact of construction related activities and operation of the improved Expressway;
3. Provide an opportunity to the public to influence Project design in a positive manner;
4. Obtain local and traditional knowledge, before decision making;
5. Increase public confidence about the proponent, reviewers and decision makers;
6. Reduce conflict through the early identification of controversial issues, and work through them to find acceptable solutions;
7. Create a sense of ownership of the proposal in the mind of the stakeholders; and
8. Develop the proposal which is truly sustainable.

8.1 Identification of main Stakeholder

282. During the field survey, significant efforts were made to identify the possible categories of stakeholders and their stakes. During the field survey different stakeholders identified were the villagers, local residents, government officials, shop owners, public representative, NGO's and general public. All those stakeholders had different types of stakes according to their professions.

8.2 Consultations

283. A series of consultations were carried out in January 2007 involving more than 300 local residents and local government representatives at the subdistrict and village levels of the four districts traversed by the Project. The meetings were held at various locations. The second round of public consultation was conducted in March 2007 in nine different locations within the project districts. The consultations involved a total of 949 residents from 101 villages.

284. Generally, people were found to be aware of the need of the Expressway, and indicated their support for the present NHA Project. Local communities demanded that they should be part of a continuous consultation process with other stakeholders at different stages of the Project including the design, construction, and operational periods. The scoping sessions were carried out according to the schedule indicated in Table 8.1.

Table 8.1

Schedule of Scoping Sessions

S. No.	Date	District /Tehsil	Time	Village	No. of Participants	Topic
1	19th January 2007 20th January 2007	Faisalabad Tehsil (District Faisalabad)	10:00 am	Kamal Pur Shahbaz Pur Chanan Key Gardana Dandawal	6 12 8 11	Project introduction & Suggestions of Stakeholders Compensation package for affected persons Land acquisition related matters Under passes and Fly overs designs
2	21th January 2007 22th January 2007	Gojra Tehsil (District T.T.Singh)	05:00 pm	Chak No 334 J.B. Chak No 337 J.B. Chak No 343 J.B. Chak No 353 J.B. Chak No 438 J.B.	9 12 7 12 7	Project introduction & Discussion on Compensation Package with the Affectees Resettlement issues were discussed Compensation in cash and in time Special care for vulnerable groups
3	23th January 2007 24th January 2007	Tehsil Toba Tek Singh (District T.T.Singh)	10:30 am 10:30 am	Chak No 317 J.B. Chak No 384 J.B. Chak No 383 J.B. Chak No 397 J.B. Chak No 400 J.B.	10 7 8 6 5	Project introduction & Suggestions regarding Road Safety Resettlement issues were discussed Compensation package with the Affectees Compensation in cash and in time
4	23th January 2007 24th January 2007	Tehsil Shorkot (District Jhang)	1:30 pm 16:30 pm	Chak No 487 J.B. Chak No 489 J.B. Chak No 404 J.B. Chak No 406 J.B. Chak No 505 J.B.	11 9 8 9 6	Project introduction & Discussion on Compensation Package with the Affectees Compensation in cash and in time Resettlement issues were discussed Under passes and Fly overs designs
5	25th January 2007 26th January 2007	Tehsil Kabirwala (District Khanewal)	10:30 am 15:30 pm	Mouza Jalal Pur Mouza Allah Hoo Mouza Nahaley Wala Mouza Ali Pur Mouza Kot Bhader	9 6 4 6 5 5	Project introduction & Discussion on Compensation Package with the Affectees Resettlement issues were discussed Compensation Package with the Affectees Compensation in cash and in time Resettlement issues were

S. No.	Date	District /Tehsil	Time	Village	No. of Participants	Topic
				Mouza Sham Kot	4	discussed Under passes and Fly overs designs
6	27th January 2007	Tehsil Khanewal (District Khanewal)	13:30 pm	Mouza 8 Vanohe Mouza 15 Vanohe Mouza Dunaya wala Mouza 9 Vanohe	6 4 6 4	Project introduction & Discussion on Compensation Package with the Affectees Resettlement issues were discussed Compensation in cash and in time

8.3 Stakeholders' Concerns

285. The most commonly raised concerns raised during the meetings are listed herewith:

(a) Expressway Design

- Provide underpasses at shorter distances;
- Provide interchanges at appropriate places so that residents of the Project Area can avail the Expressway travel;
- Overhead bridges at existing Link road crossings;
- Improve general standards of construction;
- Abate dust emissions by providing paved road shoulders;
- Construct median in the centre of road for the safety of moving traffic.
- Provide drain outlets to help drain away run-off from the Expressway, particularly in areas where road level is higher than that of surrounding settlements; and
- Plant trees along the Expressway that could reduce air and noise pollution.

(b) Expressway Construction

- Avoid dumping construction material along the Expressway;
- Adopt measures to minimise dust, smoke, and noise pollution, and to control spillages from construction machinery;
- Implement a proper solid waste management plan;
- Induct local labour into the construction workforce as far as possible to avoid social conflict between the migrant labour and local communities; and
- Provide proper diversion for the traffic during construction to avoid traffic congestion, related hazards, and dust emissions.

(c) Expressway Operation

- Erect cautionary and informatory signs;
- Control use of loud horns near schools, traffic disorders and violations of traffic regulations;

- Specify speed limits where required;
- Ensure that cross-drainage pipes and culverts are regularly cleaned; and
- Regularly remove accumulated piles of rubbish from the RoW.

8.4 Proposed Measures for incorporating the Stakeholders' Concerns

(a) Expressway Design

286. The contractors and design consultants will include the following environmental and safety provisions in the project design under the Project:

- Under passes, bridges and interchanges will be located at appropriate and possibly shorter distance;
- A tree plantation programme to compensate for the anticipated loss of vegetation during the construction activities, and to help abate pollution caused by emissions, dust, and noise during Expressway operation; and
- Drainage system will be provided to control surface runoff.

(b) Expressway Construction

287. The following measures will be carried out in order to protect surrounding communities from the expected impact of construction:

- Project facilities will be located at a minimum distance of 500 metres from existing settlements and built-up areas. In order to avoid restricting the mobility of local people, construction vehicles will remain confined within their designated areas of movement.
- Sensitivity towards local customs and traditions will be encouraged to minimise social friction. Good relations with local communities will be promoted by encouraging contractors to provide opportunities for skilled and unskilled employment to locals, as well as on job training in construction for young people.
- As for as possible local communities will be hired for construction works.
- To prevent impacts due to noise all the noisy construction activities will be carried out in day time.
- NHA is bound to comply with the prevailing national/provincial regulations concerning pollution and waste disposal.
- Solid waste generated during construction and at camp sites will be properly treated and safely disposed off only in demarcated waste disposal sites approved by the supervision consultant; and
- All necessary measures will be taken to ensure the safety of traffic during construction, including barricades (including signs, pavement markings, flags, and lights) erected as required by the NHA/NH&MP (National Highway and Motorway Police). All such barricades will be set up as per local regulations.

(c) Expressway Operation

- Cautionary and informatory signs will be erected;
- Use of loud horns near schools, traffic disorders and violations of traffic regulations will be monitored and controlled by NH&MP;

- Speed limits will be specified and NH&MP will control it; and
- Cross-drainage pipes and culverts cleaning will be ensured on regular basis.

8.5 Village Meetings

288. Village meetings have many uses in participatory development, including information sharing and group consultation, consensus building, prioritising and sequencing of interventions and collaborative monitoring and evaluations. Concerns raised during village meetings have been discussed in Table 8.2.

8.6 Future Information Disclosure Plan

289. After suggesting the possible solutions of the stakeholders' concerns, the solutions (final EIA report) will be disclosed once again before the stake holders and general public. EIA report will be accessible to interested parties on request and the version of final report will be available in the nearest library and its summary will be available in stakeholders' mother tongue.

Table 8.2
Village Meetings and the Concerns

S. No	Village Name/ Venue	Total House hold	Population	Date	No of Participant	Main Concerns	Expectations
1	Chak No. 5 Kamalpur	1000	8000	19.01.07	12	Judicious compensation at market price should be given to affected persons. Agriculture land will be divided in to two portions. Title less affected persons will not given compensation	Economics opportunities for the people of area. Employment opportunity for the people of area. Transport Facility will be improved.
2	Village Shahbazpur	500	4000	19.01.07	9	Under passes should be given. Land should be acquired at market price. Land price should be given before land acquisition.	Transport Facility will be improved.
3	Chak No.337 J.B.	400	3500	21.01.07	10	Agriculture land will be divided in to two portions. Tenants should be compensated for their crops. Under pass should Be constructed. Interchange should be given here.	Better transport facilities. Chance of labour work during construction. Less time consumption during Journey
4	Chak No.317 J.B.	300	3000	23.01.07	10	Judicious compensation at market price will be given to affected persons. Accidents Chances will be increase. .	Better transport facilities. Chance of labour work during construction. Less time consumption during Journey
5	Chak No.487J.B.	50	750	23.01.07	11	Accidents Chances will be increase. Judicious compensation at market price will be given to affected persons. Fly over should be constructed. Agriculture land will be divided in to two portions.	Unemployment will be decrease. Patients would easily go to big cities
6	Chak No.406J.B.	300	6000	24.01.07	9	Accidents Chances will be increase. Land should be acquired at current market price. Fly over should be constructed. Agriculture land will be divided in to two portions.	We will enjoy better trans port facilities. Business facilities will be generated. Better transport facilities will be available.
7	Mouza	250	1800	25.01.07	9	Service road should be provided.	We will enjoy better trans port

S. No	Village Name/ Venue	Total House hold	Population	Date	No of Participant	Main Concerns	Expectations
	Jalalpur					Sign board should be provided along the settlement. Proper arrangements should be done to avoid construction hazards.	facilities. Business opportunities will be generated. Better transport facilities will be available.
8	Mouza Allah hoo	200	2100	26.01.07	6	Agriculture land will be divided in to two portions. Cash compensation should be given through one window operation.	People will be able to reach big cities easily. Village people will never migrated to big cities
9	Village Mouza Vanohe	100	1000	27.01.07	6	Agriculture land will be divided in to two portions. Houses and shops should not be dislocated Compensation should be given before demolition. Business should be disturbed Village will be ruin.	People will be able to reach big cities easily. This road will link the people of different cities. Economy of the area will be boasted village at people will never migrated to big cities
10	Mouza 9 Chak Vanohe	150	1800	27.01.07	21	Fair and proper compensation should be given. Compensation should be given well in time. Agriculture land will be divided in to two portions.	Different kind of conveyances will be available. Different kind of industries will be installed. We will enjoy better trans port facilities. Business facilities will be generated. Better transport facilities will be available.

The Public Meetings were also held in the affected villages for sharing social and environmental issues and their mitigation measures. The details of these meetings are attached as Annexure-IV.

8.7 Proponent Commitments

290. The LAA and its implementation Rules require that following impacts assessment / valuation effort, land and crops are compensation in cash at market rate to titled landowners and registered land tenants /users respectively. The LAA mandates that land valuation is to be based on the latest 5-3 years average reinstated land sale rates, through, in several recent cases the median rate over the past 1 year, or even the current rates, have been applied. Due to vide spread and under – valuation by the revenue department current market rates are now frequently applied with an added 15% compulsory Acquisition surcharge as provided in LAA.

291. Based on the LAA, only legal owners and tenants' registered with the Land Revenue department or processing formal agreements are eligible for compensation or livelihood support. The right of the title less are however addressed under the 1986. Jinnah Abadees for non proprietors in Rural Areas Act which recognise to squatters the right to receive rehabilitation in from of a replacement plot. It is to be noted that this right has been sometime extended in practice to include some from of rehabilitation in cash or in the forms of different from land. Projects such as Chotiari Dam, Ghazi Brotha Hydropower and National Highways Improvement, have awarded compensation and assistance to unregistered tenants and other forms of AP (sharecropper/squatters).

292. As noted above, exceptions to the rule are intrinsic to the fact that the law is elastic and are broadly interpreted at provincial level depending on operational requirements, local needs, and socio-economic circumstances. Recourse is often taken to ad hock arrangements, and understandings for resettlement in difficult situations. The above is also influenced by the fact that an amendment of the LAA has been considered necessary by the Ministry of Environment. Accordingly, a National Resettlement Policy (NRP) and a Resettlement Ordinance have been drafted to broaden LAA provisions and current practices so as to widen the scope of eligibility and tightening up loopholes (i.e. regarding definitions of malpractices, cut-off dates, political influence on routing, etc.). But both these documents are still awaiting government's approval for implementation.

8.8 ADB's Involuntary Resettlement Policy

293. The ADB Policy on Involuntary Resettlement is based on the following principles which will be adopted at time of land acquisition problem:

- Involuntary resettlement will be avoided or at least minimized.
- Compensation will be given to ensure the maintenance of the APs' pre-project living standards.
- APs will be fully informed and consulted on LAR compensation options.
- APs' socio-cultural institutions will be supported/ used as much as possible.
- Compensation will be carried out with equal consideration of women and men.
- Lack of formal legal land title should not be a hindrance to rehabilitation.

- Particular attention will be paid to households headed by women and other vulnerable groups, such as IPs and ethnic minorities, and appropriate assistance should be provided to help them improve their status.
- LAR will be conceived and executed as a part of the project, and the full costs of compensation will be included in project costs and benefits.
- Compensation/rehabilitation assistance will be paid prior to ground levelling, demolition, and in any case, before an impact occurs.

SECTION 9

CONCLUSIONS

294. The conclusions are, in fact, summary of findings of the EIA study, which provide valuable input to the decision-makers to take informed decisions.

a) The major issues discussed in the proposed Project are summarized below:

- A total of 4,715 acres agricultural land will be acquired.
- A total number of 207 houses (including kacha, semi-pacca and pacca) will be demolished.
- About 18,309 trees (mainly Keeker, Taali, Eucalyptus, Sumbal) will fall within the proposed RoW.
- About 12,956 fruit trees (mainly citrus, guava, mango) will be lost.
- Different utilities such as transmission lines and poles, telephone lines and poles, Sui gas will be disrupted.
- Other infrastructures, which will be lost, include tube wells, farm houses, poultry farms, fish farms.
- The proposed Expressway will cross the River Ravi, about 20 canals and drains (mainly Sidhnai Canal) and about 400 water courses will be crossed by the proposed Expressway.

b) The mitigations proposed for the loss and disturbance of the afore-mentioned infrastructures and utilities are mentioned hereunder:

- Judicious compensation package will be designed for the proposed Project Affectees.
- Cash compensation (at market value plus 15 per cent for compulsory land acquisition) will be paid to those whose agricultural land will be lost and / or affected.
- Cash compensation will be paid for the loss of houses.
- All non-fruit trees will be compensated at market rate after due consultation with the Forest Department. Whereas the payment for fruit trees will be evaluated and paid on the basis of their types, ages and production potential.
- All the affected utilities will be re-located in cooperation with the concerned departments prior to construction work.
- Other built infrastructures such as tube wells, farm houses, poultry farms will be compensated as per market value.
- Bridges, underpasses, flyovers, culverts will be provided at the existing crossing points.

ANNEX 1

NATIONAL HIGHWAY AUTHORITY

ROUTE SELECTION FOR EXPRESSWAY E-4

National Highway Authority

Route Selection for Expressway E-4

by

Chairman NHA

26th April, 2007

Events in chronological order

- NHA invited proposals for Pindi Bhatian – D.G. Khan Motorway and design work awarded to M/s BCEOM & NESPAK of Pakistan on 8th October 1992.
- For approval of alignment presentation to Prime Minister of Pakistan was given on 5th December 1992.

Alignment Alternatives Considered

Option A (370 Km)

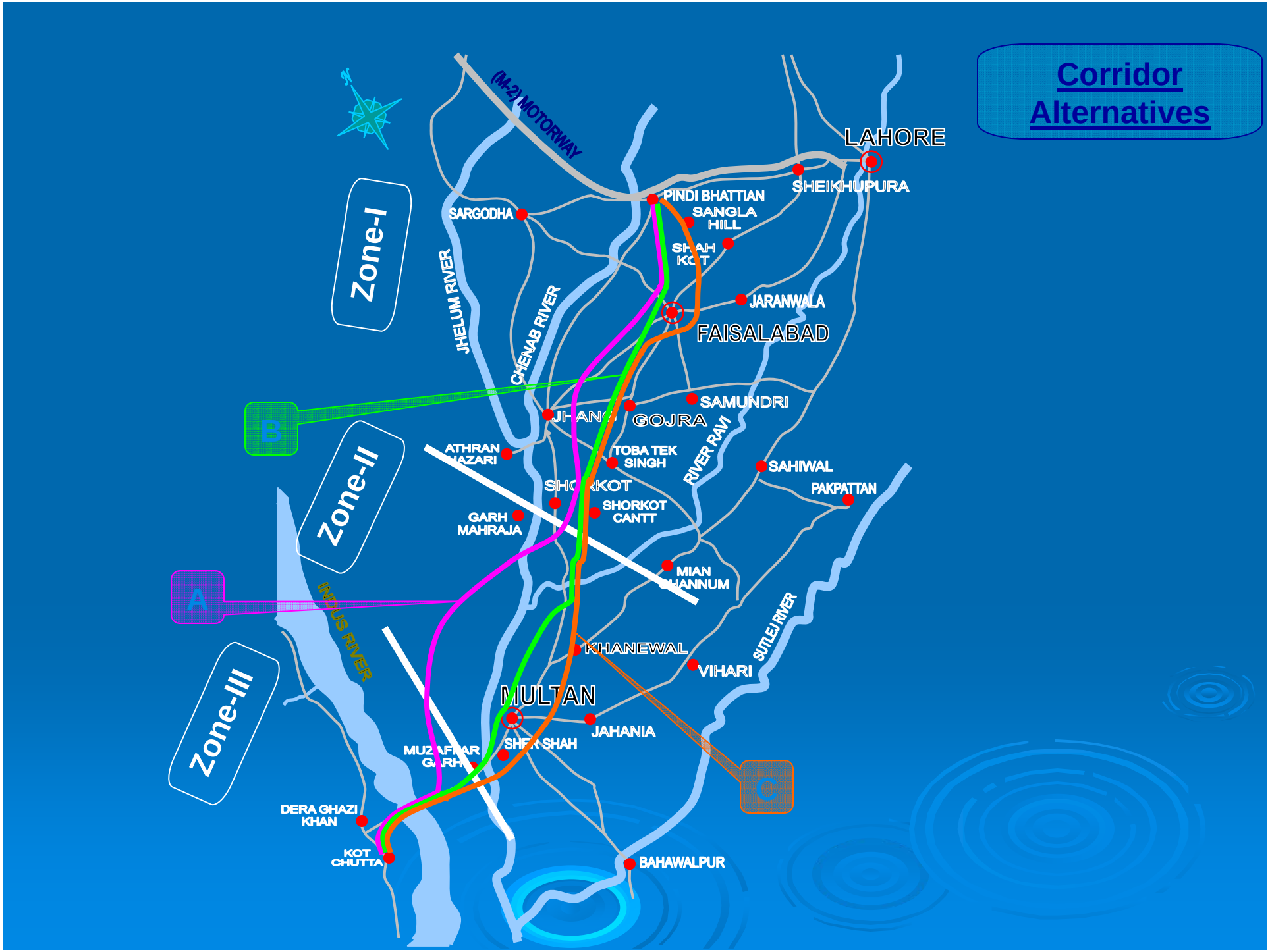
Starts at Pindi Bhattian, passes west of Faisalabad, East of Jhang & Shorkot, crosses river Chenab-Passes through Thal desert, passes west of Muzaffargarh town crosses river Indus and meets Indus Highway at Kotchutta near D.G. Khan.

Option B (375 Km)

Starts Pindi Bhattian-West Faisalabad-west Gojra shorkot-passes west of Multan-crosses river Chenab south of Shershah bridge, crosses river Indus and meets Indus Highway at Kotchutta near D.G.Khan.

Option C (405 Km)

Starts at Pindi Bhattian, passes East of Faisalabad, passes West of Gojra & Shorkot, crosses Khanewal Multan section of N-5 near Khanewal, crosses Multan-Bahawalpur section of N-5 south of Multan, crosses river Indus and meets Indus Highway at Kotchutta near D.G.Khan.


Corridor Alternatives
(M-2) MOTORWAY
LAHORE
SHEIKHUPURA
PINDI BHATTIAN
SANGLA HILL
SARGODHA
SHAH KOT
JARANWALA
FAISALABAD
JHELUM RIVER
CHENAB RIVER
Zone-I
SAMUNDRI
GOJRA
B
ATHRAN HAZARI
TOBA TEK SINGH
RIVER RAVI
SAHIWAL
PAKPATTAN
SHORKOT
SHORKOT CANTT
GARH MAHRAJA
Zone-II
MIAN CHANNUM
A
INDUS RIVER
KHANEWAL
VIHARI
SUTLEJ RIVER
Zone-III
MULTAN
JAHANIA
SHER SHAH
C
DERA GHAZI KHAN
KOT CHUTTA
BAHAWALPUR

Decision of the Prime Minister

"The Expressway will take off from Sheikhupura Interchange instead of Pindi Bhattian and would terminate near Multan touching Multan – Bahawalpur road as proposed by M/s BCEOM & M/s NESPAK. The Expressway from Multan to D.G. Khan will be undertaken in subsequent phases. However, design of entire section from Sheikhupura to D.G. Khan will be completed in two section/parts".


(M-2) MOTORWAY
LAHORE
SHEIKHUPURA
PINDI BHATTIAN
SANGLA HILL
SARGODHA
SHAH KOT
JHELUM RIVER
CHENAB RIVER
JARANWALA
FAISALABAD
SAMUNDRI
JHANG
GOJRA
RIVER RAVI
ATHRAN HAZARI
TOBA TEK SINGH
SAHIWAL
SHORKOT
PAKPATTAN
SHORKOT CANTT
GARH MAHRAJA
MIAN CHANNUM
INDUS RIVER
SUTLEJ RIVER
KHANEWAL
VIHARI
MULTAN
JAHANIA
MUZAFFAR GARH
SHER SHAH
DERA GHAZI KHAN
KOT CHUTTA
BAHAWALPUR
Approved Alignment by PM
Selected Corridor Alignment BECOM & NESPAK

Design of Motorway M-3 Pindi Bhatian to Faisalabad

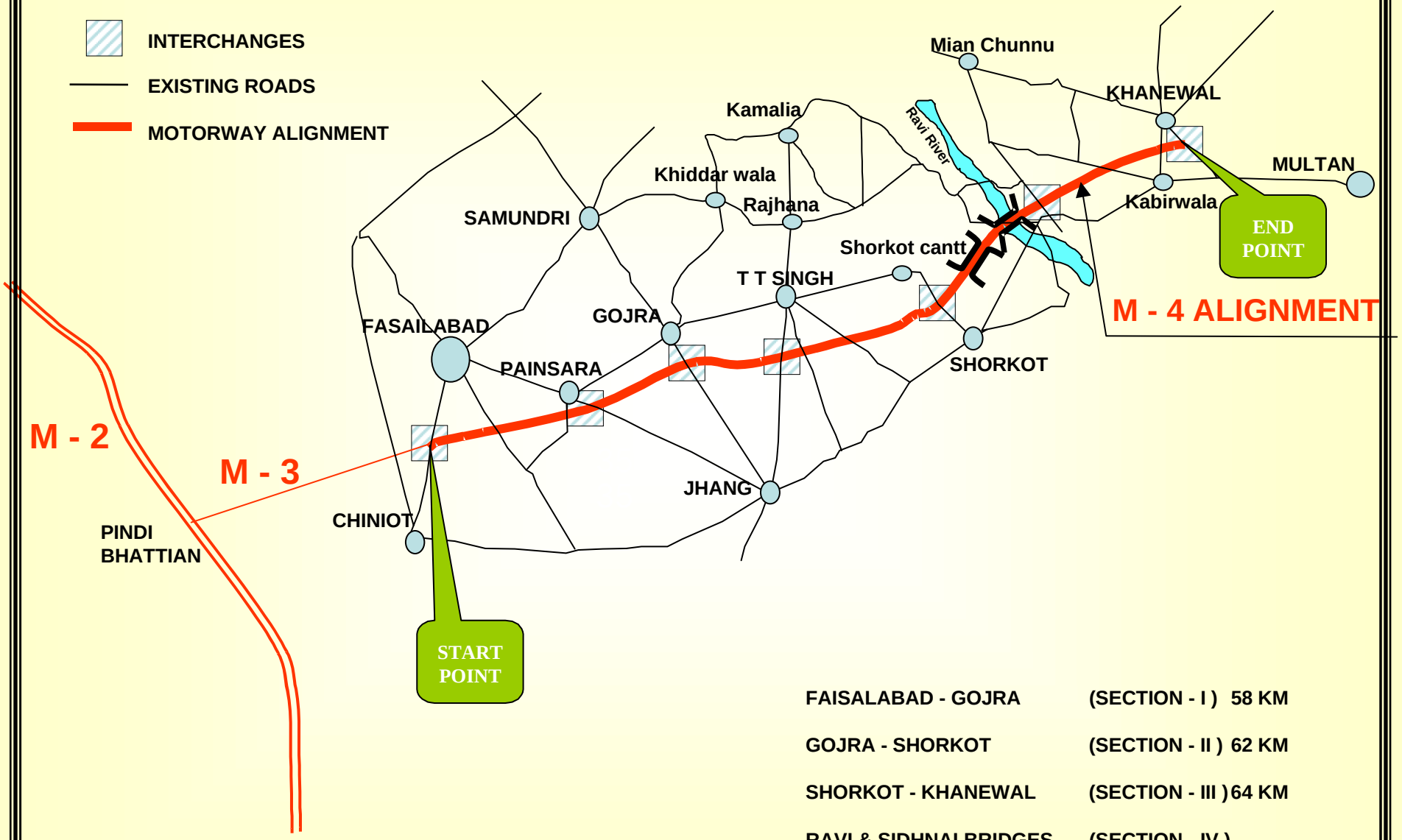
In1997 when Lahore – Islamabad Motorway M-2 Project was nearing completion, NHA through NESPAK designed a 53 Km long four lane motorway with the provision of adding two more lanes in future. The alignment was designed between Pindi Bhattian - Faisalabad and designated as (M-3). The M-3 was completed in 2003 with GOP funding.

Design of Motorway E-4 from Faisalabad to Khenewal

After the completion of M-3, the alignment of E-4 was designed as under:

Starts from terminal point of M-3 on Faisalabad Chiniot Road, passes west of Gojra & Toba Tek Singh, passes in between Shorkot and Shorkot Cantt, crosses river Ravi and meets N-5 near Khanewal on West side. The length of Motorway from Faisalabad to Khanewal is 184 km.

FINALIZED ALIGNMENT



FAISALABAD - GOJRA	(SECTION - I)	58 KM
GOJRA - SHORKOT	(SECTION - II)	62 KM
SHORKOT - KHANEWAL	(SECTION - III)	64 KM
RAVI & SIDHNAI BRIDGES	(SECTION - IV)	

CDWP Minutes for PC-I approval

- PC-I for the designed alignment was submitted to CWDP committee.

- The CDWP constituted a committee under the Chairmanship of Member (I&M) Planning commission and Member (Infrastructure) Planning Division with Chairman NHA, Additional Secretary (Development) Finance Division. Additional Secretary Communication and the representatives form Development and Revenue Departments of Gov. of Punjab to resolve issues:

  a) Fixing of alignments under NTC including alignment of E-4

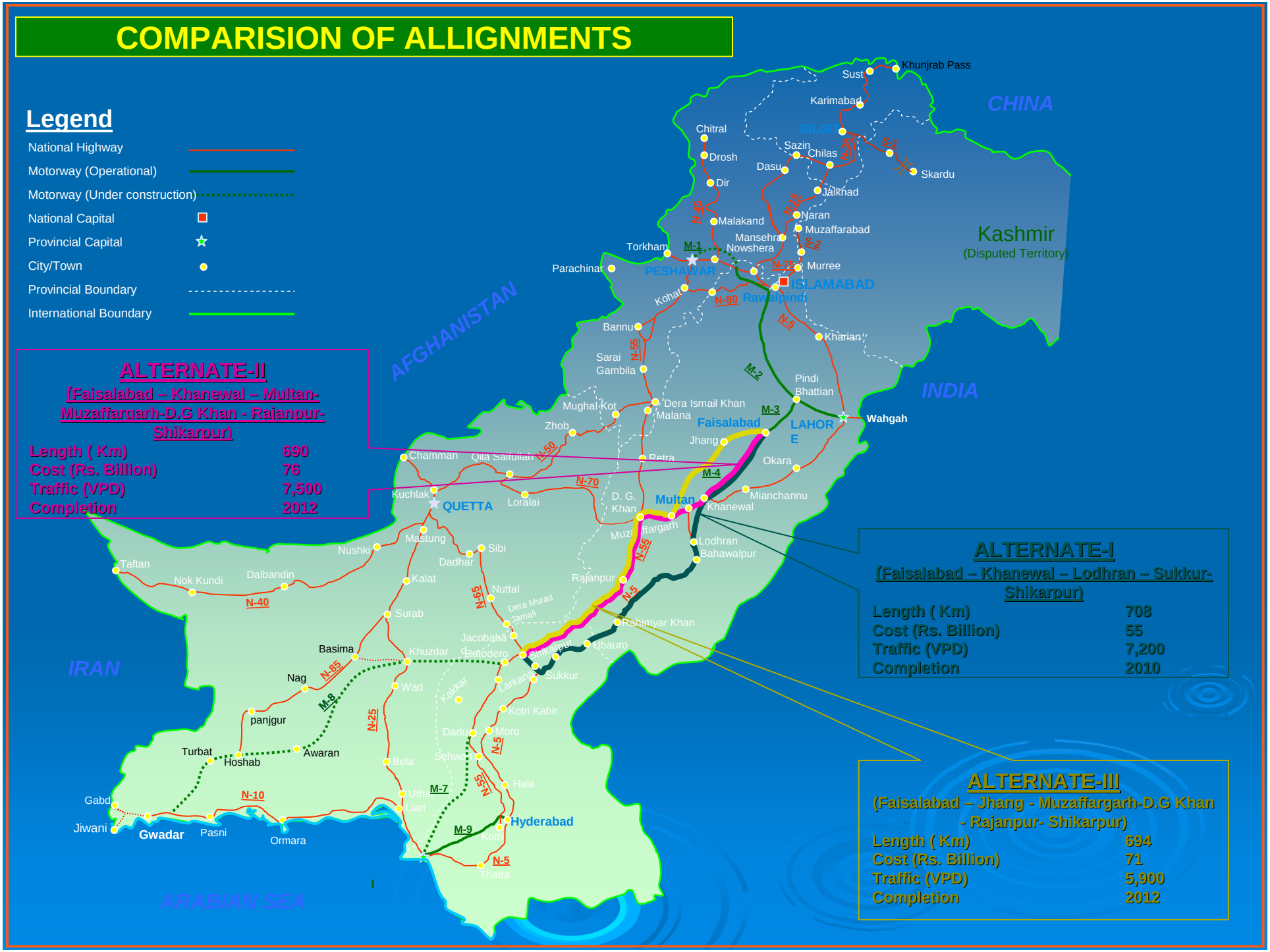
  b) Assessment of cost of land and time involved in land acquisition process

  c) Hampering of federalization process of roads in Punjab.

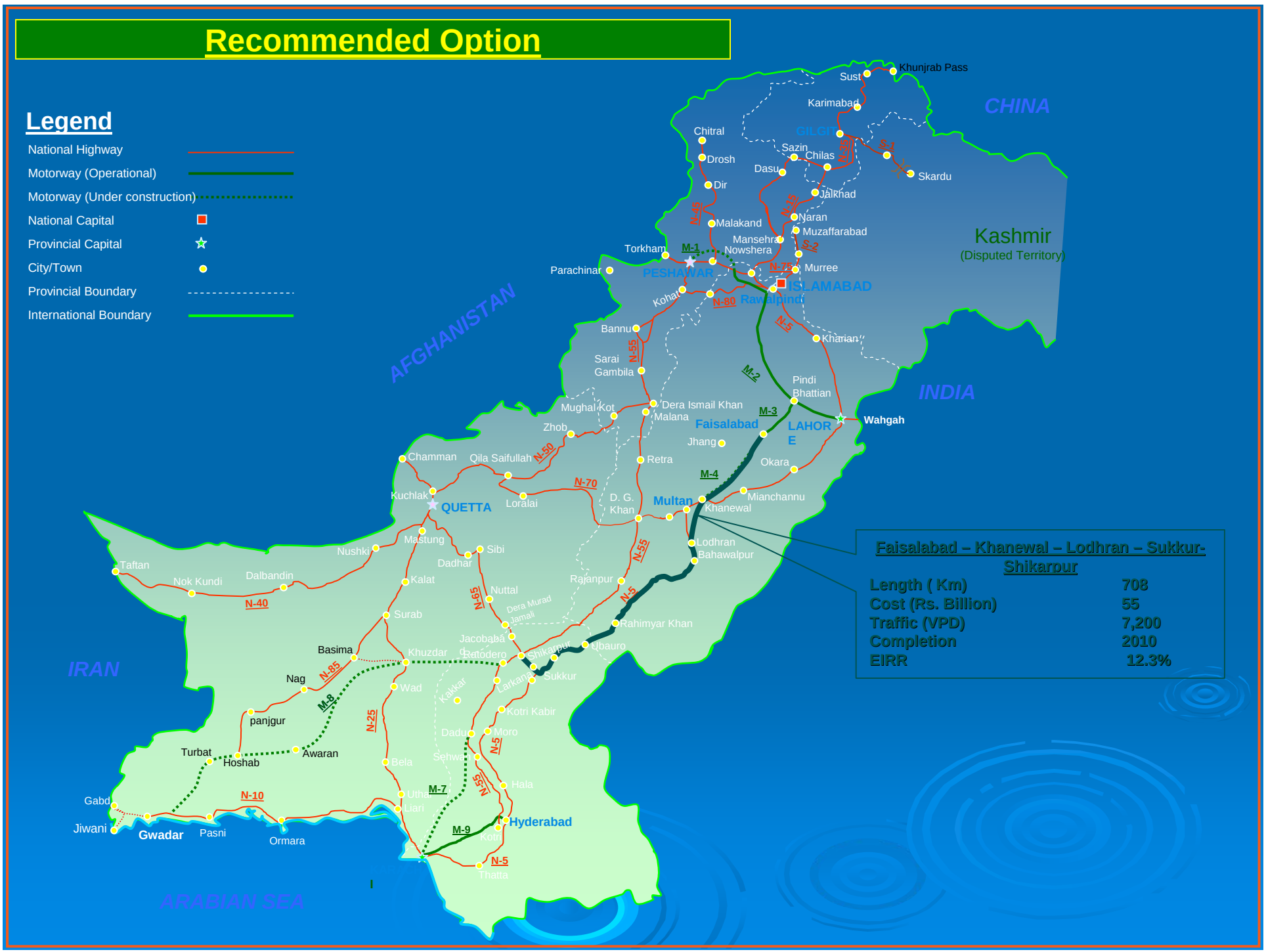
Second Option of M-4 Alignment

In addition to the designed alignment of E-4, the CDWP committee, proposed another option of E-4 alignment from Faisalabad – Jhang – Garh Maharaja – Muzaffargarh.

COMPARISION OF ALLIGNMENTS



Recommended Option



Faisalabad – Khanewal – Lodhran – Sukkur-Shikarpur

Length (Km)	708
Cost (Rs. Billion)	55
Traffic (VPD)	7,200
Completion	2010
EIRR	12.3%

Presentation to Member (I&M) Planning Commission on June 22nd 2006

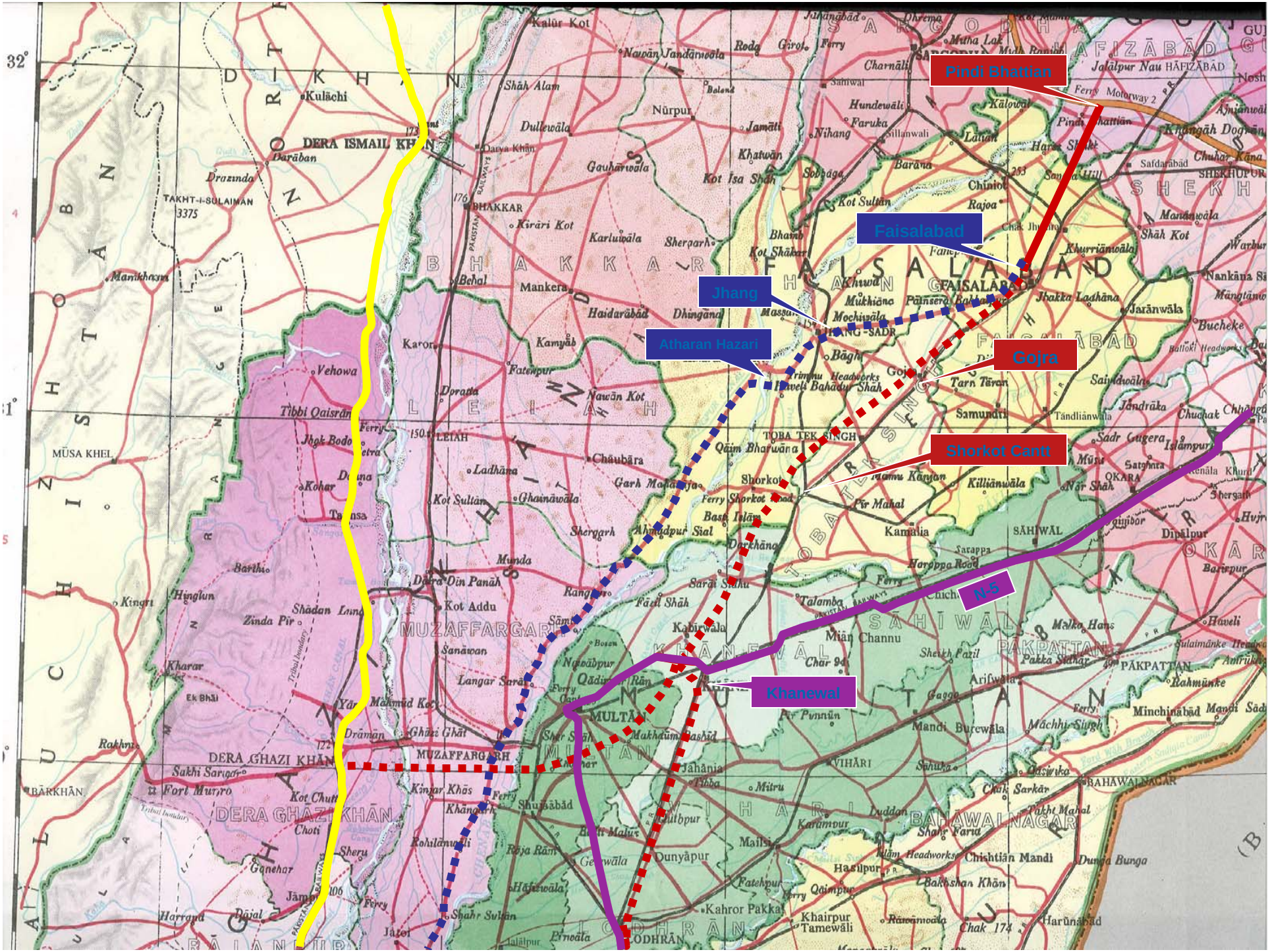
- As a follow up of the CDWP decision, a meeting was held on June 22nd , 2006 under the Chairmanship of M(I&M). NHA made a detailed presentation on the Project indicating various options for new alignment of E-4 with cost analysis and other factors.

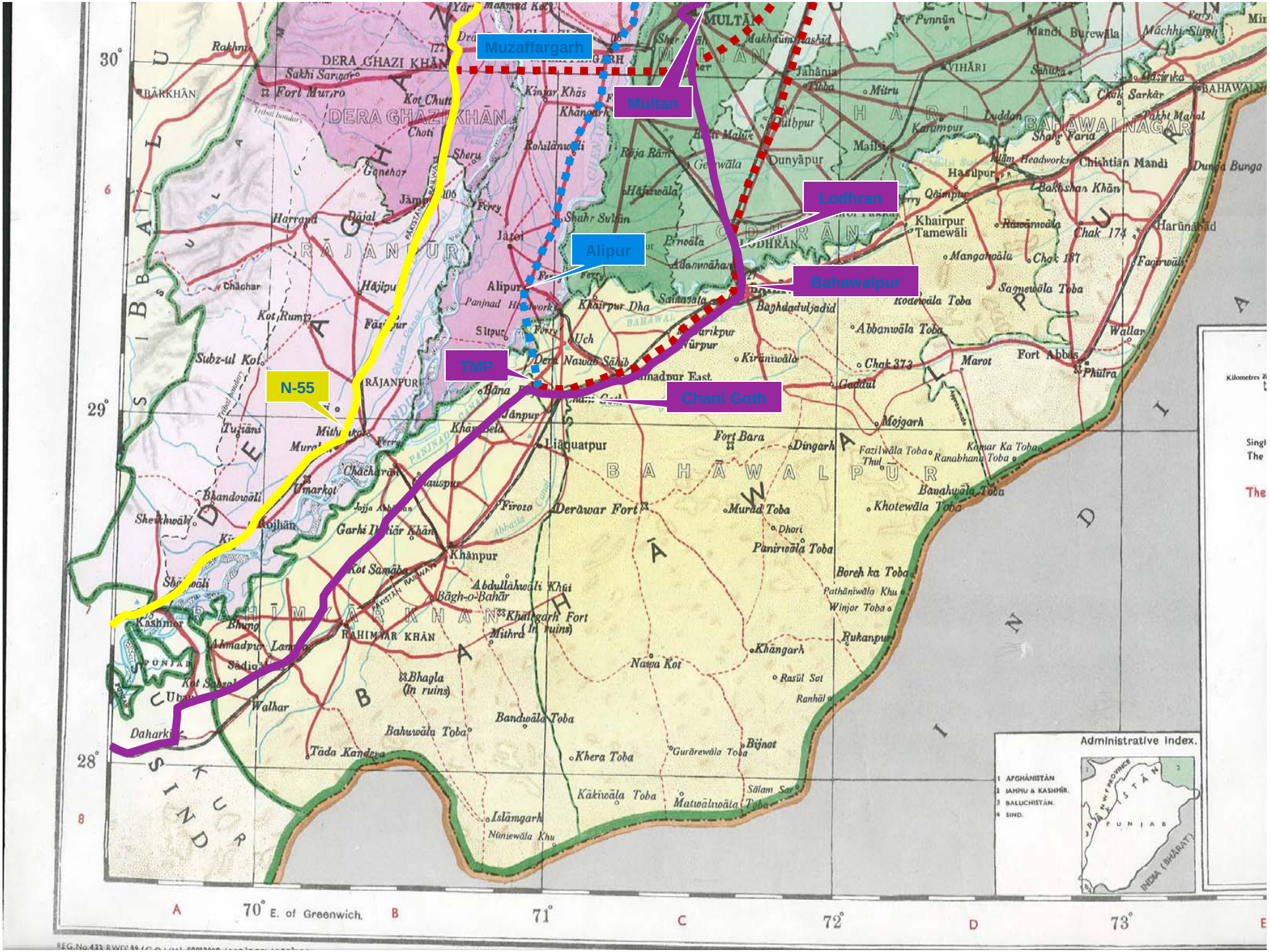
- Comparison was made between existing designed alignment and Faisalabad to Muzaffargarh via Jhang along the existing provincial roads. It was highlighted that notification under section-4 of land acquistion Act had been issued for entire length and documents for issuance of Section 14 (4) & (6) for 130 km had been submitted. An amount of Rs. 255 million has been spent for investigation survey, designing and fixation of ROW markers. Rs. 100 million had been placed in the District Treasuries for land acquisition.
- It was decided that detailed presentation shall be given to Deputy Chairman Planning Commission for decision.

Comparison of Two Options

The comparison of following two options is discussed in detail in the following slides

Faisalabad – Gojra – Khanewal (Multan)
Vs
Faisalabad – Jhang – Garh Maharaja - Muzaffargarh


Pindi Bhattian
Faisalabad
Jhang
Atharan Hazari
Gojra
Shorkot Cantt
N-5
Khanewal


Muzaffargarh
Multan
Lodhran
Alipur
Bahawalpur
TMP
Chani Goth
N-55
DERA GHAZI KHAN
RAJANPUR
MULTAN
LODHRAN
BAHAWALPUR
BAHAWALNAGAR
RAHIMYAR KHAN
Administrative Index.
1 AFGHANISTAN
2 JAMMU & KASHMIR.
3 BALUCHISTAN.
4 SIND.
70° E. of Greenwich.
71°
72°
73°

TERRAIN ANALYSIS FAISALABAD KHANEWAL

Crosses Urban areas and outskirts Faisalabad and traverses through firm and cultivated land. The area is thickly populated and enriched with economic activities.

Negotiates dry bed of Sidhnai Channel and river Ravi.

Links major communication centres like Faisalabad, Gojra, Toba Tek Singh, Jhang, Shorkot, Kabirwala, Khanewal and Multan.

A link pin in the necklace of National Trade Corridor.

Less flood prone areas and reduced length of bridges.

More attractions for the commuters being safe and passing through green fields and orchards.

Less number of people being effected.

Serving and harnessing maximum users.

Requirement of Pakistan Air force for Shorkot Base

TERRAIN ANALYSIS FAISALABAD – JHANG – MUZAFFARGARH

The area is similar upto Trimu Head Works.

After crossing the Chenab river, it runs along the river line upto Muzaffargarh. More river training works will be a compulsion.

Flood prone area and due to high water table and extended marshes motorway is not recommended between Rangpur Canal and Rirver Chenab

Extended length bridge required over river Chenab (appox 2000m)

Since the alignments follows the existing Provincial Government roads, more commercial and urban land will be involved. Thus enhancing the cost of land and damages manifold. Extensive resettlement and relocation of utilities will be required.

Due to passing through remote area and wilderness pronounced safety problems and psychological effects will be experienced, thus less attraction for commuters.

Sand dust likely to create safety hazards beyond Trimu Head Works.

The bridge and road immediately downstream of Head works is susceptible to high current water on activation of the breaching section.

As per JICA study 2006, the existing infrastructure along right of Chenab and Indus river is sufficient for the traffic needs of next 10 years. Where as the the infrastructure inbetween the Chenab and Satluj rivers has reached its capacity and expansion is direly necessitated.

Technical Comparison

Parameters	Faisalabad - Gojra Khanewal	Faisalabad-Jhang-Muzaffargarh
Length	184 km	290 km
Distance b/w Faisalabad - Multan	206 km	330 km
Traffic	10,170 vpd	6,167 vpd
Construction cost	Rs. 23.55 billion	Cost not available
Land/structures/utilities	About 3.5 billion	About 6 billion
Linkage with NTC	Part of NTC	Not Part of NTC
Road Geometry	As per Motorway standards	Req. to be improved, resulting in acquiring public property
Time Frame	Immediately started	Two years required
Land acquisition Process	Almost completed	Two years required
Traffic diversions	No required	Required

View point of Chief (T&C)

- NHA analysis is based on technical grounds, but appears to be biased in favor of present route.
- Other option will result in opening of new areas and will provide access to remote areas
- Other Option suites PM program of NTC and to uplift under developed areas.
- Suitable for industrial zones
- Shall result in population shift and opening of new vistas of development.
- Present alignment is highly agriculture area and no possibility of industrial zone

Decision of the Meeting

Analysis made by NHA shall be presented to the Deputy Chairman Planning Commission for a final decision. It is also recommended that NHA should arrange an arial view of both the routes for the Deputy Chairman Planning Commission.

Presentation to Deputy Chairman Planning Commission

- NHA should prioritize on the basis of development of Gawadar links and the KKH
- The alignment for the future Motorways should be selected in such a way that they should open up new areas and serve maximum number of expected planned industrial zones and new cities. NHA should under take land survey of the area within three months time and present its findings to the committee for consideraiton
- The proposed alignment for Faisalabad-Gojra-T.T. Sing and Shorkot-Khanewal should be considered for construction of 2-lane facility with 4 lane ROW with design speed of 100 kph in combinaiton with the National Highways
- The matter of federalization of provincial road and ROW should be dealt with as per NHA Act. Punjab province to give its future plans in the regard.

Arial Reconnaissance Visit

- In order to investigate the two alignments, an Arial reconnaissance visit was done by following officials:
  - Member (I&M), Planning Division
  - Chairman (NHA)
  - Member (Operations)
  - Member (Planning),NHA
  - General Manager (Design), NHA
  - Project Director (NHA)

Cultivated land along alternate alignment

Thank you