

# Initial Environmental Examination

---

March 2014

## BHU: SASEC Road Connectivity Project

Pasakha Access Road and Alay Land Customs Station

Prepared by the Ministry of Works and Human Settlements (MOWHS), Royal Government of Bhutan for the Asian Development Bank.

## **CURRENCY EQUIVALENTS**

(as of 17 March 2014)

Currency unit	–	Ngultrum (Nu)
Nu1.00	=	\$
\$1.00	=	Nu

## **ABBREVIATIONS**

ADB	–	Asian Development Bank
BOD	–	biological oxygen demand
CFO	–	Chief Forestry Officer
DO	–	dissolved oxygen
DOR	–	Department of Roads
DOT	–	Department of Trade
DOR	–	Department of Urban Development and Engineering Services
EAA	–	Environmental Assessment Act (2000)
ECR	–	Environmental Conservation Regulations (2002)
EIA	–	Environmental Impact Assessment
EMP	–	environmental management plan
ESM	–	Environmental and Safety Manager
ESC	–	Environmental and Safety Consultant (PMU)
ESO	–	Environmental and Safety Officer (PT)
RGOB	–	Government of Bhutan
IEE	–	Initial Environmental Examination
MDP	–	Phuentsholing Mini Dry Port
MEA	–	Ministry of Economic Affairs
MMP	–	Materials Management Plan
MOAF	–	Ministry of Agriculture and Forests
MOWHS	–	Ministry of Works and Human Settlements
PT	–	Phuentsholing City Corporation
PMU	–	Project Management Unit
REA	–	rapid environmental assessment
SEMP	–	specific environmental management plan
SPS	–	ADB Safeguard Policy Statement (2009)
SR	–	sensitive receiver
TA	–	Technical Assistance
TOR	–	Terms of Reference
TSP	–	total suspended particulate
TSS	–	total suspended solids
TMP	–	traffic management plan

## **WEIGHTS AND MEASURES**

dB (A)	decibel (A-weighted)
masl	meters above sea level
km	kilometre
km/h	kilometre per hour
m	meter
m <sup>3</sup>	cubic meter

This initial environmental examination is a document of the borrower. The views expressed herein do not necessarily represent those of ADB's Board of Directors, Management, or staff, and may be preliminary in nature.

In preparing any country program or strategy, financing any project, or by making any designation of or reference to a particular territory or geographic area in this document, the Asian Development Bank does not intend to make any judgments as to the legal or other status of any territory or area.

## CONTENTS

EXECUTIVE SUMMARY .....	i
I. INTRODUCTION.....	1
A. Project Background .....	1
B. Purpose of the Study .....	1
C. Methodology Adopted for IEE .....	1
D. Description of Project.....	2
E. Construction Approach .....	2
F. Project Cost and Implementation Schedule .....	2
II. POLICY AND LEGAL FRAMEWORK.....	3
A. Environmental Regulatory Compliance .....	3
B. Environmental Clearance Requirements.....	6
C. Occupational Health and Safety.....	7
D. International Conventions .....	8
E. Environmental Roles of Relevant Agencies .....	9
III. DESCRIPTION OF THE PROJECT .....	10
A. Background .....	10
B. Existing Conditions of PAR and the Proposed Site for Alay LCS .....	11
C. Studies and design of PAR and Alay LCS .....	12
D. Proposed upgrading of PAR and proposed LCS facilities at Alay.....	12
E. Construction materials .....	15
F. Implementation Schedule .....	16
IV. DESCRIPTION OF ENVIRONMENT.....	20
A. Physical Environment .....	20
B. Biological Environment .....	25
C. Social-Cultural Environment .....	26
D. Demographic characteristics and public health .....	27
V. ANTICIPATED ENVIRONMENTAL IMPACTS & MITIGATION MEASURES.....	30
A. Design / Pre-Construction Phase.....	30
B. Construction Phase .....	33
A. Operational Phase .....	42
B. Cumulative Environmental Impact Associated with the Project Locations ....	44
VI. INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION .....	45
A. Identification of Stakeholders.....	45
B. Consultation with Stakeholders.....	45
C. Concerns Addressed .....	45
D. Information Disclosure and Participation.....	46
VII. GRIEVANCE REDRESS MECHANISM .....	47
VIII. ENVIRONMENTAL MANAGEMENT PLAN .....	49
A. Implementation Arrangements.....	49
B. Environmental Mitigation.....	51
C. Environmental Monitoring .....	74
D. Reporting.....	75
E. Capacity Assessment .....	75
F. Capacity Building .....	76
IX. CONCLUSION AND RECOMMENDATIONS .....	77

## FIGURES

Figure 1: Location of Pasakha Access Road.....	iv
Figure 2: Locality Plan for Pasakha Access Road.....	v
Figure 3: Road & Pavement Cross Sections for Pasakha Access road.....	13
Figure 4: Plan and profile PAR .....	17
Figure 5: Typical cross sections PAR .....	18
Figure 6: Locality Plan for PAR .....	19
Figure 7: Grievance Redress Mechanism .....	48

## TABLES

Table 1: Government Environmental Policies, Laws, Regulations, and Standards .....	3
Table 2: No Objection Statements required.....	6
Table 3: Environmental Regulatory Compliance.....	7
Table 4: Relevant Occupational Health and Safety Laws and Rules .....	7
Table 5: Current and proposed widths on PAR .....	11
Table 6: Estimates of Earthworks and structure works.....	15
Table 7: Summary of rainfall data.....	21
Table 8: Responsibilities for EMP Implementation .....	49
Table 9: Environmental Mitigation and Environmental Performance Monitoring Plan for Pasakha Access Road .....	53
Table 10: Summary of Estimate Costs for EMP Implementation of Pasakha Access Road.....	75

## APPENDIXES

Appendix A	Selected Photographs
Appendix B	Results of Public Consultation
Appendix C	Environmental Criteria



## EXECUTIVE SUMMARY

1. The Royal Government of Bhutan (RGOB) has requested the Asian Development Bank (ADB) to provide financing to facilitate investments to support the Pasakha Access Road (PAR) and Land Custom Station (LCS) at Alay. The Department of Roads (DOR) in the Ministry of Works and Human Settlements (MoWHS) will implement the widening and rehabilitation of PAR, while LCS construction will be done by the Phuentsholing Thromde<sup>1</sup> (PT).
2. This report is the initial environmental examination (IEE) for the Project and complies with the provisions of ADB's Safeguard Policy Statement (SPS 2009). The IEE has been carried out to ensure that the potential adverse environmental impacts are appropriately mitigated and to present the environmental assessments for the Project. The Pasakha Access Road (PAR) will be an improvement of a 1.2km section of the existing alignment of the road from Phuentsholing to Pasakha and near to proposed additional international border crossing facilities and the associated roads. The new Alay LCS is proposed on reclaimed land adjacent to Bhawanijhora stream (Figures 1.1 & 1.2).
3. The objectives and scope of this IEE are to (i) assess the existing environmental conditions of the project area, (ii) identify potential environmental impacts from the proposed works, (iii) evaluate and determine the significance of the impacts, (iv) develop an environmental management plan (EMP) detailing mitigation measures, monitoring activities, reporting requirements, institutional responsibilities and cost estimates to address adverse environmental impacts, and (v) carry-out public consultations to document any issues/concerns and to ensure that such concerns are addressed in the project design. This IEE is submitted to ADB by the DOR/PT and before the proposals are agreed to be financed by ADB the final IEE report will be disclosed to the public through the ADB website and to the public in Bhutan by DOR/PT.
4. **Project Description.** The proposed works will require widening and reconstruction of a 1.2km section of the existing access road to Pasakha coming from Phuentsholing; reconstruction of the bridge over the Bhalujhora River (120m) and construction of the multi-cellular culverts over Bhawanijhora landslide debris flow. The activities that are included are (i) earthworks to facilitate replacement and upgrading of the PAR carriageway, extended road base, multicellular culvert over the landslide sections of PAR, (ii) re-construction of the bridge (iii) renewing and reconstructing culverts across the PAR route, providing better crossing drains and better side drains and lead off drainage facilities and (iv) surfacing works.
5. The activities for development of Alay LCS includes, i) the reclamation of 2.4ha of land adjacent or at the western end Bhawanijhora stream bordering India through river training; and ii) development of land customs station and associated facilities within the reclaimed land.
6. The proposed works of PAR and LCS will be confined to Alay and Pasakha. PAR development will follow existing road Right of Way (ROW). PAR is scheduled to be started by late 2014 and will be completed in 2016; while the civil works for LCS will begin early 2016 and complete by late 2017.
7. **Categorization.** The project is classified as Category B in accordance with ADB's Safeguard Policy Statement (2009), as no significant impacts are envisioned.

---

<sup>1</sup> Thromde – Municipality

8. The focus of this IEE is on the key physical activities in the above outputs which would cause environmental impacts as defined by SPS, 2009. This IEE is based on field reconnaissance surveys, secondary sources of information, and public consultation undertaken specifically for this study.

9. **PAR Implementation Arrangements.** Department of Roads (DOR) under the Ministry of Works and Human Settlements (MOWHS) is the implementing agency and PAR will be implemented through the Project Coordination Unit (PCU). Under the PCU there will be three Project Implementation Units (PIUs) responsible for day-to-day operation of each subproject, viz. two contract packages for Nganglam-Dewathang Highway (NDH) and one for Pasakha Access Road (PAR). Project Manager (PM) heading the PIU will be the environmental focal person for the DOR at the PIU level, who is responsible for ensuring the compliance of environmental conditions of the project. Construction Supervision Consultant (CSC) hired is part of the PCU. CSC includes Team Leader (the Engineer) supported by Survey Engineer, Bridge Engineer, Material Engineer, Quantity Surveyor, Environmental Specialist (ES), Wildlife Specialist (WS), Resettlement Specialist (RS), and respective resident engineers (RE) and site inspectors (SI). Each PIU will have respective RE and SI that includes PAR. RE and SI will be main the persons who will carry out the daily monitoring of construction works; and ensure the implementation of environmental mitigation measures as prescribed in the EMP, by the construction contractor (CC). The contractor through its Project Manager/engineer will be responsible for submission of monthly EMP compliance report. Similarly, RE will also make the monthly project progress report which includes the section on compliance of environmental terms and conditions. ES will carry out intermittent environmental compliance monitoring of the project to ensure the environmental mitigation measures or conditions are adequately addressed. ES will be responsible for compiling and submitting the quarterly environmental compliance report to the DOR through PCU; and semi-annual report to the ADB.

10. **LCS Implementation Arrangements:** The Phuentsholing Thromde (PT) will be implementing agency and the development of Land Customs Station (LCS) at Alay will be carried out through PCU that will be established as part of the project management. Under Phuentsholing Thromde "PCU", there will be two PIU – one for Mini-Dry Port (MDP) and LCS constructions; and other for Phuentsholing Bypass Road (PBR) Construction. The project managers of PIUs will be responsible for ensuring the compliance of environmental conditions of their respective subprojects. There will be one CSC and its organization and functions will be similar to the one stated in the previous section. Except for ES, there will be no WS under CSC of the PT. ES will carryout intermittent compliance monitoring and reporting also as described in the previous section.

11. **Policy, legal, and administrative framework.** The Project shall comply with requirements of the ADB SPS 2009 and the Government's guidelines or initiatives on implementation of Environmental Assessment Act 2000 and the Regulation for Clearance of Projects (RECOP), 2002 under the Environmental Assessment Act 2000). The National Environment Commission (NEC) delegate powers to various competent authorities including MOWHS for issuances of environmental clearance for the projects as listed under the RECOP 2002. However, if the project proponent is DOR under the MOWHS then only NEC has the authority to issue the clearance. But if, the PT is implementing agency or the proponent, MOWHS has the authority to issue the environmental clearance of the projects. Therefore, IEE of PAR will need to be forwarded to NEC for assessment and approval while IEE for LCS can be approved by the MOWHS.



12. **Environmental management plan.** Mitigation measures, environmental monitoring, and capacity development are required to minimize the environmental impacts in the design, construction, and operational phases.

13. The environmental management plan (EMP) is prepared to ensure the negatives impacts are mitigated to the maximum feasible extent. The EMP which will form part of the bidding and contract documents and will include: (i) waste management and spoil disposal; (ii) temporary and permanent drainage; (iii) runoff control and excavation protection; (iv) noise and dust control; (v) temporary traffic management; and (vi) worker and public safety.

14. The construction and operation of the PAR and LCS will have beneficial effects on the overall surrounding environment. The construction PAR and LCS in combination with the construction of Hashimara-Pasakha Bypass Road will remove congestion of Phuentsholing town; improve transport efficiency through shortening of transport distance; reduce greenhouse gas emission; minimize air pollution; and improve the regional trade and commerce. The improved road will also reduce dust pollution which is the common sight along the existing PAR.

15. **Information disclosure, consultation, and participation.** The stakeholder consultation process disseminates information to all key stakeholders, including the general public and authorities, through meetings and door-to-door surveys around the project area. Information was provided on the scale and scope of the project works, expected impacts, and the proposed mitigation measures by means of consultations with local government departments, local authorities, and the general public by surveys. The process also gathered information on relevant concerns of the authorities and local community so as to address these in the project implementation stage.

16. **Grievance redress mechanism (GRM).** A GRM will be established to receive, evaluate and facilitate the resolution of affected people's concerns, complaints, and grievances. The GRM aims to provide a time-bound and transparent mechanism to voice out and resolve social and environmental concerns linked to the project.

17. **Conclusion and recommendations.** The IEE study of the proposed development of Pasakha Access Road (PAR) and Land Customs Station (LCS) at Alay reveals that the benefits from their implementation are more significant and long term in nature; against the adverse impacts, most of which could be mitigated or avoided. Therefore, this IEE is sufficient for approval of the proposed project. This project is recommended for implementation with incorporation of mitigation measures and environmental monitoring plan.

Figure 1: Location of Pasakha Access Road

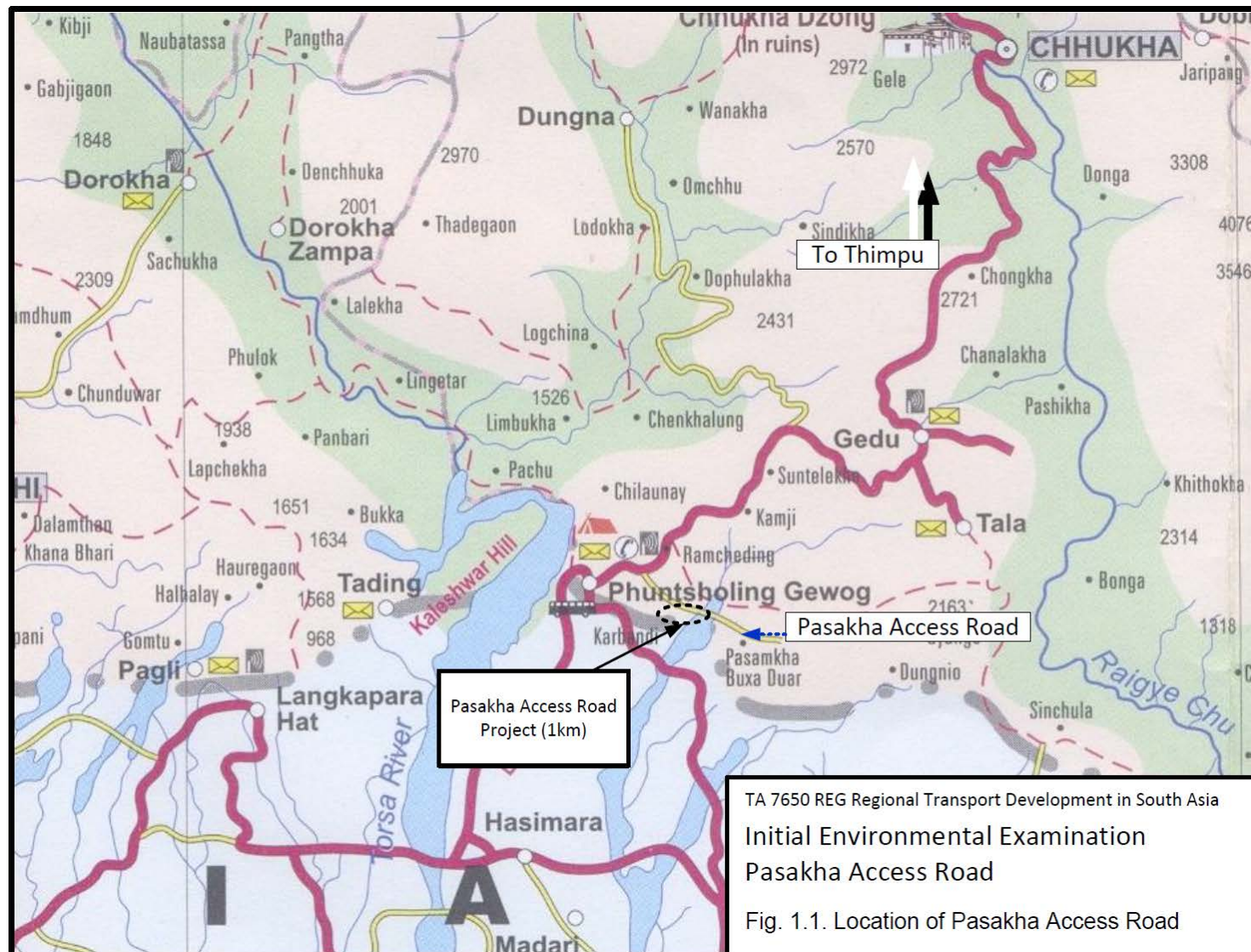
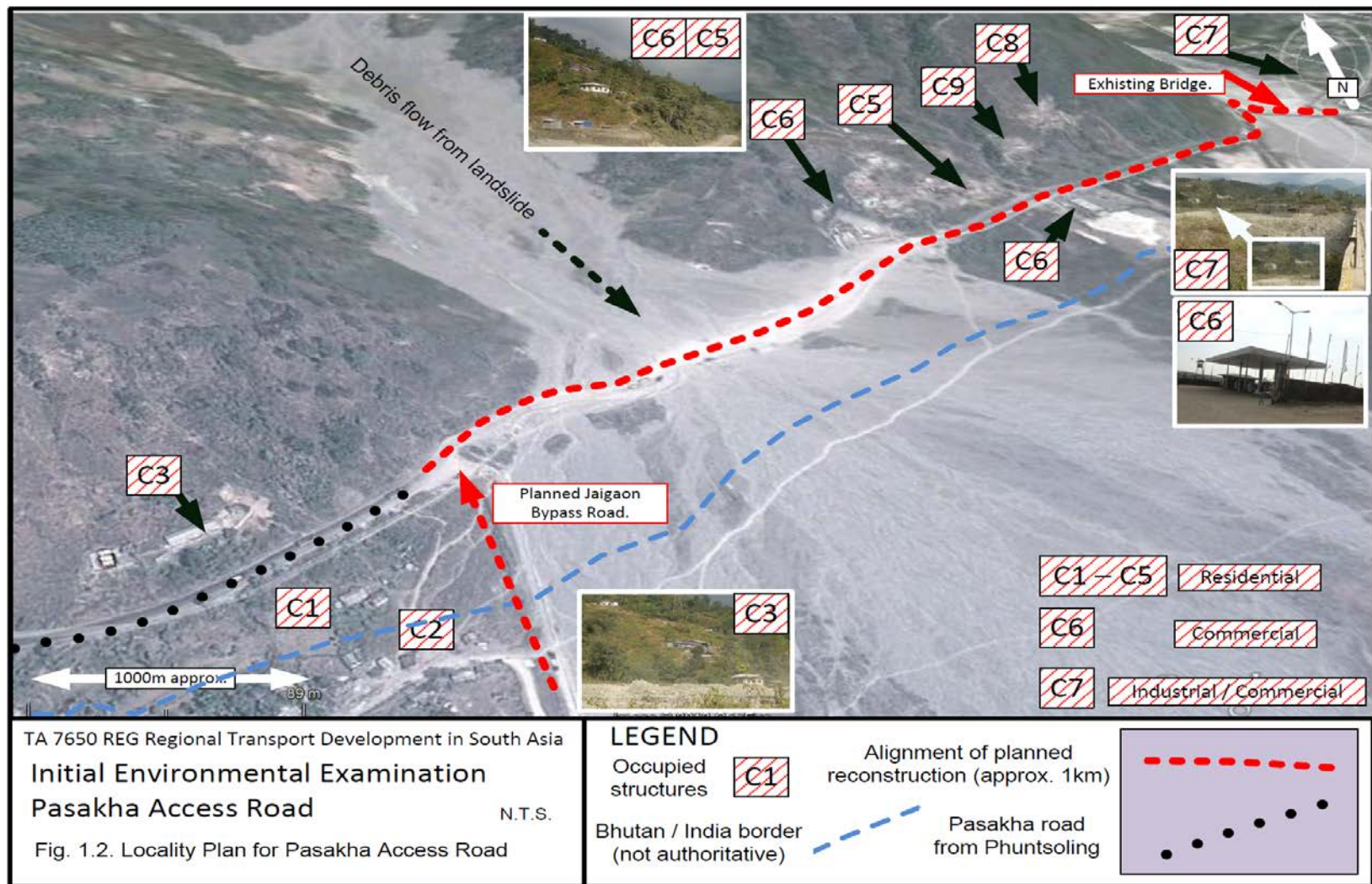


Figure 2: Locality Plan for Pasakha Access Road







## I. INTRODUCTION

### A. Project Background

1. South Asia Sub-regional Economic Cooperation (SASEC) involving four member countries; namely Bangladesh, Bhutan, India and Nepal; have entered into a regional cooperation to improve or develop regional trade and commerce through development of integrated land transport and related infrastructures. For Bhutan, project is identified as “SASEC Road Connectivity Project”, which includes following components or sub-projects:

- i) 68.3Km Nganglam-Deothang Highway (NDH);
- ii) 1.2Km Pasakha Access Road (PAR) including Land Custom Station (LCS) at Alay;
- iii) 2.8km Phuentsholing Bypass Road (PBR); and
- iv) Mini Dry Port (MDP) at Phuentsholing

2. 68.3km NDH is the major components of the SASEC Road Connectivity Project; and it is classified as an Environment Category A Project in line with ADB’s Safeguard Policy Statement (SPS 2009) project classification system. The detailed Environment Impact Assessment (EIA) studies have been carried out; and accordingly the draft final EIA report has been disclosed on ADB website on 2<sup>nd</sup> December 2013. NDH is physically located at some 184km aerial distances from the other subprojects, which are located within the Phuentsholing Thromde (PT).

3. The three remaining subprojects – 1.2km Pasakha Access Road (PAR) including Alay Land Custom Station (LCS); 2.8km Phuentsholing Bypass Road (PBR); and Mini Dry Port are classified as Category B project requiring only the initial environmental examinations (IEE). This report presents the findings of initial environmental examination for the proposed widening and rehabilitation of 1.2km Pasakha Access Road from Alay till Pasakha industrial estate; and the construction of Land Custom Station at Alay.

### B. Purpose of the Study

4. The objectives and scope of this IEE are to (i) assess the existing environmental conditions of the project area, (ii) identify potential environmental impacts from the proposed works, (iii) evaluate and determine the significance of the impacts, (iv) develop an environmental management plan (EMP) detailing mitigation measures, monitoring activities, reporting requirements, institutional responsibilities and cost estimates to address adverse environmental impacts, and (v) carry-out public consultations to document any issues/concerns and to ensure that such concerns are addressed in the project design. The IEE is done under the guidance of the policies of the Asian Development Bank (ADB) and the Royal Government of Bhutan (RGOB) and includes chapters on description of the project, environmental impacts and mitigation measures, mitigation and monitoring plan, and public consultation procedures. The draft IEE was submitted to ADB and other stakeholders for review; and, it has been finalised during the detail design. The final IEE is submitted to ADB and National Environment Commission (NEC) for approval and further public disclosure.

### C. Methodology Adopted for IEE

5. The IEE study has followed the guidelines of RGOB and ADB. The study has been conducted through review of secondary information collected from relevant agencies, and

primary information collected from the field survey in November 2012. Public consultations and disclosure were carried out and the concerns of affected persons are documented. The relevant Phuentsholing Thromde (PT) officials were contacted to verify information collected and also to solicit their concerns. Based on the analysis of information the impacts have been predicted, mitigation measures prepared and monitoring plan has been developed.

#### **D. Description of Project**

6. 1.2km Pasakha Access Road or PAR is proposed in between Alay Land Custom Station and Pasakha Industrial Estate within Bhutan. It will connect the Indian SASEC Bypass Road from Hashimara under West Bengal to Alay in Bhutan. At Alay, Land Custom Station or LCS will be built over 2.4ha of reclaimed land.

7. PAR construction activities will include i) widening and rehabilitation of 1.2km of the existing access road to Pasakha from Phuentsholing; ii) construction of 50m multicellular culvert over Bhawanihora slide zone; iii) 120m span pre-stressed concrete bridge over Bhalujhora river; iii) construction of river training and check dams for minimizing the flow velocity; iv) construction of road side drains and culverts; v) road surfacing works; and upstream catchment improvement through bioengineering applications.

8. Major activities of LCS development include the reclamation of 2.4ha of flood plain; river training and embankment construction; and construction and development of custom station on the reclaimed land.

#### **E. Construction Approach**

9. PAR widening and reconstruction will be based on Environment Friendly Road Construction (EFRC) Technology with the principle of balance cut and fill. Excess excavated materials will be disposed off in the pre-identified approved disposal sites. Civil and Bioengineering techniques will be applied to rehabilitate degraded or unstable Bhalujhora river catchment area as well as the completed dumpsites. Climate change adaptation (CCA) measures of improved slope stabilization, proper river trainings and embankments, and adequate drainage constructions will be carried out.

10. The detailed design for the LCS will be prepared by the design consultants procured by PT and a construction contractor will be hired for construction.

#### **F. Project Cost and Implementation Schedule**

11. The estimated cost for PAR is Nu. 371.5million including 5% physical contingencies. As per the detail design costing, the environmental management cost comes to around Nu.10.74 million which is about 3% of the total project cost.

12. The construction of PAR is scheduled to by third quarter of 2014 and expected to be completed by 2016 within 2 years.

13. Feasibility study project that LCS development will cost Nu.218million inclusive of supervision costs. It is scheduled to be implemented by early 2016 and complete by late 2017.

## II. POLICY AND LEGAL FRAMEWORK

### A. Environmental Regulatory Compliance

14. The implementation of the Project will be governed by Asian Development Bank Safeguard Policy Statement (SPS, 2009) and the environmental laws, policies and regulations of the Government of Bhutan (RGOB).

15. **Asian Development Bank.** The ADB SPS stipulates addressing environmental concerns, if any, of a proposed activity in the initial stages of Project preparation. For this, the ADB SPS categorizes the proposed components into categories (A, B or C) to determine the level of environmental assessment required to address the potential impacts. The Project has been categorized as B. Accordingly this IEE is prepared to address the potential impacts in line with the SPS. Stakeholder consultation was an integral part of the IEE and an environmental management plan (EMP) specifying mitigation measures to be adhered to during implementation of the Project has been prepared.

16. **Royal Government of Bhutan.** The implementation of the Project will also be governed by laws, regulations, and standards for environmental assessment and management of Royal Government of Bhutan (RGOB). Table 1 summarizes the main requirements of RGOB for environmental management that will apply to the Project.

**Table 1: Government Environmental Policies, Laws, Regulations, and Standards**

Statute	Outline	Relevance
Environmental Assessment Act, 2000	This Act establishes procedures for the assessment of potential effects of projects on the environment, and aims to determine measures to reduce potential adverse effects and to promote environmental benefits.	<ul style="list-style-type: none"> <li>To ensure that all foreseeable impacts on the environment, including cumulative effects are fully considered prior to any irrevocable commitments of resources or funds.</li> <li>To ensure that all feasible alternatives are fully considered.</li> </ul>
Regulation for the Environmental Clearance of Projects, 2002	Regulation for Environmental Clearance defines responsibilities and procedures for the implementation of the Environmental Assessment Act, 2000 for issuance and enforcement of environmental clearances.	<ul style="list-style-type: none"> <li>To ensure that all projects are implemented in line with the sustainable development policy of the Royal Government of Bhutan</li> <li>To ensure that all feasible means to avoid or mitigate damage to the environment are implemented; and</li> <li>To ensure that concerned people benefit from projects in terms of social facilities.</li> </ul>
National Environment Protection Act, 2007	The aim of this Act is to enable an effective system of conserving and protecting Bhutan's environment. This system is constituted of the National Environment Commission or other designated Competent Authorities and advisory committees responsible for independently regulating and promoting sustainable development in an equitable manner.	<ul style="list-style-type: none"> <li>The Act provides a framework for developing measures and standards to protect Bhutan's environmental quality. Guidance relevant to this project includes:</li> <li>Handling of hazardous substances: No person shall handle or cause to be handled any hazardous substance except in accordance with such procedure and after complying with such safeguards as may be prescribed under national and international instruments.</li> </ul>

Statute	Outline	Relevance
		<ul style="list-style-type: none"> <li>Discharge of environmental pollutants: No person shall discharge or emit or be permitted to discharge or emit any pollutants in excess of such standards as may be prescribed.</li> </ul>
Waste Prevention and Management Act of Bhutan, 2009	This Act defines the institutional framework for preventing and managing waste in Bhutan. It sets out the principles, measures, mechanisms and responsibilities for reduction, segregation, and appropriate disposal of waste to protect the country's environment.	<ul style="list-style-type: none"> <li>Waste management requirements of relevance to the proposed development include:</li> <li>Non-hazardous waste: Implementing agencies shall ensure that the reduction, reuse, recycling and disposal of non-hazardous waste are addressed in an environmentally sound manner.</li> <li>Hazardous waste: Implementing agencies shall prevent manufacturing of products with potential to generate hazardous waste. The agencies shall also ensure that the reduction, storage, treatment, and disposal of hazardous waste are addressed in an environmentally sound manner.</li> </ul>
General Rules and Regulations on Occupational Health and Safety (OHS) in Construction, Manufacturing, Mining and Service Industries, 2006	OHS Rules and Regulations aims 'to assure safe and healthful working conditions for working men and women as well as other persons present at workplaces from work related risks to their health, safety, and well being	During Construction and operation stage of the project.
The Labour and Employment Act of Bhutan, 2007	The labour and employment act of Bhutan 2007 provide policies and programs in the areas of employment promotion, labour protection and relations, vocational education and training, and occupational standards setting and certification.	The proposed development will adhere to the policies provided under different sections of the Act.
The Forest Act (1969).	The first environmental legislation in Bhutan. It brought all forest resources under government custody to regulate utilization.	This was repealed with the enactment of the FNCA in 1995
Forest and Nature Conservation Act (FNCA) 1995	Allows community stewardship of forests and aims to provide protection and sustainable use of forests, wildlife, and related natural resources.	Schedule I of the Act, lists those wild animals and plants that are given full protection under the Act. The FNCA establishes that all forests in Bhutan are Government Reserved Forests (GRF), and prohibits any development activity in these areas except with a permit.



Statute	Outline	Relevance
Forest and Nature Conservation Rules (FNCR) 2000	Under powers established by the FNCA, the Ministry of Agriculture promulgated the FNCR in 2000, which was revised in 2006.	Amongst other things the FNCR allows for: <ul style="list-style-type: none"> <li>• Allotment of land and land rights in GRF;</li> <li>• Prohibitions, restrictions and concessions in GRF;</li> <li>• Transport and trade of forest produce;</li> <li>• Declaration and administration of protected areas;</li> <li>• Protection of wildlife and use of certain wild species;</li> <li>• Prevention of forest fires, land clearance, and activities potentially impacting soil, water and wildlife resources; and</li> <li>• Enforcing penalties for offences related to these and other aspects of the FNCR.</li> </ul>
Land Act 1979 (Revised 2007)	The Land Act 1979 provides the basis for land tenure in Bhutan was revised in 2007 to streamline many provisions in the Land Act. One major Change was the establishment of an autonomous National Land Commission Secretariat which has been given full responsibility for all matters pertaining to land registration. Land categories have been reduced to seven including i) Chhuzhing (wetland), ii) Kamzhing (dry land) including orchard, iii) Khimsa (Residential land), iv) Industrial land, v) Commercial land, vi) Recreational and vii) Institutional land.	Under this Act, there are provisions for acquisition of land by the Government, if it is required for the benefit of the country. In such cases, the affected person will be compensated with substitute land from the same Dzongkhag or given cash compensation depending on the land classification as per the prevailing land compensation rate determined by the Act. If a house is acquired, compensation is paid on the basis of an evaluation carried out by a qualified engineer appointed by the competent authority.

17. The policy, legal, and administrative frameworks relevant to the environmental assessment of infrastructure projects in Bhutan have been established by the following laws and regulations: (i) the National Environmental Protection Act of 2007, (ii) the Environmental Assessment Act of 2000, and (iii) Regulation for Environmental Clearance of 2002. At the national policy level, environmental protection and conservation is a constitutional mandate to: (i) protect, conserve, and improve the pristine environment; (ii) safeguard biodiversity; and (iii) prevent pollution and ecological degradation.

18. The National Environmental Protection Act of 2007 is the overall law on environmental protection and specifies the powers, functions, and operational framework of the National Environment Commission (NEC), the government agency with responsibility for all issues related to the environment. Their mandate includes the maintenance of environmental quality through the enforcement of environmental standards and promotion of best environmental management practices to address pollution and environmental hazards.

19. The Environmental Assessment Act of 2000 was enacted to establish procedures for the assessment of the potential effects of strategic plans, policies, programs, and projects on the environment, and for the determination of policies and measures to reduce potential adverse

effects and to promote environmental benefits. Under this law, no development consent can be issued without first seeking an environmental clearance. The permission is given under Chapter III of the act and is issued in writing by the secretariat or the competent authority, to let a project proceed, which includes terms to ensure that the project shall be managed in an environmentally sound and sustainable way.

20. The Guideline for Application for Environmental Clearance for Forestry Activities has been promulgated by the NEC. Nevertheless project information consistent with an EIA Report will be required under general provisions including requirements for no-objection certificates that are provided by affected parties, as listed in Table 2.

**Table 2: No Objection Statements required**

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

## **B. Environmental Clearance Requirements**

21. The RECOP 2002 categorizes all projects that may be given environmental clearance by a Competent Authority. According to RECOP Appendix 2, the Project has some components that can be given environmental clearance by the certain competent authorities. However the Competent Authority for the Project cannot also be the Project proponent.

22. Since DOR under MOWHS is the proponent of PAR, the IEE will be submitted to the NEC for assessment and ultimate approval. While PT is the proponent of LCS, the MOWHS has the authority to issue environmental clearance. Both DOR and PT are obliged to fill up the standard IEE application form and submit with the no objection certificates (NOC) from the affect persons/public and other stakeholders.

**Table 3: Environmental Regulatory Compliance**

Component Description	Royal Government of Bhutan		ADB	
	Competent Authority in accordance with RECOP 2002	Environmental Assessment	Category in accordance with SPS	Environmental Assessment
Proposed Pasakha Access Road	NEC	Environmental Information*	Category B **	IEE and EMP
Land Custom Station	MOWHS	Environmental Information*	Category B **	IEE and EMP

ADB = Asian Development Bank, RECOP\* = Regulations for Environmental Clearance of Projects, EMP=Environmental Management Plan, IEE = Initial Environmental Examination, SPS = Safeguard Policy Statement.

\*\* Nothing is envisaged at this stage that could cause reclassification to Category A.

### C. Occupational Health and Safety

23. The Project will conform to the labour laws and occupational and health related rules as outlined in Table 4.

**Table 4: Relevant Occupational Health and Safety Laws and Rules**

Title	Year	Overview
Labour and Employment Act 2007, Bhutan	2007	The L&E Act, 2007 provides general legislation governing employment conditions and environment at work. The aim of the Act is to improve the work environment and working conditions in order to safeguard and maintain the employees' work ability, and to prevent occupational accidents, diseases, and other physical or mental health problems related to work. Employers are required to identify the hazards and risk factors at workplace, eliminate, and assess the effects of the remaining risks to the employees' health and safety. The Act describes the employers and employees general duties, rights and obligations in pursuing a healthy and safe workplace. The Act also emphasizes reporting system for workplace injury and diseases and the requirement of the enterprise to develop health and safety policy at the enterprise level.
Mines and Mineral Act, 1995	1995	The Department of Geologies and Mines under the Ministry of Economic Affairs are responsible for implementing the Mines and Mineral Act, 1995. Under the Mines and Mineral Act, 1995 the employers or lessees are responsible to ensure a safe and healthy working environment. They should report any workplace accident to the ministry. The ministry is also empowered to frame regulations and standards on health and safety in keeping with the view of national legislation on occupational health and safety.
Mines and Minerals Management Regulations 2002. (MoEA)	2002	This regulation clearly outlines Occupational Health and Safety procedures to be followed by the mining industries.
Road Safety and Transport Act, 1999	1999	The objectives of the Road Safety and Transport Act 1999 are to provide safe and efficient use of road systems and to provide an efficient and a safe public transport system. This responsibility is shouldered by the RSTA. The Act also describes general duties of the drivers related mainly to traffic safety signs and safety procedures in order to prevent transport accidents.
Electricity Act of Bhutan, 2001	2001	The Act provides authority to the Bhutan Electricity Authority to develop regulations, standards, codes, principles & procedures, which include performance standards, including minimum technical & safety

Title	Year	Overview
		requirements for construction, operation & maintenance of generation, transmission & distribution facilities.
Pesticides Act of Bhutan 2000	2000	The objectives of this act are to minimize deleterious effect of pesticides on human beings and the environment. Guidelines direct the import procedures of pesticides and the use of pesticides in a way that the effect on the environment is mitigated.
Food Act of Bhutan 2005	2005	The purpose of this act is to protect human health from consumption of food which has adverse effect on the health and to regulate and facilitate the import, export and trade of food in the country.
Regulations on Occupational Health, Safety and Welfare (MoLHR)		This regulation was framed under the Labour and Employment Act, 2007. It prescribes standards and procedures on occupational health, safety and welfare for workplaces, instruments, vessels, appliances, apparatuses, tools, devices, electrical safety and other hazardous conditions. The objective of this regulation is to ensure safety, health and welfare for employees as well as other persons at workplaces, from work related risks to their health, safety and wellbeing.
Regulations on Occupational Health and Safety for Construction Industry (MoLHR)		Regulation on Occupational Health and Safety for the Construction Industry was framed under the Labour and Employment Act, 2007. This regulation establishes occupational health and safety standards and procedures on construction safety. It aims to ensure safety and health for employees, as well as other persons at the construction sites, from work related risks to their health, safety, and wellbeing. It also prescribes the roles and responsibilities of the workers and employers in ensuring health and safety at the site.
Regulation on Workers Compensation 2009 (MoLHR)	2009	Regulation on Workers Compensation was notified by MoLHR as empowered by the Labour and Employment Act, 2007. It establishes standards and procedures for compensation of employees and their dependents as a result of injury, diseases or death arising from their work or related to the tasks and duties they are required to perform. It aims to compensate employees or their dependents for a loss of earning capacity rather than compensate for a particular injury or disease, and provides for the payment of medical and related costs and the rehabilitation of employees to enable them to return to work as soon as possible.
Regulation on Hours of Work 2009 (MoLHR)	2009	This regulation was framed as per the Labour and Employment Act, 2007 and it provides the maximum working hour and related matters falling within the scope of the Labour Act. It prescribes a maximum of 8 working hours per day with 2 hours overtime per day.
Bhutan Building Rule 2002 (MOWHS)	2002	The City Corporation Offices of the respective towns have the responsibility to enforce the Bhutan Building Rules, 2002, which make reference to aspects of safety on construction sites.

Source: Profile on the Occupational Health and Safety of Bhutan, March 2012

#### D. International Conventions

24. **Protection of biodiversity:** The RGoB ratified the UNESCO Convention on 22 October 2001 with national park having 8 different cat species present within the same area which is very rare, highest recorded tiger density, and having spectacular landscape. Currently, RGoB has 8 sites in the tentative UNESCO list of which 4 are earmarked for the protection of biodiversity, namely: Royal Manas National Park, Bumdeling Wildlife Sanctuary, Sakteng Wildlife Sanctuary, and the Jigme Dorji National Park. The RGoB is a party to the Convention on International Trade in Endangered Species since 13.11.2002 and has supported the South Asia Wildlife Enforcement Network to protect the threatened 10 big and small cat species including the

4 color morphs of the Asiatic Golden Cats and the Monitoring of Illegal Killing of Elephants. Relevance: Project potentially has both beneficial and adverse impacts on biodiversity. Beneficial impacts stem from improved access to an area where biodiversity resources are found, particularly bringing increased number of tourists for nature or ecotourism. Adverse impacts from improved access causing resource exploitation and land use changes that affect biodiversity.

25. Bhutan is also to the Convention to Combat Desertification (CCD) in 2003 and ratified the Framework Convention on Climate Change (FCCC) in 2006. Local conservation legislation is still in development.

## **E. Environmental Roles of Relevant Agencies<sup>2</sup>**

### **1. National Environmental Commission Secretariat (NECS)**

26. NECS has overall responsibility for enforcing environmental assessment and management in Bhutan. Various functions and responsibilities have been delegated to ministries and competent authorities. NECS will be directly involved in the environmental management of the proposed project as requested by the secretariat as there is no appropriate delegation of authority in this case. NECS will issue the environmental clearance and provide guidance when needed.

### **2. Ministry of Agriculture and Forest (MOAF)**

27. MOAF is competent authority for certain type of project activities in its purview. In this project the Chief Forest Officer for the district in MOAF will be consulted regarding permission to cut trees.

### **3. District Environmental Committee (DEC)**

28. A District Environmental Committee (DEC) consists of Dzongkhag planning officer, Dzongkhag forest officer, Dzongkhag land record officer, Dzongkhag agriculture officer, Dzongkhag environmental officer, and Dzongkhag engineer. The District Environmental Officer (DEO) is district official of NECS. DEC is responsible for issuing Environmental Clearance to some project activities mandated to the committee and for checking compliance of the projects to which it issues EC periodically. As part of its regular activities, NECS gives general training and orientation to DEOs before sending them to districts. These orientations focus mainly on Bhutan's environmental requirements.

---

<sup>2</sup> Royal Govt of Bhutan-Agriculture and Env

### III. DESCRIPTION OF THE PROJECT

#### A. Background

##### 1. Pasakha Access Road

29. The Pasakha access road provides the principal access to the Pasakha industrial estate from Thimphu, Phuentsholing and India. The Pasakha industrial estate is the largest in Bhutan with 40 manufacturing plots available over an available area of 117 acres, of which 20 are currently in operation. The 1.2km section of PAR connects the junction with Phuentsholing Road and the future Jaigaon bypass road with the entrance to Pasakha industrial area that is east of the bridge on the Bhalujhora River. The PAR traverses two major drainage catchments: (i) the debris flow from the landslide area (approx. 500m length) with flash floods in highly erodible valley slopes and (ii) the area upstream from the crossing of Bhalujhora River (115m) currently by a concrete bridge (with two sunken piers) damaged during the last rainy season.

30. The PAR is classified as a primary national highway and is managed by Department of Roads (DOR). The existing road infrastructure from Pasakha to the west needs to be improved because the standards and conditions are inadequate to meet rapidly growing demand for efficient traffic movement. Most of the country's cross border trade takes place in Phuentsholing and there is only one entry and exit point for the core area which results in traffic congestion from local traffic and trucks transporting goods to and from Thimphu, and containers carrying raw materials and finished goods to and from the Pasakha industrial area. Immediate relief is required in the form of the PAR improvements but further improvements are being progressed and therefore another crossing point is planned near the PAR area that will also relieve congestion and poor mobility in the urban area. These improvements will also relieve some of the restrictions to national development and economic growth related to the poor mobility.

31. The existing conditions of the Project road vary and are generally only fair in some places but mostly poor and unacceptable in most places. The bridge has collapsed and the debris flow from the landslide has demolished about 400m to 500m of the western end of the PAR. The road was sealed in most sections but the earthen shoulders are mostly in poor condition and overgrown with grass and other plants. The culverts are in fair to poor condition but many are blocked and damaged and some require major improvement and repair or replacement.

32. Detailed design of the PAR has been carried out by the DOR through design consultant. Project Coordination Unit (PCU) will hire and recruit the construction supervision consultant (CSC) for construction supervision and monitoring. Construction will be carried out by National contractor. The DOR offices in Phuentsholing District will monitor the project in the operational phase.

##### 2. Alay Land Custom Station

33. The proposed land customs station (LCS) at Alay is aimed at providing future customs import and export clearing services when complimentary services across the border in India are also established (Figure 3). The facility will contain parking for import and export trucks; warehouses for temporary storage; administrative building and the parking facilities.

34. Phuentsholing Thromde (PT) will be the implementing agency during the construction phase. However, once completed, it will be handed over to the Regional Revenue and Customs

Office (RRCO) under the Ministry of Finance. LCS construction will be overseen by same PIU that also administers the MDP construction.

## **B. Existing Conditions of PAR and the Proposed Site for Alay LCS**

### **1. Pasakha Access Road**

35. The current widths of the existing road to Pasakha are a standard 5.5 m carriageway (varying from 5.5 to 8.5 m). The proposed widening of the sections PAR due for improvement is summarized in Table 5. The widening will be 3m or less and no widening will be required in some places. Widening of about 0.5 to 1m will be required in most places.

**Table 5: Current and proposed widths on PAR**

<b>Road Location</b>	<b>Start (Km)</b>	<b>Finish (Km)</b>	<b>Length (m)</b>	<b>Current formation width (m)</b>	<b>Current pavement width (m)</b>	<b>Proposed pavement width (m)</b>	<b>Proposed formation width (m)*</b>	<b>Formation Widening required (m)#</b>	<b>Pavement Widening required (m)@</b>
Pasakha	0.0	1.242	1.242	6.0 to 9.0	5.5 to 8.0	6.0	8.50	0 to 2.5	0 to 3

Source: TA 7650Consultants. @ = based on pavement width. # = based on formation width. \* Proposed pavement and formation widths may be wider (up to 8m and 12m respectively) on some widened curves.

36. The western end of PAR connects with the eastern end of the Pasakha to Phuentsholing road. The section to be improved runs across the debris flow to the bridge over the Bhalujhora River. The concrete bridge crossing of Bhalujhora River (115m) has two sunken piers that were damaged during the last rainy season. The carriageway has subsequently collapsed.

37. The daily traffic on the PAR runs from early in the morning to evening. The major portion of the traffic is heavy trucks (>10T by observation and more than 90%) with a few cars, 4WD and buses. The rest are other public motor vehicles. Some trucks carry people as well as goods in and out of the area.

38. The existing alignment passes at a distance of >30m from a few dwellings (Figure 2) that form about six isolated settlements. The Project road ascends from Phuentsholing through villages, agricultural land and hill farms to the west of PAR. The land form is hilly and mountainous. The PAR section is just below the hills and is predominantly downhill from west to east (towards the river) rolling with a slow gradient from Km0 to Km1. The terrain was inspected by the TA7650 REG consultants in December 2012 and areas were identified that will require work to increase the vertical profile from about Km0.2 to KM0.4 (Figure 4).

### **2. Alay Land Custom Station**

39. The proposed site for Alay LCS on the west bank of the Bhawanihora River (Figure 2) borders India. Currently, it is filled with large amount of debris from the flash flood and landslides of the Bhawanihora catchment areas. The LCS is proposed to be constructed over the 2.4ha of reclaimed land.

40. The proposed site is problematic but offers ample space for all necessary facilities. The catchment area of the Bhawanihora stream area is confined by hills on three sides, limiting the catchment to a little over eighty two hectares. The slopes of the adjacent hills and high bed

slope of about 10% add considerably to flood velocity and scour. The unstable hill slopes and the moving load of debris only aggravate the adverse effects further.

41. The Bhawanihora stream merges into Bhalujhora River at approximately 1 km downstream from the existing PAR and the proposed Alay LCS. The debris flow accumulation runs out at few hundred metres downstream of the existing road. The total length of the flow (between the river banks) is approximately 2.3km. It is thus anticipated that training the river with adequate protection works could be used advantageously to redirect and channelize the water course and reclaim significant usable area (Figure 6).

### **C. Studies and design of PAR and Alay LCS**

42. The design standards applied for hydrological and drainage assessment were those of the Department of Roads' Bridge Reference Manual, DoR (June 2005) and the relevant codes of practice of the Indian Roads Congress (IRC) were also adopted where provisions are incomplete or unavailable in the Bhutanese standards.

43. The hydrological study was based on: (i) daily rainfall data for Phuentsholing 1996 to 2011 (ii) Surface Hydrological data of Bhutan Year book 2009 and (iii) Hydrological report ADB RNPII March 2011. Calculations for the hydrological study have been made based on standard hydrological principles and the bridges and other engineering controls are designed to accommodate the predicted discharges accordingly.

44. The catchment area from which the discharge is derived is relatively small making the surface flow very flashy. It is noted that the massive rainstorm that destroyed the Bhalujhora River Bridge occurred in 2012.

45. Detailed design for PAR has been completed. The multicellular low level culvert is proposed over Bhawanihora stream while 120m pre-stressed RCC concrete bridge is designed to replace the existing damaged bridge over Bhalujhora River. Environment Friendly Road Construction (EFRC) methods and climate change adaptation measures have been incorporated into the design.

46. In the case of LCS, the detailed design will be prepared by the design consultant that will be procured by PT and a construction contractor will be hired for construction.

### **D. Proposed upgrading of PAR and proposed LCS facilities at Alay**

47. The western end of PAR connects with the eastern end of the Pasakha to Phuentsholing Road and Jaigaon Bypass (Figure 4). The surface flows needs to be channelized and therefore the centre portion of the landslide shall be bridged across with a length of about 140m. The PAR section to be improved will run up high embankment to this bridge to cross the debris flow and the Bhawanihora stream (Figures 5 & 6). The PAR will then descend on another embankment and run towards the Bhalujhora River and cross it on a new concrete bridge about 120m long (Figure 7).

48. For the Alay LCS, around 2.4ha of land will be reclaimed at the west end of Bhawanihora stream adjacent to the Phuentsholing road and the future proposed Jaigaon Bypass road (Figure 4). LCS facilities will be basically comprised of customs administrative buildings, warehouses and parking facilities. In order to protect LCS facilities, stream channelization, construction high embankment and other river training works will be carried out.



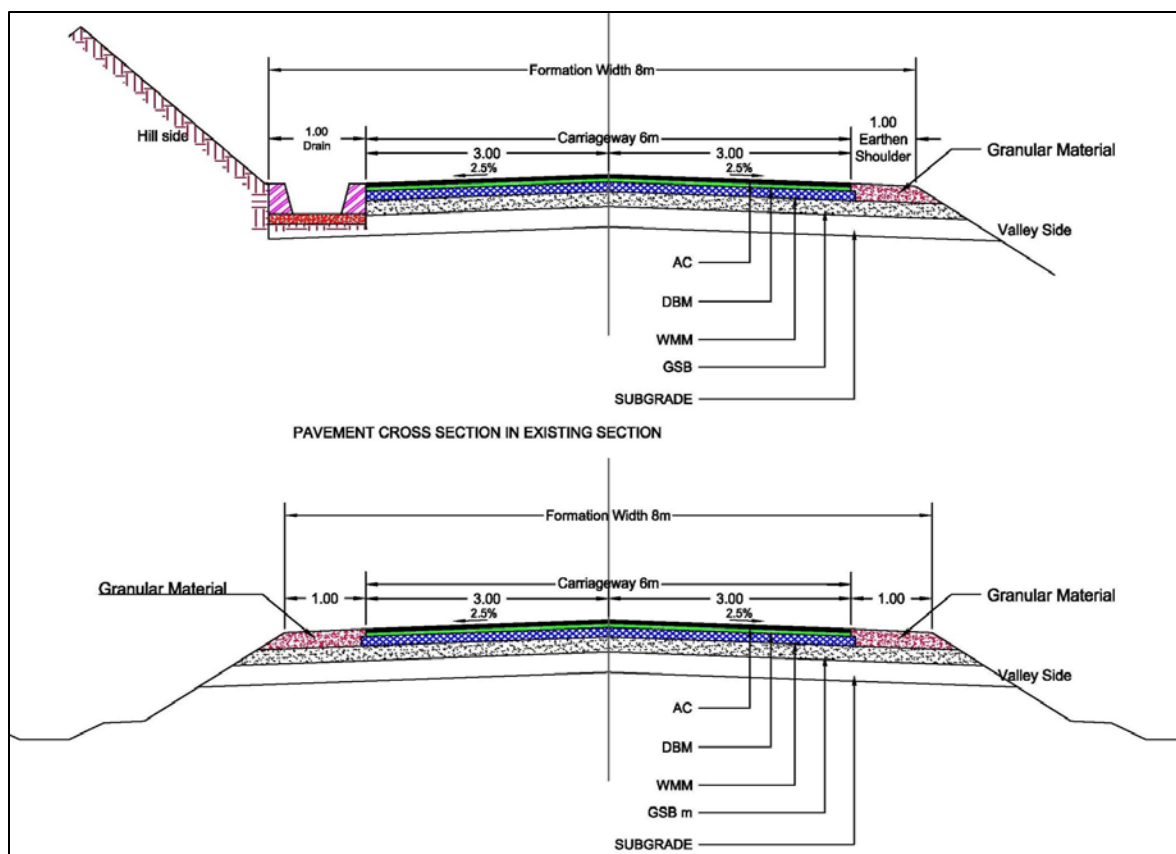
## 1. Pasakha Access Road

49. The PAR road requires rebuilding and upgrading. This will involve some alterations to the width by 1.0m to 3.0m in various places to improve road geometry. The existing road corridor either side of the centerline, is ample for the proposed rehabilitation works in all places but will require additional cutting slopes in a few locations (Figure 4). The works for the PAR will therefore take place within the existing road corridor and no significant impacts are expected outside the road corridor. Alignments are generally acceptable. The proposed geometric design standard and widening is shown in Figure 3 which shows the typical cross sections.

50. The road works will include (i) excavation and reconstruction of the embankment, slopes and retaining walls, (ii) reconstruction of the carriageway (6.0m wide) plus hard shoulders; (iii) repair and reconstruction of retaining walls and gabions (iv) ensuring drainage and access near villages and at other key areas is unimpaired by repair and extension of culverts; (v) reconstruction and repair improvement road side drainage and (vii) installing slope stabilization and bioengineering measures, landscaping road signage and accessories and (viii) reconstruction of the bridge and construction of viaduct over landslide. The waste disposal issues for the works should be manageable but there will be a surplus of cut materials, however a lot of these materials can generally be reused on the Project.

51. The works are generally expected to take place within approximately 5m of the centre line of the alignment (allowing about 1m-2m temporary working space either side, where available).

**Figure 3: Road & Pavement Cross Sections for Pasakha Access road**



Source: SASEC Detailed design, December 2013.

## 2. Alay Land Customs Station

52. The Alay LCS is proposed to be located on reclaimed ground on the western side of Bhawanihpora stream near Alay Village (Figures 3, 4, 6 and 7). Near the new bridge over the landslide the engineering control works have been designed to extend both upstream and downstream of Alay LCS as far as the Bhutan /India border. The LCS area will be reclaimed by filling and also be protected by providing gabion retaining walls. The reclamation will include 2.4ha of land in the Bhawanihpora stream bed with the necessary flood calming and protection work upstream and with development of LCS) within 2.0 Ha the reclaimed land.

53. Upstream catchment and slope protection works to control landslide and debris flows and reduce the destructive effects on the proposed PAR and LCS will be carried out. Along the Bhawanihpora stream, checkdams will be constructed to reduce the flow velocity and arrest the debris. Downstream, nearer to the proposed LCS site, the high embankment and gabion retaining walls will be constructed. Other activities that will be carried out are i) construction of park lots; ii) drainage system development; iii) construction of internal access road; iv) installation of road signages and accessories; v) construction of security apparatus. The surplus material from stream channelization works will be used for developing high embankment within LCS perimeter.

54. The Alay LCS will include the following typical facilities: (i) main entry gate and office, security house; (ii) weigh bridge; (iii) truck parking for import and export trucks; (iv) covered truck inspection platform; (v) confiscated goods warehouse; administration building with services; and (vi) car parking bays for administrative staff and authorised persons.

## E. Construction materials

55. The feasibility study team consulted with the local public works authority in Phuentsholing and clarified that there are established sources of fine and coarse aggregates for pavement and structural concrete near the project, and borrow materials likely to be used for road construction materials should also be available for the Project.

56. The estimates of cut and fill made by the engineers for the Feasibility Study indicate that there will be no surplus cut materials as fill requirements for the embankment and reclamation are estimated to exceed cut materials by more than 75,000m<sup>3</sup>, some of which will be rock cutting. However the rock often has joints. Such joints are opened by weathering, which appears also to be one of the primary causes of rock fall and rock slope failure. This means the rock can be excavated by powered mechanical equipment and there should be no need for blasting except in unexpected circumstances. All of the cut materials can be used for bulk fill for the embankment and reclamation to offset the need to extract fresh rock based materials from quarries and borrow pits. This will reduce the requirement for rock based materials (Table 6).

**Table 6: Estimates of Earthworks and structure works**

<b>Structures and Works</b>	<b>PAR</b>
Bulk Excavation (soil & rock - m <sup>3</sup> -assume 100% reuse)	7.433m <sup>3</sup>
Bulk Fill (total required rock based materials - m <sup>3</sup> )*	84 .419m <sup>3</sup>
Bulk Fill from debris / other sources 100% reuse - m <sup>3</sup>	76,986m <sup>3</sup>
Surplus for disposal or reuse in another project	Nil
Retaining walls and gabion embankments new (m*)	2223m
Proposed new lined drains (m**)	1133m
Bitumen (m <sup>3</sup> approx.)	<800m <sup>3</sup>

Source: based on information from TA 7650 Consultant Reporting July 2013

\*=m length in various heights 1m to 9m.

\*\* = m length various diameters

## 3. Locations

57. The materials from common and rock excavation work along the PAR are expected to be suitable as borrow soil. The excavation volume was estimated to be more than the required quantity of borrow soil for bulk fill, it is assumed that little or no borrow soil will be needed for construction.

## 4. Riverbed materials

58. Riverbed gravels in the several rivers (based on observation) should have enough strength as aggregates for asphalt concrete and suitable as mixture to any aggregates and sand. However, laboratory tests will be required to confirm its applicability for asphalt concrete. Sands from several rivers were observed as applicable for structural use.

## 5. Existing Quarries

59. The debris flow and a few small scale existing active areas and redundant small quarries are within short travelling distances from the PAR and aggregates are available but there is no hot mix plant near the Project area. Contractors will need to install the necessary plant. The

crushers and hot mix plant must have an environmental permit and be licensed (by NEC) before the construction works can begin. There are some quarries and borrow pits that have been used in the past for obtaining aggregates. If these quarries and pits can provide further quantities of suitable materials they can be reopened and NEC should be consulted to clarify if these locations also require an environmental permit and license before the construction works can begin.

#### **F. Implementation Schedule**

60. PAR is scheduled to be started by late 2014 and will be completed in 2016; while the civil works for LCS will begin early 2016 and complete by late 2017.

Figure 4: Plan and profile PAR

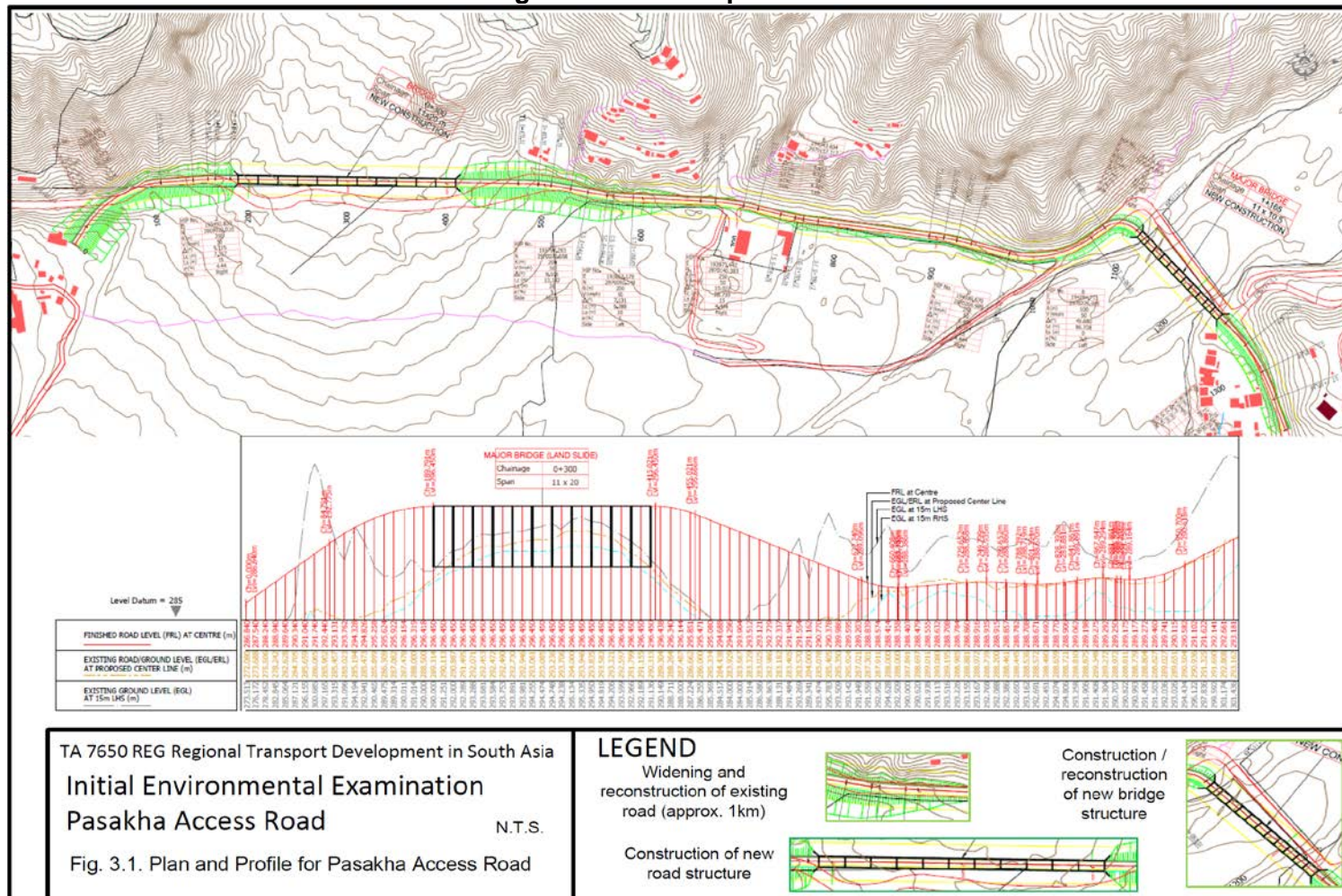


Figure 5: Typical cross sections PAR

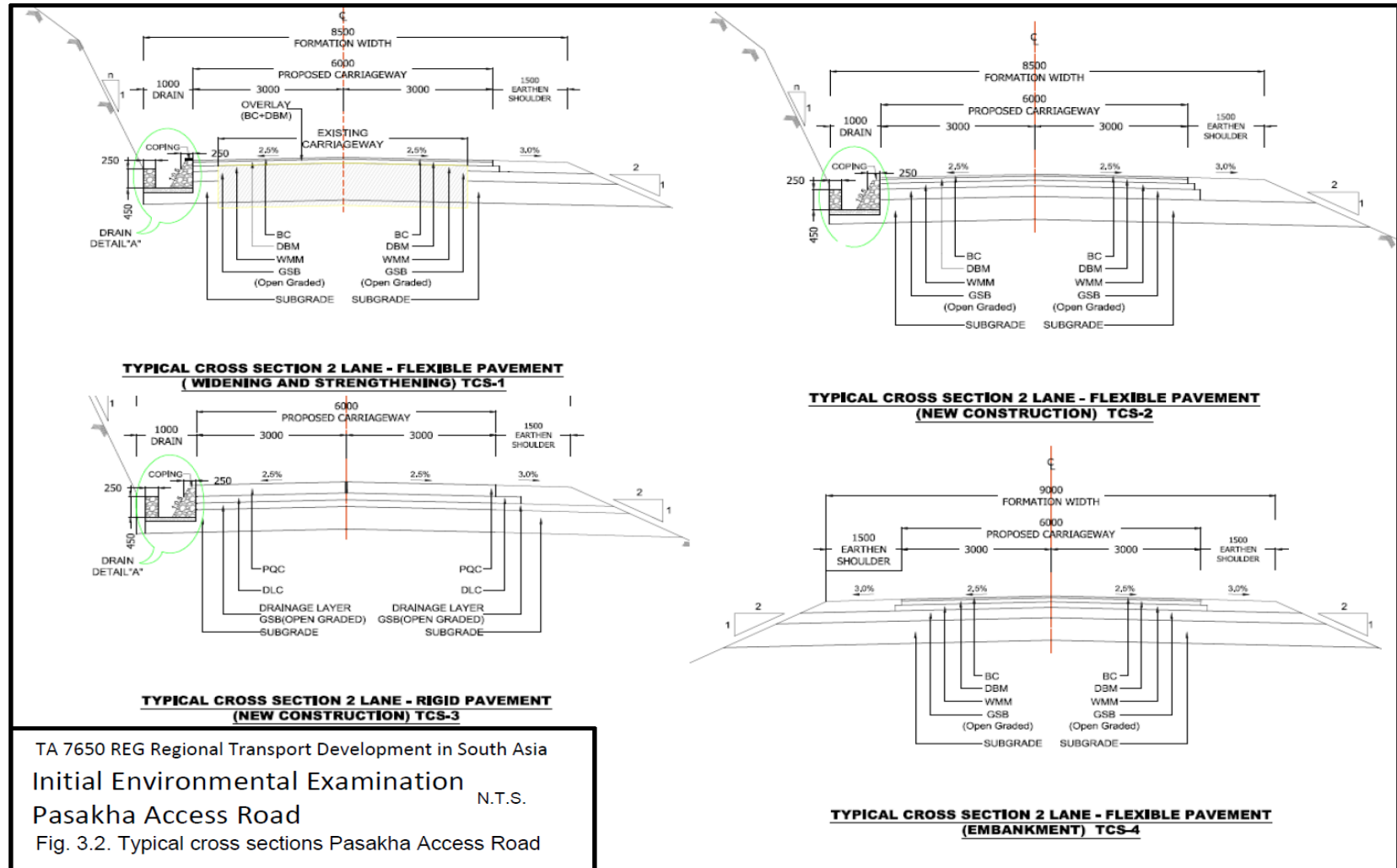
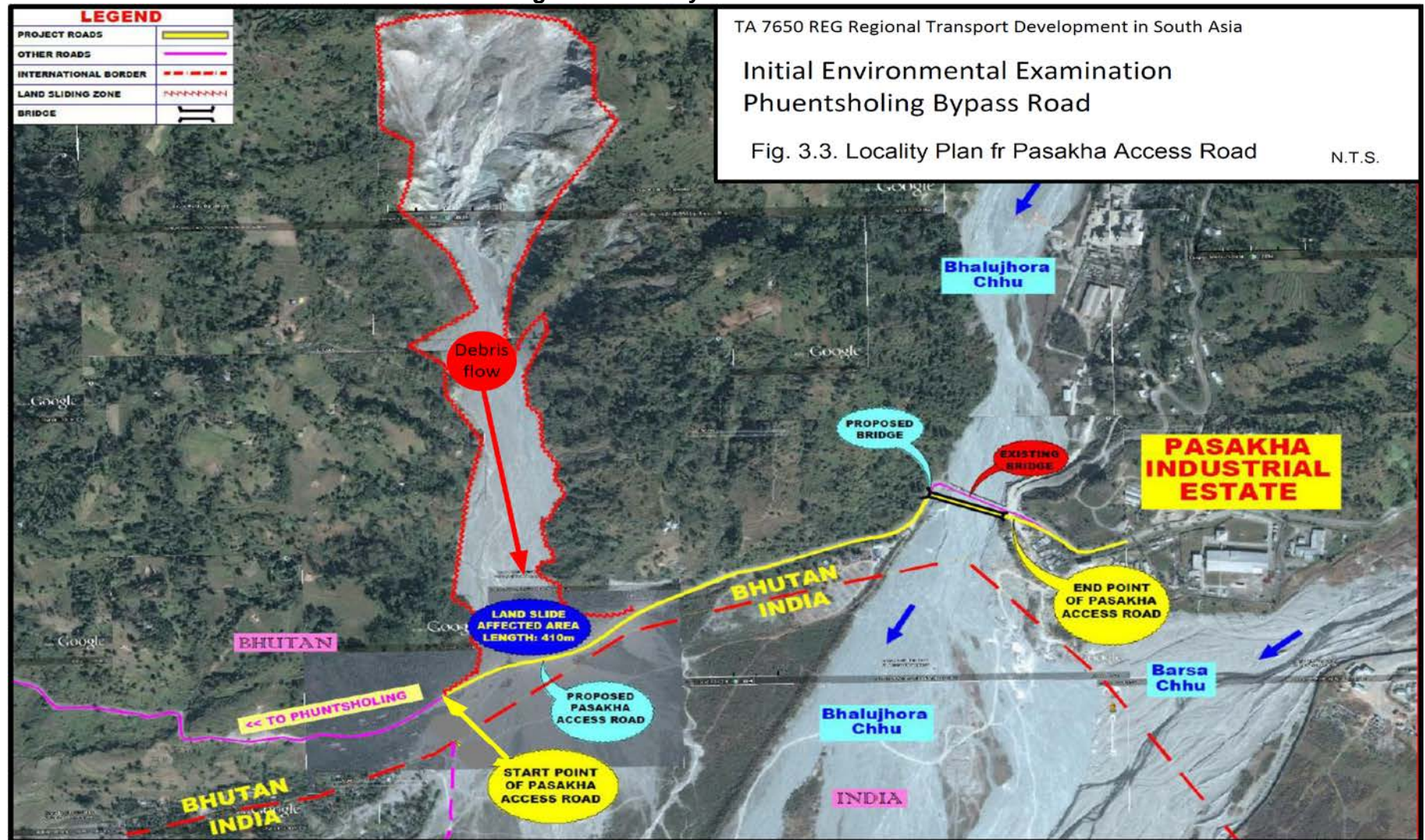




Figure 6: Locality Plan for PAR



## IV. DESCRIPTION OF ENVIRONMENT

### A. Physical Environment

#### 1. Topography

61. Bhutan is a landlocked and entirely mountainous country bordered by China in the north, the Indian states of Assam and West Bengal in the south, Sikkim in the west and Arunachal Pradesh in the east. The country has three geographical zones ranging from an altitude of 150m in the south to over 7000m on the northern border. The southern zone with below 2000m has low forest hills and dense tropical forests with a hot and humid climate. The central zone lies between 2,000m and 3,500m with a semi-tropical climate. The northern zone lies from east to west between 6,800m and 7,400m and is part of the eastern Himalayas.

62. Phuentsholing is in Chhukha District situated in the south of Bhutan at the edge of the Duar plain on the low spurs of the sub Himalayan foot hills. The geographical co-ordinates of Phuentsholing are 26 51' N 89 23' E and the city lies at an altitude of 160 metres above mean sea level. The distance from Thimphu is 176km and the nearest airport is Bagdogra (India), 4hrs drive from Phuentsholing.

63. The topography of Phuentsholing District is mostly hilly with occasional steeper slopes and mountainous sections. Phuentsholing City is hilly and is dominated by the Om Chhu River (Dhote Khola) that flows east to west through the centre between the industrial area to the north and the commercial border area to the south. The surrounding mountains and the Amo Chhu River (Toorsa River) and the plains to the West lead to India. The topography around the PAR is hilly to mountainous.

#### 2. Meteorology and Climate

64. Bhutan experiences four seasons: spring (March-May), summer (June-August), autumn (September-November) and winter (October-February). Annual rainfall is concentrated in the monsoon season from June to September. The autumn months of September to November bring shorter days and cooler evenings. However Phuentsholing is typical of the south which has a warmer sub-tropical to temperate climate

65. Surface air temperature data in Bhutan from 1985 to 2002 has shown a warming trend of about 0.5°C, mainly during the non-monsoon season. Analysis of data from 2000 to 2009 from meteorological stations of the four representative eco-floristic zones of Bhutan also shows a trend of rising mean summer and winter temperature. However, due to the short time-series data on temperature, it is difficult to quantify the annual rise in temperature. In Phuentsholing temperatures vary between 10°C in winter to 40°C in summer. Phuentsholing experiences warm subtropical climatic conditions and all four seasons with a heavy monsoon rain for about three months starting from June. The local climate is wet, and the highest rainfall of the country is reported to occur in the southern foothills, including Phuentsholing town, where it has been known to reach a total maximum of 4,400mm.

66. Unlike temperature, no consistent spatial trends have been observed in precipitation throughout the eastern Himalayan region. The changes in annual precipitation are quite variable, decreasing at one site and increasing at a nearby site. In Bhutan, no comprehensive precipitation observations are available to conclude any trends. However, rainfall fluctuations are largely random with no systematic change detectable on either annual or monthly scale. A



recent analysis of rainfall data from 2000 to 2009 across four eco-floristic zones of Bhutan shows annual fluctuations within regions without any detectable trend. A summary of total daily rainfall in Phuentsholing city (1996 to 2011) is given in Table 7.

67. Given the rainfall pattern over the region of the Project, it is important that season be considered in planning the implementation of the improvement program. In order to avoid runoff and protect the works earthworks and major construction should be planned for the dry season (October to March) particularly for areas susceptible to flooding and landslides and for works near rivers.

**Table 7: Summary of rainfall data**

Year / Month	Total Jan-Dec (mm)	May – Sep (mm)	May - Sep (%)
<b>1996</b>	3554.8	3064.6	86
<b>1997</b>	4376.6	3828.6	87
<b>1998</b>	6699.0	6026.6	90
<b>1999</b>	4547.2	3865.2	85
<b>2000</b>	6106.4	5512.1	90
<b>2001</b>	4593.6	3623.6	79
<b>2002</b>	4691.4	4040.0	86
<b>2003</b>	4633.2	3545.0	77
<b>2004</b>	5034.8	4243.6	84
<b>2005</b>	2606.0	2259.9	87
<b>2006</b>	1975.9	1788.6	91
<b>2007</b>	3376.6	3105.6	92
<b>2008</b>	1681.4	1536.1	91
<b>2009</b>	3175.8	2582.3	81
<b>2010</b>	4181.8	3454.7	83
<b>2011</b>	3049.9	2749.0	90

*Source: Meteorology Section, Hydrological Meteorological Services Division,  
Department of Energy, MTI, Thimphu, Bhutan.*

*Annual Report Daily Rainfall, Station Number : Ph11150048, Phuentsholing, Elevation : 220.0m*

### **3. Geology, and Soils**

68. Bhutan covers two broad geological zones, the Lesser Himalayan belt along the southern and south-eastern border and the Tethyan belt further north. The Lesser Himalayan formation includes a wide range of sedimentary and low-grade metamorphic rocks, including argillites and metargillites, sandstones, quartzites, limestone, dolomite, and gypsum. The Tethyan formation mainly includes stronger gneisses that account for more than 70% of the country's bedrock and schists and marble, affording a relatively high degree of stability compared to other locations in the Himalayas. Chhukha district is in the Lesser Himalayan belt with tectonically active sedimentary and metasedimentary rocks, gneiss, schist, quartzite, and limestone. The "main central thrust" area falls close to Phuentsholing. Hence, it is underlain mostly with schistose rocks. The majority of the soil in and around the town is of weaker phyllites. This makes the soil texture very fine and the slopes very unstable.

69. Intermittent occurrence of heavy rain, slow erosion-deposition, rapid mass washing processes, including rock falls and landslides, the and weaknesses underlying in the rocks coupled with the steep terrain, make erosion and sedimentation significantly active geological processes in the Phuentsholing area. There are observable problems at the landslide and near the river.

#### 4. Seismicity

70. Bhutan is prone to a number of natural hazards due to fragile geological conditions, steep sloping terrain, great elevation differences, variable climatic conditions and active tectonic processes taking place in the Himalayas.

71. There is no detailed seismic micro-zonation of the country. However, since the north-eastern parts of India (next to Bhutan) fall under seismic zone V (seismically most active), it can reasonably be assumed that Bhutan is contiguous with this zone and either in seismic zone IV or V. Hence, there is a threat of a significant earthquake.

#### 5. Surface Water

72. Bhutan has four major river basins, namely the Amo Chu (Toorsa), the Wang Chu (Raidak), the Punatshang Chu (Sunkosh) and the Drangme Chu (Manas). All these river systems are either directly or indirectly fed by permanent or seasonal snows, glaciers or high altitude lakes at their sources and surface runoff water from the monsoon rainfall. The subalpine lakes above 3,000masl constitute valuable high altitude wetland ecosystems in Bhutan but these are far from Phuentsholing. They are also valued for the diverse habitat provided and the willow, rhododendron bushes and juniper forests.

73. Phuentsholing urban area is divided by the River Om Chhu (Figure 1). This river rises in Bhutan, and discharges to the River Amo Chhu that crosses the Indian-Bhutanese border. Amo Chhu originates in China and flows through a well-defined valley system. The Bhalujhora Chhu near Pasakha rises in Bhutan crosses the Indian-Bhutanese at Pasakha and discharges to the River Amo Chhu about 10km east of Cooch Behar in India.

74. Pasakha lies on the east bank of the Bhalujhora Chhu which emerges from its steep upstream reaches onto the Duar plain and broadens to a width up to 500m near Pasakha. High monsoon flows in the river are eroding the land along the east of Pasakha, and expose the industries to the danger of flooding from the river. The river banks have been protected with limited success. Bhalujhora Chhu also has high flow and discharges can reach as high as 500m<sup>3</sup>/s, and flooding can occur.

75. River flows are the highest from May to September. When they do discharge they carry high sediment loads, depositing large quantities of gravels and sands in the lower reaches. During the wet season some of the culverts are inundated, cutting off roads. Water levels in the rivers drop to almost nothing in the dry season and have very low flow October to April unless there is unusually heavy rain.

76. The area does not provide any aquatic resources for subsistence or trade, but the streams in the hills provide water for drinking, bathing, and crop irrigation. The rivers are not navigable. Transportation is on the roads.

77. The industries in Pasakha are in the east bank catchment area of the River Bhalujhora Chhu. The major land use in the PAR project area (west of River Bhalujhora Chhu) is rural leading to some industries in Pasakha itself. Upstream of Pasakha the Bhalujhora Chhu River has generally good water quality and is used for drinking. Apart from domestic sources, pollution loading from other sources is moderate. Thus water quality in such a setting is good upstream but more polluted south of Pasakha.

78. No quarries are in operation near this Project stretch. Limestone exploitation nearby is from quarries in the nearby foothills and aggregates are also taken from the River. There are settlements and local mechanical, carpentry and other workshops near the banks of Bhalujhora Chhu River but these are small scale and unlikely to affect the water quality significantly during implementation.

79. Water quality monitoring was not undertaken during the environmental assessment. The Bhutan Water Act (2011) regulates water pollution and is the appropriate standard for comparison purposes for impacts on water supply for human consumption. NEC has created standards for ambient water quality in Bhutan (Appendix C). The World Bank's Environmental, Health, and Safety (EHS) General Guidelines<sup>3</sup> will also apply to the implementation of the Project if World Bank's parameters are not included in the NEC standards.

## 6. Hydrology

80. Hydrology studies have been carried out and are presented in the feasibility study report. The project presents two major flood-prone problem areas at the Bhawanihora stream and the Bhalujhora River Bridge. The catchment area from which the discharge is derived is relatively small making the surface flow very flashy. Surface water runoff from these high catchment areas with steep slopes upstream crosses the PAR road section two places and occasionally flows with great force over a wide area at the Bhawanihora stream and Bhalujhora River Bridge. Bridge-type solutions are appropriate in both locations to allow the debris and water to pass (Figure 4)

81. **Bhawanihora Stream.** The 400m to 500m wide landslide area in the Bhawanihora River needs special attention as the surface flows from the hills will need to be controlled and diverted into a pre-determined manmade course. The debris has blocked the PAR and needs regular dredging across in the Bhawanihora River landslide during the rainy season. The slide affected area of the Bhawanihora River stretches back up the valley for more than a kilometer upstream from the PAR (Figures 2 and 3) over which distance the main course of the river fluctuates with in a curving shape over a slope of about 10% down towards the road. The soil is sandy and gravelly which allows water to seep inside; as evidenced by the rapid regrowth of pioneer vegetation since the major storm 2012. The high speed of flow is thus able to scour much deeper through this looser alluvial material.

82. The Bhalujhora River also carries large amounts of debris as evidenced by the destruction of the old bridge in 2012 after more than 900mm of rainfall in one day. The flow here also carries large amounts of debris and very large boulders. The composition of the sand and gravel in the river bed of Bhalujhora River also resembles loose construction debris full of stones, sand and silt. It appears weak and unsuitable for shallow foundations. This will require special attention to foundation type and it is likely that deeper foundations will be needed.

83. The above points of concerns were considered in proposing bridges and other flood protection works with massive arrangements as the design concept solution at both locations.

## 7. Ground water and Ground water quality

---

<sup>3</sup> World Bank Group, 2007. *Environmental, Health, and Safety General Guidelines*. Washington, DC.

84. There are no data available on the groundwater potential. Ground water resources appear to be abundant with springs emerging from basement rocks near the landslide and fluvial deposits. Groundwater in landslide and alluvial deposits has been estimated at an exploitable rate of 3l/s/km<sup>2</sup>. Currently water quality monitoring is only conducted in the four major river system of Bhutan. Generally, the state of Bhutan's ground water quality is still good but with expanding settlement along rivers, there are localized pollution problems. In the Project area ground water quality is anticipated to be good.

## **8. Water supply and sanitation**

85. Phuentsholing Thromde (PT) is responsible for providing safe drinking water to the residents within the city. Piped water supply is available to all parts of the main city and some of the sub-urban areas but not the settlements near the PAR. The outermost areas such as Damdara, Pipaldara are served through rural water supply schemes. Water supply near PAR is satisfactorily based on a local rural water supply scheme.

## **9. Air Quality**

86. Air pollution in Bhutan is a recent phenomenon and can be attributed to rapid urbanization and industrial developments. Diesel vehicles with poor engine maintenance and poor quality of fuel are also major sources for the urban air pollution.

87. Air quality monitoring was not undertaken for the Project. By observation in general, air quality near the PAR is acceptable but there are large amounts of dust being resuspended from the roads surface. Ambient air quality concerns are mainly limited to the industrial estates near Pasakha some 1km to the east. In this Project area the gaseous pollutants of carbon monoxide (CO), sulfur dioxide (SO<sub>2</sub>), nitrogen dioxide (NO<sub>2</sub>) from traffic are well dispersed in the open terrain and there is potentially adequate dispersion in the wide open areas near the settlements. Air quality appears to be generally acceptable with the exception of dust. Dust arises owing to the poor condition of the existing roads and dust arising when vehicles pass over the landslide and unsealed shoulders of roads in many places. At these times dust levels are high enough to obscure vision significantly. Dust concentrations will be higher, if only intermittently, within about 10m of the Project when dust rises as vehicles pass along the construction site on unpaved roads until construction is complete. Dust from road surfaces will be reduced when the site is completed and all areas are sealed.

88. Ambient air quality monitoring is not being done in project area. NEC has completed air quality monitoring in the past at Pasakha industrial area. The concentrations of respirable particulate matter and gaseous pollutants concentrations at Pasakha were within the limits (NEC pers. comm.) at that time. In project area ambient air quality is expected to be better as there are less heavy traffic and industrial activities. These both are contributor to air quality through release of exhaust gases.

89. The areas around the PAR have a few potential sources of atmospheric pollution from domestic, commercial and industrial sources but these are not making significant impacts on air quality based on observation. The majority of pollution is from Pasakha to the east. These areas are more polluted due to significant industrial development as well as emissions from workshops and poor waste disposal practices. RGOB and World Bank's Environmental, Health, and Safety (EHS) General Guidelines<sup>4</sup> will apply to the implementation of the Project.

## **10. Noise**

90. Noise from vehicles is not a concern in most of the areas around the PAR as the sensitive receivers are set well back (<30m) from the road and uphill and at present traffic is confined to occasional vehicles. Noise levels are generally within acceptable limits for the public and there were no complaints about current noise levels from the public during consultation. The criterion for site noise for a mixed area in Bhutan is Leq65dB(A) (day) and Leq55dB(A) (night, Appendix C). The World Bank standard applies an ambient criterion of Leq55dB(A) for residential areas, hospitals and schools which is equivalent to the NEC standard for sensitive areas. Where the background exceeds the ambient standards the criterion is background +3dB(A). Based on observation in the settlements and towns where traffic runs throughout the day the criterion of Leq55dB(A) for residential, school and hospital sensitive receivers is potentially exceeded at some times. As the criteria are potentially exceeded at some times of the day it is recommended that in order to make a consistent assessment for all locations the existing criterion of background +3dB(A) will be applied in the assessment for both daytime and night time. This will meet the requirements of ADB SPS. Given that the work is urgent it will not be unacceptable to have night time working.

## **B. Biological Environment**

### **1. Forestry**

91. Bhutan has significant natural forest resources. The subtropical plains and alpine terrain provide more rainfall than neighbors to the west which facilitates forest growth. The forests contain numerous deciduous and evergreen species, ranging from tropical hardwoods to predominantly oak and pine forests. About 87.7% of the Pemagatshel and 86.9% of Samdrup Jongkhar Dzongkhag are under original forest cover<sup>4</sup>. Pemagatshel has the slightly higher percentage of agriculture land (5.1%) than Samdrup Jongkhar (4.3%) in relation to its land area. Broadleaf forests are dominant in both Dzongkhags.

92. Forests are managed according to four types: government owned national forest, community forest, sokshing (registered to an individual person or household) and private tree plantations. Government forests are managed by the Department of Forests while community forest is managed by the village or a community. The sokshing (woodlots) and private forests are owned and managed by individuals, households and local communities. No forest management units (FMUs) are within the project area of influence. The project site is outside the fringe of the urban area where there are few forested areas. There are only a few mature trees the vicinity of the project.

93. The local forests are managed by the Department of Forests and there is a District Forestry Office for Phuentsholing District which has the headquarters in Gedu City. Forests are managed according to the instructions and quotas for cutting and planting received from the Ministry of Agriculture and forests (MOAF). The Department for Forests and Park Services indicated that the Sal forest area and that the mature trees can be removed with permission.

### **2. Fauna and Flora**

94. The area around the Project is rural development with heavy industry within 1km and there are no rare, threatened or endangered species of terrestrial and aquatic flora and fauna in the impact zone. The disturbed rural and industrial area, the road corridors and immediate

---

<sup>4</sup> As per NSB's Statistical Yearbook of Bhutan, 2011,

environs are unlikely habitats for large wild animals and rare or endangered species. The animals present are domesticated animals as well as those species that can tolerate disturbed conditions.

## C. Social-Cultural Environment

### 1. Human Issues and Quality of Life

95. **Land Use.** Phuentsholing is strategically located on the border with the Indian city of Jaigaon. Phuentsholing is a busy commercial and industrial area. It occupies the river terraces of the River Om Chhu and is confined by steeply rising foothills to the north and east and by the Amo Chhu to the west. Topography around the PAR is generally hilly. Areas to the north of PAR consist of steep slopes, with many of the slopes already denuded of trees to create space for housing development, thus leaving little room for further expansion. The land within the Phuentsholing City Municipality (PT) boundary is 320ha, but only 180ha are suitable for development and are mostly already fully developed. Because of land constraints, development has already grown beyond the existing city boundaries to the elevated areas like Kabreytar, Damdara, and Kharbandi to the north and Pasakha to the east.

96. Due to rapid urbanization, more than half of Bhutan's population will reside in urban centers by 2020. There is a rapid influx of rural migrants, resulting in an urgent need for improved urban services. The urban centers such as Phuentsholing will be major drivers of economic growth; reliant on good infrastructure. Owing to the thriving trade and related development in Phuentsholing, the town has experienced rapid population growth and urbanization and now suffers overcrowding, traffic congestion and unhygienic conditions. Expansion is constrained by fragile hill slopes around the city, the flood prone River Amo Chhu and the international border.

97. A conceptual land use plan has been formulated, as the beginning of a process to develop a vision for the utilization of the land resource. Possible courses for development are<sup>5</sup> (i) an extension of the existing town, continuing in the style of the existing town, (ii) extension of the existing town and redevelopment in a new form (iii) a fresh approach to development, setting an example for development in the 21st century, which would influence resource development of the existing city.

98. **Agriculture.** Agriculture in Bhutan has a dominant role in the economy of the country. In 2000, agriculture accounted for 35.9% of GDP of the nation. The share of the agricultural sector in GDP declined from approximately 55% in 1985 to 33% in 2003. However, agriculture remains the primary source of livelihood for the majority of the population. Approximately 80% of the population of Bhutan are involved in agriculture. Over 95% of the earning women in the country work in the agricultural sector. Agriculture in Bhutan is characterized by its labor intensive nature with relatively low intensity of farm inputs. Most of the peasants in the country are small and marginal.

99. Among the agricultural lands in the nation, an estimated 21% are irrigated, approximately 43% are rain fed, about 27% are used for shifting cultivation, approximately 8% are used for orchards and 1% is kitchen gardens.

---

<sup>5</sup> Urban Development Plan-Phuntsholing

100. Major crops cultivated in Bhutan are maize and rice. Maize accounts for 49% of total domestic cereal cultivation, and rice accounts for 43%. Rice is the major staple crop. Agriculture in the country includes cultivation of wheat and other minor cereal crops. Rice is the primary crop in those regions where proper irrigation is available. Other crops like wheat, barley, oil seed, potato and different vegetables are also cultivated in these lands. Maize is mainly cultivated in dry land regions at lower elevation<sup>6</sup>. Forests in the nation act as the source of livestock fodder and organic materials for the purpose of development of fertility. Forests are also responsible for regulating the availability of water for agricultural purpose.

#### **D. Demographic characteristics and public health**

101. Phuentsholing is the second largest city in Bhutan. In 2005 the total population of 20,537 has been projected to exceed 24,000 by 2013. The unprecedented growth of the city in 1986-1991 converted the surrounding forests and available agricultural land into residential, commercial, and other uses to accommodate the increasing population. The population is projected to reach 67,000 by the year 2027. There are no sensitive cultural features in the project area<sup>67</sup>.

102. The public health condition is more or less similar throughout the PT. Most Bhutanese have access to potable drinking water in the urban areas (98%) and basic sanitation (91%). Widespread health concerns include diarrhea and pneumonia. Diabetes, alcohol-related liver disease and cancer are also prevalent. Less widespread are w malaria and tuberculosis. Among children under age 5, skin infections; conjunctivitis and intestinal worms are significant concerns. Influenza, including H1N1 ("swine flu") and H5N1 ("bird flu") strains, are present in Bhutan. As of 2009, there were 6 confirmed cases of H1N1, none of which were fatal. Bird flu, however, has resulted in at least one outbreak in Phuentsholing and remains a serious concern for the Ministry of Health.

103. Bhutan launched its telephone Health Help Centre in 2011 which has proved successful and provides emergency response and the Healthcare Helpline which dispenses medical advice. Both services accessible through land and mobile phones. Emergency responses are served by ambulances in Phuentsholing.

#### **1. Cultural and historical sites, schools and housing**

104. The Bhutan Himalayas straddle the watershed of the Brahmaputra River basin. The river is regarded with religious reverence and faithfully believed as the blessed water of Lha Tshangpa or Goddess Tshangpa, thus called as Tshangpo in its head water sources of the Autonomous Region of the Tibetan Plateau.

105. The Project district is home to a number of cultural and historical sites but generally all are several kilometers from the PAR. During public consultation no sacred places or traditional heritage sites for local villagers were brought to the attention of the consultants.

---

<sup>6</sup> Draft IEE-Urban Infrastructure Project-Phuentshilong road and Bridge Project

<sup>7</sup> <http://world-gazetteer.com/wg.php?x=&men=gcis&lng=en&des=wg&srt=npan&col=abcdefghijklmno&msz=1500&geo=-41>

106. **Kharbandi Goenpa:** This monastery was founded in 1967 by the Royal Grandmother, Ashi Phuntsho Choedron and Guru Rimpoche. From the monastery garden there is a fascinating view of Phuentsholing town and surrounding plains.

107. **Zangtho Pelri:** this is a small temple built in the centre of Phuentsholing town, represents the heaven of Guru Rimpoche. On the ground level there are statues of the eight manifestations of Guru Rimpoche and paintings of Buddha's life.

108. **The Crocodile Zoo:** This zoo was established during 1976 with two different species mugger crocodile & gharial crocodile. Entry inside this zoo is restricted. This small zoo is situated in Phuentsholing.

109. The nearest school is at Pasakha and about 500m from the bridge on the PAR. Schools and colleges are particularly vulnerable to construction impacts and the scheduling of works should be scheduled after discussions with the principal to avoid impacts.

110. Residential properties are located at intervals around the PAR and residential development is spread out in about six locations. The front facades of the houses are generally set back from the PAR site by >30m (outside the area of direct impact). No major land acquisition will be required or relocation of properties and resettlement does not seem to be a significant issue based on observation.

## 2. Power supply

111. Electrical power is supplied in Phuentsholing Bhutan Power Corporation (BPC) grid. The low voltage distribution network runs on poles adjacent to the Project site and will need to be protected during the works. Some of these poles and lines may need to be reprovisioned before the improvement works commence to ensure continuity of power supply. The Project road works must be programmed not to create any impacts on these facilities and maintain security of power supply.

112. Given the status of Phuentsholing as the Gateway and commercial capital of Bhutan, the Bhutan Power Corporation (BPC) has been recommending adoption of underground (UG) cable network irrespective of higher costs. Selective adoption of UG is contemplated mainly from the view-point of safety in major cases and specific cases related to aesthetic considerations.

## 3. Telecommunications

113. The telephone system in Phuentsholing consists mainly of primary (UG & Aerial) and secondary (Aerial) networks with 5200 pairs of telephone line capacity. The primary or the UG network is laid underground. The capacity of the network is sufficient to meet the demand and is met as and when applied by the consumers. The future proposals include provision of UG secondary network in every building and replacement of the existing aerial network by underground network. Apparently, the Bhutan Telecom does not have a Master Plan of telephone network in Phuentsholing but their plan has been prepared based on the annual growth or demand.<sup>8</sup> Some telecoms poles are near the PAR on the southern side and may need to be replaced depending on the detailed design of the downhill embankments.

---

<sup>8</sup> Urban Development Plan-Phuentsholing



#### **4. Rail Transportation**

114. There are no railways in Bhutan but it is possible to travel close up to the Bhutan border by Indian Railway. Nearest major railway station is Alipurduar and Hasimara is also close by. Phuentsholing is half an hour drive from Hashimara.

#### **5. Roadways**

115. Jaigaon the Indian border town is 180 kilometers from Siliguri. Phuentsholing in Bhutan is approximately 182 kilometers by road from Siliguri. Phuentsholing is six / seven hour's drive from Bagdogra / New Jalpaiguri and seven hours drive from Gangtok or Darjeeling. The Royal Bhutanese Government runs bus services to Phuentsholing from Kolkata. These buses depart from Kolkata Esplanade bus station and reaches Phuentsholing via Siliguri. Phuentsholing is the only entry / exit point via road. The other is only entry point is in Assam.

116. Phuentsholing is one of the few cities which are well connected with other parts of the country through national road network. It is connected with Thimphu, the capital of Bhutan and other important cities like Gedu, Chhukha, Paro, etc. through Thimphu – Phuentsholing Highway. The access is not easy due to difficult terrain, poor road conditions and the distance involved (170kms – Thimphu). Being the gateway, it is also connected to other parts of Bhutan like Samdrup, Jhonkhar, Gelephu, and Samste through the road networks of India.

#### **6. Air Travel**

117. Bagdogra airport is 192km from Phuentsholing. Bhutan's national air carrier, Druk Air, operates several flights per week from Bangkok, Bagdogra, Delhi, Kolkata and Kathmandu to Paro. Spectacular flights fly passengers through the stretch between Kathmandu and Bhutan. The flight passes along the Himalayan Range.

## V. ANTICIPATED ENVIRONMENTAL IMPACTS & MITIGATION MEASURES

118. This section discusses the potential environmental impacts of the proposed improvement of the PAR road stretch and identifies mitigation measures to minimize the impacts in the design, construction and operation.

119. **Physical Impacts.** The main physical issues relate to impacts such as earthworks; erosion control; construction of culverts and bridges; obtaining fill and rock based construction materials; noise; dust; spoil disposal; disposal of other waste; and water quality. The works will be mainly carried out within the ROW for the PAR road.

120. **Management Issues.** The main management issues relate to impacts such as waste management and waste disposal, prevention of flooding, repair and re-provisioning drainage, materials supply, planning temporary traffic management measures, controlling noise and dust and managing workers and public safety.

121. **Biological Impacts.** The main biological issues relate to acquisition of narrow strips of roadside verges either side of the alignment, and removal of occasional trees in the works areas. There is no issue of interference with sites protected for their biodiversity as the PAR is very more than 50km from the nearest protected area. There will be no interference with protected forests. The only biological issues relate to possible removal of occasional trees on the slopes to be cut along the PAR.

122. **Social Impacts.** In the short-term the proposed sub-project will potentially have positive impacts on local employment in the Phuentsholing and Pasakha area by creating a demand for unskilled construction workers for the development of infrastructure. This will result in facilitate better health and safety provisions if other management practices are introduced as in the EMP.

123. The potential environmental impacts in the design, construction and operational phases are assessed below. Where impacts are significant enough to exceed accepted environmental standards, mitigations are proposed in order to reduce residual impact to acceptable levels and achieve the expected outcomes of the Project. The environmental assessments are carried out in line with Safeguard policies of ADB and the regulations of RGOB. The EMP is presented in Table 8.as a matrix of mitigation and monitoring measures to prevent or minimize the impacts.

### A. Design / Pre-Construction Phase

124. The proposed Project involves improvement of a single carriageway existing Phuentsholing to Pasakha road and the construction of the Alay LCS and its associated flood protection works. Detailed design for PAR is complete and it has been carried out by the design consultant hired by the DOR. As for the LCS, the detailed design will be prepared by the design consultant that will be procured by PT and a construction contractor will be responsible for its construction.

125. In this study, PAR assessment is based on the detailed design while LCS is based on conceptual design presented in the feasibility study. An environmental impact as result of execution of PAR construction activities is expected to be minimal as it is basically the upgradation and improvement of part of the existing Phuentsholing-Pasakha road. Only about 1.2km from Alay to Pasakha will be upgraded.

126. The LCS development at Alay is proposed to be carried out on 2.4ha of reclaimed land. Currently the area is barren without any vegetation filled with landslide debris adjacent to India-Bhutan boundary, on the western side of the Bawajhora stream. The area is unfit for agriculture and development activities until there is substantial river training and flood protection. As a long term mitigation measures, at the foot of the slopes both at the right and left side of the Bhawanihora slide, 10 meters high gabion retaining walls for about 500 m in length have been proposed combined with series of 8m high gabion check dams at 50 m intervals through the existing flood plain up to the multi-cellular box culvert. This measure will reduce the debris flow velocity and subsequent flood damage of both PAR and the proposed LCS. Climate change adaptation measures particularly for side drains, bridges, and culverts have been applied.

127. Bhawanihora stream and Bhalujhora River catchment protection and management works as well as building of check dams along the river course have been included the detailed design of PAR. Therefore, LCS activities including design will be more or less focus its site and the immediate surroundings. The Catchment management, flood protection and river training works are expected to bring the positive impact on environment as it will stop the further landslide and the flooding of downstream.

128. The EMP is a live document as it has to be updated continuously even during construction and operation of the project. For LCS, EMP will be updated during the detailed design by the design consultant (procured by PT). And since detailed design for PAR is complete, EMP will be updated by the Environmental Specialist (ES) during construction period.

## **1. Environmental capacity development of DOR**

129. DOR has an established Environment Management Unit (EMU) but it is critically understaffed. Currently it has only one environmental officer looking after the entire DOR road projects. Although the officer in charge has required experiences and training is overwhelmed with high amount of workload. DOR will need to recruit additional Environment officers and the capacity building in the form of in-country training or on the job training proposed in the mitigation strategy associated with the EMP. Capacity building measures proposed in the mitigation strategy associated with the EMP is in country or on the job training for project managers, site inspectors, and contractors.

130. Environment Division under PT is involved in management and operation of city's solid waste collection and disposal; sewerage treatment; water treatment and supply; and maintenance of drainage and footpaths. However, it is not involved in monitoring and supervision of any new projects; since it is the responsibility of the Engineering Division. Both the Divisions lack expertise and experiences in carrying out the environmental compliance monitoring of the projects. Under the current SASEC road connectivity project, personnel of Engineering Division who part of the Project Coordination Unit (PCU); will be provided on the job training on environmental monitoring and reporting.

131. Moreover, as part of the overall capacity development, ADB will provide environmental baseline (air and noise) monitoring equipment and the required training on data collection and assessment. During the construction period, equipment will be placed with the respective PCU/CSC; and after the completion of project it will be handed over to the Engineering Division for PT while for DOR it will be handed over to Environment Unit.

## **2. Ambient environmental baseline data**

132. **Air Quality and Noise.** As part of institutionalization and capacity building for environmental compliance monitoring and reporting, ADB will finance the procurement environmental monitoring equipment and provide the necessary training. Baseline data on air quality and noise levels will be collected before commencement of civil works. These data will help in assessing project impacts during implementation.

133. PMU shall arrange for the ES to collect baseline data on total suspended particulates (TSP) and noise levels at one sensitive receiver location along the alignment at least two weeks before commencement of civil works; i.e., the sampling station shall be a residential location. Field measurements for TSP shall be carried out using portable dust meter(s) using 1-hr and 15 minute averaging periods based on the prescribed manufacturers prescribed methodology.

134. Noise impacts may be short lived, although can be very intrusive if not controlled properly. Noise measurement shall be undertaken using hand held noise meter at the same site sampled for TSP and shall follow the methodology specified by the manufacturer. Noise shall be measured in dB(A) over a 24 hours covering the different periods (i.e., 6h to 18h, 18h to 22h and 2h to 6h). Measurement will also be taken to establish if the World Bank criterion of Leq55dB(A)1-hour is exceeded at the measurement points. If it is exceeded by the existing noise a criterion of background +3dB(A) will be applied in the impact monitoring. Works are not expected to be carried out at night but if this is unavoidable for unexpected reasons separate measurements will also be taken before construction commences to establish if the World Bank criterion of Leq45dB(A)1-hour is exceeded and the monitoring assessment criteria will be established accordingly.

135. Information such as recent rainfall will be documented as part of the baseline measurement. The sampling report will also specify if the sampling was undertaken during the rainy or dry season. Time and date of sampling, sources of dust and noise emissions during the sampling period, comparison of results to applicable standards shall also be included in the report. Actual location of the sampling stations shall be described in the report and plotted on a map together with GPS readings. The noise and TSP baseline monitoring will be reported by PMU at the end of the detailed design period, either in the detailed design report or in a dedicated baseline monitoring report before the bidding documents are completed.

136. **Water Quality.** Impact on water quality during construction will be negligible as the Bhawanihora stream and Bhalujhora River are seasonal (flowing only during monsoon). Construction works is scheduled to be carried out only during dry season from October till April. River and stream channelization along with the embankment and flood protection works will be carried out during dry season. Upstream catchment management and slope protection works is expected to reduce the soil erosion and landslide, and subsequently reduce flooding and aquatic life downstream.

### 3. Enhancements

137. Environmental enhancements are recommended in SPS and it is noted that it has been common practice in many places to plant trees along highways to provide visual interest in line with best international practice for highway design. Locations to create some local soft landscaping where successful planting of trees and shrubs could be accomplished and should be investigated at the detailed design stage. This practice should be in addition to tree replacement needed for any of the trees that must be cut at the road side to implement the Project or those trees planted for purposes of bioengineering. Enhancement planting should be encouraged as far as practicable and to foster good will with the local community. Other

opportunities for enhancements can be assessed prior to construction and proposed enhancements should be discussed with the local population to identify stewardship of any planting and also to serve as a vehicle for further public consultation at the implementation stage and to assist in public relations.

## **B. Construction Phase**

138. The source of the construction impacts from the PAR will include (i) excavation and reconstruction of the embankment, slopes and retaining walls, (ii) reconstruction of the carriageway (6.0m wide) plus hard shoulders (1.5m wide); (iii) construction of a new bridge (iv) construction of embankments and viaduct over landslide (v) repair and reconstruction of retaining walls and gabions (vi) construction of engineering controls upstream in the form of staggered masonry walls and gabions to reduce the velocity of river water and debris flow, (vii) ensuring drainage and access near villages and at other key areas is unimpaired by repair and extension of numerous culverts; (viii) reconstruction and repair improvement road side drainage and (ix) installing slope stabilization and bioengineering measures, landscaping road signage and accessories. Construction of engineering controls upstream to reduce the velocity of river water and debris flow is essential for the PAR will also protect the Alay LCS.

139. The works for the Alay LCS will include (i) construction of the retaining walls (ii) excavation of materials for filling and reconstruction of the reclaimed area and retaining walls, (iii) construction of the internal roads and parking areas; (iv) construction of perimeter walls and security fencing (v) ensuring drainage and access near villages and at other key areas is unimpaired by reclamation and construction works; (vi) construction of internal road side drainage (vii) installing landscaping road signage and accessories (viii) construction of the buildings and security apparatus throughout the site. The waste disposal issues for the works should be manageable and the reclamation can utilize any surplus of cut materials from the PAR part of the Project for the reclamation.

140. Separate CSC for PAR and LCS will be hired and they will closely work with the respective PCUs in construction monitoring and supervision of the project. CSC will also include ES who will be responsible for carrying out project environmental compliance monitoring and reporting.

### **1. Orientation of contractor**

141. PIU shall conduct awareness training for the contractors and the site agents and workers on implementation of construction mitigation measures in the Project EMP and any additional mitigation measures that may be required during construction phase.

### **2. Loss of trees and impacts to fauna**

142. Loss of trees and vegetation cover during construction will be limited. PAR is basically an improvement of existing road to Pasakha from Alay. While LCS will be constructed over barren reclaimed land. However, if the tree felling is required, then it will be carried out in accordance with Forest and Nature Conservation Rules. The trees that are required to be felled will be marked; and only marked trees will be felled. Economical valuable timbers will be handed over to the Natural Resources Development Corporation Limited (NRDCL). The remaining trees or logs could be used for construction of log barriers if required. Compensatory plantation with locally available species will be carried out. Plantation with alien invasive species will be totally prohibited. The ratio of tree felled and compensatory plantation required will be decided by ES

during construction depending on the availability of barren government land. The compensatory plant site has to be approved by the local authority and as well as the Department of Forest and Park Services.

143. Impact on fauna will be limited or negligible as the construction zone lies within the human settlement and industrial zone.

### **3. Drainage and hydrology**

144. Two main water bodies – Bhawanijhora stream and Bhalujhora River are the perennial source problem for locality as well as for industrial and commercial activities of the region. The yearly mud and debris slides have damaged agricultural land; washed away paved roads; and damaged bridge. Huge debris flow has even affected neighboring Indian plains. Downstream aquatic ecology has been completely damaged due to massive flooding. Therefore, project under its climate change adaptation measures implementations will carry out upstream catchment and slope management. It will also build check dams along the stream and river beds to reduce velocity of flow and arrest the debris. The trapezoidal side drains with higher discharge capacity will be constructed. Cross drains or culverts are designed based on the discharge of the area. Overall, the construction of drainages; river protection works; upstream slope and catchment through bioengineering and plantation will reduce the damage to both manmade structures and the aquatic life.

### **4. Utilities and re provisioning**

145. PAR construction and improvement works may damage and disrupt the local power and telephone systems. The contractor will ensure the minimal damages the existing system. If the power and telephone lines need relocation, it will be carried out in consultation with Bhutan Power Corporation and Bhutan Telecom. During the relocation the alternative power supply will be provided.

### **5. Materials exploitation and management of quarry and borrow areas**

146. As there are no identified quarries within the project area, construction materials particularly stone will be sourced from the nearby government approved, existing and operational quarries. Sand will be imported from the quarries in the neighboring India state of West Bengal.

147. For LCS land reclamation, borrow area will be needed. Flood debris of Bhawanijhora stream will be extracted and used for land reclamation. Borrowing activities will have positive environmental impact as it will clear the stream course and help channelize the stream through its proper course. Embankment construction and retaining wall construction will reduce impact on surrounding land. However, borrowing activities is likely to generate dust pollution affecting the nearby communities and the vegetation. Dust emission will be minimized by spraying or sprinkling water, at least twice a day by tankers. Minimum of one tanker each for PAR and LCS will be deployed for the water spraying job. Water will be sourced from Pasakha River.

### **6. Spoil Disposal**

148. There will be limited excavation requirement and hence the limited spoil generation. The assessment indicates the possibility of achieving 100% balance cut and fill for the both PAR and LCS. Therefore, identifying separate disposal sites was found unnecessary. The spoil generated

from excavation will be piled and reused in area wherever there is requirement of filling. The temporary spoil mound will be placed in safe area away from the settlement and river courses. If there are any excess spoil, the CSC along with the PIU will consult local authorities and identify the proper disposal site. Disposal area once complete will be re-vegetated using the local or native species.

## **7. General Construction Waste Management**

149. Uncontrolled waste disposal will contaminate soil and water bodies, thereby harming the environment. Mitigation measures will seek to reduce, recycle and reuse waste as far as practicable. The contractors will ensure implementation of following measures.

- i) In principle, the waste generation will be minimized at source.
- ii) Waste products will be segregated, recycled and reused whenever possible.
- iii) Recyclable waste will be sold to the scrap dealers.
- iv) Organic waste such as plant materials will be composted
- v) Residual non-hazardous waste will be disposed off in the municipal landfill.
- vi) Construction/workers' camps will be provided with sufficient refuse bins.
- vii) Burning of construction and domestic wastes will be prohibited.
- viii) Disposal of solid wastes into flood ways, wetland, rivers, other watercourses, farmland, forest and associated places of worship or other culturally sensitive areas or areas where a livelihood is derived canals, agricultural fields and public areas will be prohibited.

## **8. Hazardous materials and hazardous waste disposal**

150. Use of hazardous substances such as oils and lubricants can cause significant impacts if uncontrolled or if waste is not disposed correctly. Oils and lubricants discharged to woodland can kill the roots and destroy the trees. Mitigation measures will seek to control access to and the use of hazardous substances such as oils and lubricants and control waste disposal. Contractor will carry out following measures to minimize the impacts:

- i) Oil and lubricants will be safely stored. Secondary containment around fuel storage area will be ensured.
- ii) Hydrocarbon, toxic material and explosives (if required) will be stored in adequately protected sites as per the Explosive and Hazardous Rules of RGOB to prevent soil and water contamination.
- iii) Equipment/vehicle maintenance and refueling areas will be confined to areas in construction sites designed to contain spilled lubricants and fuels. Such areas will be provided with drainage leading to an oil-water separator that will be regularly skimmed of oil and maintained to ensure efficiency.
- iv) Fuel and other hazardous substances will be stored in areas provided with roof, impervious flooring and bund/containment wall to protect these from the elements and to readily contain spilled fuel/lubricant.
- v) Hazardous wastes (oil, used batteries, fuel drums) will be segregated, labeled and safely stored. The spent oil and batteries will be sold to recycling dealers.
- vi) Hazardous materials will be stored away from water bodies and above flood level.
- vii) Cleanup operation using readily available absorbent such as sawdust will be carried out immediately during accidental spillage of hazardous waste

- viii) All areas intended for storage of hazardous materials will be quarantined and provided with adequate facilities to combat emergency situations complying with all the applicable statutory stipulation.

## **9. Asphalt, hot mix plant, rock crushing and bitumen supply**

151. The rock crushing activities will generate noise and dust and pavement works will generate gas and odour from the asphalt hot-mix plant and noise from the compaction of the pavement. Improvement the Project road will require significant amounts of rock based material and many tons of asphalt. Although the emissions from powered mechanical equipment that supply crushed rock and bitumen will be rapidly dispersed in the open terrain they will need to be sited carefully to avoid complaints. The works for the pavement in any section of the road are estimated by the TA Team to take only 3 to 4 weeks depending on the terrain and therefore emissions from mobile powered mechanical equipment for road surfacing will be short lived.

152. In order to maintain the existing air quality of the Project area in a condition acceptable to the local population compliance with the following mitigation measures will be implemented:

- (i) Cement batching and aggregate mixing plant will be located as far as possible (preferably at least 500m) from settlements and habitation or as required by environmental regulations.
- (ii) Construction zone through sensitive areas such as residential and school campus will be watered at least twice a day using tanker. Water will be sourced from Pasakha River.
- (iii) Where local roads are used for haulage they shall be kept in serviceable condition and any damage shall be repaired promptly without interference to local travel routes.
- (iv) Storage sites, mixing plants, and bitumen (hot mix) plants will be placed at least 500m of the nearest human settlements.
- (v) All hot-mix plants, crushers, and batching plants will be located in agreement with the local authority as well as the communities.

153. Due to the locations of the works fumes from bitumen and chemicals are likely to be well dissipated in the open terrain. However phenol compounds in the bitumen have a very low odor threshold and extremely low concentrations can cause nuisances. These are unlikely to accumulate to toxic levels but the plant for the supply of molten bitumen should be sighted as far away from sensitive receivers as is practicable. Asphalt plant and rock crusher activities (if required) will be controlled and hot-mix plants should not be located within 500m of any sensitive receiver, river bank or irrigation channel but located at convenient sites nearby but at least 500m (in the prevailing downwind direction) from sensitive receptors such as residences, schools, hospitals.

154. Bituminous materials will generally be applied using machines but if bituminous compounds are to be applied by hand labor methods and melted in heaters the fuel used shall be kerosene or diesel. Fuel wood will not be used for heating bitumen; neither will bitumen be used as fuel.

155. Bitumen drums will be stored in a dedicated area, not scattered along the works and any small accidental spills of bitumen or chemicals will be cleaned up immediately.



156. It is possible that contamination of soil may occur from oils and chemicals at bitumen plant sites, workshop areas, equipment washing-yards and along the roads works. As a matter of good environmental practice these materials should be cleaned up as soon as practicable.

157. The following practices will be adopted to minimize the risk of soil contamination:

- i) The contractors will prevent soil contamination and will be required to instruct and train their workforce in the storage and handling of materials and chemicals that can potentially cause soil contamination.
- ii) Debris generated by the dismantling of existing pavement will be recycled subject to the suitability of the material.
- iii) Bitumen will not be allowed to enter either running or dry streambeds and nor will be disposed of in drains or ditches or small unlined waste disposal sites prepared by the contractor.
- iv) Bitumen storage and mixing areas will be protected against spills and all accidentally contaminated soil must be properly handled according to applicable national and local laws and regulations. As a minimum, these areas must be segregated, such that any spills can be immediately contained and cleaned up.
- v) Any petroleum products used in the preparation of the bitumen mixture must also be carefully managed to avoid spills and contamination of the local water table and streams. Bitumen and other hydrocarbon residues will be disposed of as hazardous waste.
- vi) All accidental spills of bitumen or chemicals will be cleaned up immediately with the top 2cm of any contaminated soil underneath and disposed of as chemical waste to a site approved by the local authority.
- vii) Solid waste generated during construction and at campsites will be properly treated and safely disposed of only in demarcated off-site waste disposal sites identified and agreed with and the local community and local authorities.

## **10. Dust and Noise**

158. Earthworks and rock crushing activities will be the main sources of dust. The works in any given section of the road will generally be of short duration and in most locations there will be sufficient buffer distance between the work corridor and the existing SRs (30m to 50m) such that no significant impact is expected from the construction works on residential sensitive receivers in terms of noise, vibration, and dust.

159. Whereas noise and dust were recognized as nuisances by the local population they were also considered acceptable nuisances in view of the likely short duration of the works and that there were good benefits from future improved road conditions. Nevertheless it is good practice to control all dusty materials at source so that nuisances do not occur and visibility on the adjacent road is not impaired and so that road safety can be maintained or improved. Water is available in the study area from the Pasakha River and based on observations of the river flow in the dry season (December) sufficient surplus water should be available from the nearby river to be sprayed suppress dust at all locations in the dry season. The mitigation measure will include:

- i) Water sprinkling or spraying using tanker will be done twice a day to reduce dust generation.
- ii) No work will be carried out within 500m of any settlement during the night (2100 hrs to 0700 hrs).

- iii) If works have given rise to complaints over dust, the contractor shall investigate the cause, report it in the monthly progress reports and review and propose alternative mitigation measures before works recommence.
- iv) Fuel-efficient and well-maintained haulage trucks will be employed to minimize exhaust emissions. Regular maintenance will be carried out.
- v) Vehicles transporting soil, sand and other construction materials will be covered with tarpaulin sheets to reduce the release of dust and avoid impacts from dust. Speed limits of such vehicles within the works site and on unpaved edge areas of the Project road will be established and agreed with the PMU.

160. The need for large stockpiles should be minimized by careful planning of the supply of materials from controlled sources. Stockpiles should not be located within 100m of residences. If large stockpiles (more than 25 m<sup>3</sup>) of crushed materials are necessary they should be enclosed with side barriers and also covered when not in use.

## **11. Blasting and vibration**

161. Till date, blasting requirement for both PAR and LCS has been not anticipated. In the event, the blasting is required only controlled blasting will be allowed carried out by certified blaster; as per the Blasting and Explosives of RGOB. Prior notice shall be given to all local residents within 1 km of the blasting site and the local authorities. One month prior to the blasting in any area, the contractors will undertake a condition survey including photographs of all residences within 100 m of the blast sites. The condition of the residences will be agreed with the project in case there are any future claims for damage to residences due to the blasting. All blasting shall be carried out in the daytime and at regular intervals after siren warnings. All residents within 500m of the blast sites shall be kept informed of the plans and progress of blasting and residents shall be temporarily evacuated and provided with alternative accommodation if required.

## **12. Erosion control and runoff**

162. In order to avoid erosion and runoff the all excavation and earth works will be will be carried out dry season (November to April). Civil and bioengineering works will be applied to control the erosion. Following mitigation measures for slope stabilization will be carried out:

- (i) Stockpile topsoil for use in immediate replanting and bioengineering after completion of engineering work.
- (ii) Minimize damage and cutting of surrounding vegetation during slope formation.
- (iii) Protect the cut slope with planted vegetation, bioengineering or conventional civil engineering structures as soon as practicable after cutting.
- (iv) Prevent erosion and protect the cut slope with temporary or permanent drainage as soon as practicable after cutting

163. In order to preserve the constructed slopes and other works and embankments from soil erosion and runoff.

- i) Low embankments will be protected from erosion by seeding and planting indigenous grasses that can flourish under local conditions.
- ii) High embankments, i.e. 2m high and above, will be considered for protection by constructing stone pitching or a riprap across the embankment immediately after

- the works are completed. This practice will also be applied along cross-drainage structures where embankments are more susceptible to erosion by water runoff.
- iii) The contractors will also be required to include appropriate measures for slope protection, i.e. vegetation cover and stone pitching, as required in the detailed construction drawings and implement them accordingly.

### **13. River protection and culvert repair**

164. The Project proposes to replace or repair culverts and construct new ones. Careless construction and poor materials control can cause blockage to rivers and streams. Therefore in areas along and near rivers and streams the following will be carried out:

- i) Work will be programmed for the dry season.
- ii) Earth and stones will be properly disposed of so that they do not block rivers and streams, resulting in adverse impact on water quality and flow regime.
- iii) In culvert repair and demolition sites, the culvert structure will not be dropped into the river but alternative means will be used to avoid "dropping the culvert" into rivers/streams. This will be done by "sawing" appropriate sections of the culvert and using cranes to lift these sections away or alternatively by construction of a platform onto which the culvert could be lowered.
- iv) Cofferdams, silt fences, sediment barriers or other devices will be used as appropriate based on the design to prevent migration of silt during excavation and boring operations within streams. If cofferdams are used, these will be dewatered and cleaned to prevent siltation by pumping from cofferdams to a settling basin or a containment unit.
- v) Other erosion control measures above and covering open surfaces with grasses and creepers to reduce runoff will be implemented as early as possible in construction

### **14. Water Quality**

165. In order to prevent water contamination the following precautionary measures will be undertaken by the contractors

- i) Lubricants will be stored in containers /dedicated enclosures with a sealed floor >50m from water bodies.
- ii) Solid waste from construction activities will not be thrown in rivers and.
- iii) Construction storage/stockpiles will be provided with bunds to prevent silted run-off.
- iv) Stockpiled materials will be covered to reduce run-off.
- v) Work in rivers will be scheduled during dry season and work duration shall be as short as possible.
- vi) Bare slopes will be stabilized immediately after works are completed.
- vii) Stockpile areas and storage areas for hazardous substances will be located away from water bodies.
- viii) Washing of machinery and vehicles in surface waters will be prohibited.

### **15. Water Resources and Water Quality**

166. Construction water supply will be arranged by the contractor with approval from Project Management and local authority. Bhawanihora stream and Bhalujhora River is dry for eight

months of the year. Water can be sourced from the Pasakha River using tanker. Local drinking water supply will not be tapped for construction purpose to avoid water shortages for the local communities. However, drinking water for labourers could be supplied through local sources if it does not cause shortage for the community. However, it has to be approved by local authority and PIU.

## **16. Construction camps and canteen facilities**

167. Placement of construction camps too close to local community will result in unwanted interference in the community way of living. The competition for use of local resources (such as food supply, water supply and fuel wood) will increase; disadvantaging the local community. Therefore, construction camps will be placed at least 500m away from the local settlements and other sensitive areas; in an area approved by the PIU and local authority. Adequate drinking water supply, basic food items, and cooking fuel (such as kerosene) will be provided to ward off competition on local resources. For maintenance of proper health and hygiene; pit latrine and garbage cans will be provided. Fishing, hunting and illegal tree felling will be totally prohibited. After completion of constructions, the abandoned campsite will be cleaned and restored to the state. If a campsite is a government barren land then contractor will carry out compensatory plantation suitable local or native plant species.

## **17. Sanitation and Disease Vectors**

168. Import of labourers will likely result in spread of communicable diseases such as HIV/AIDS, STDs, malaria and Tuberculosis (TB). Unhygienic living condition without proper sanitation facilities will increase potential harmful waterborne diseases. In order to prevent health related impacts the contractor will implement following measures:

- i) Measures to prevent proliferation of mosquitos will be implemented (e.g., provision of insecticide treated mosquito nets to workers, installation of proper drainage to avoid formation of stagnant water, etc.).
- ii) Standing water will not be allowed to accumulate in the temporary drainage facilities or along the roadside, to prevent proliferation of mosquitoes.
- iii) Temporary and permanent drainage facilities will be designed to facilitate the rapid removal of surface water from all areas and prevent the accumulation of surface water ponds.
- iv) HIV-AIDS awareness or education will be implemented in line with social programmes and plans for the Project and HIV/AIDS awareness and prevention program shall be implemented in line with plans from the social work stream.
- v) Sanitation facilities such as construction of pit latrine and solid waste collection disposal will be implemented.
- vi) Health checkup or screening of the imported labourers will be carried out as per the existing practices to stop spread of TB.

## **18. Safety Precautions for Workers**

169. Worker occupational health and safety is generally governed Labour and Employment Act of Bhutan 2007. Construction works will generally result in accidents and injuries or even demise of the workers if no health and safety measures are followed. General Rules and Regulations on Occupational Health and Safety (OHS) in Construction, Manufacturing, Mining and Service Industries 2006 will be applied for occupation safety.

170. Mitigation measures to be implemented by contractors to ensure health and safety of workers are as follows:

- (i) The contractor will conduct of training (assisted by PIU) for all workers on safety and environmental hygiene at no cost to the employees. The contractor will instruct workers in health and safety matters as required by law and by good engineering practice and provide first aid facilities.
- (ii) The contractors will instruct and induct all workers in health and safety matters (induction course) including construction camp rules and site agents/foremen will follow up with toolbox talks on a weekly basis. Workforce training for all workers starting on site will include safety and environmental hygiene.
- (iii) Fencing on all areas of excavation greater than 1m deep and sides of temporary works shall be observed.
- (iv) Workers shall be provided with appropriate personnel safety equipment such as safety boots, helmets, gloves, protective clothes, dust mask, goggles, and ear protection at no cost to the workers.
- (v) Reversing signals (visual and audible) shall be installed on all construction vehicles and plant.
- (vi) Contractor will at all-time keep the first aid kit at the construction sites.
- (vii) Contractor will be responsible for evacuation injured person to the nearest medical center and bear all the medical expenses

## **19. Public Safety**

171. Public safety, particularly of pedestrians and children can be threatened by the excavation of the trenches for side drain construction. Construction sites near to settlement will be guarded on all sides by security personnel. Construction activities will be timed and provision for safe passage of school children and elderlies will be provided. The window period for local traffic and pedestrian will based on agreement between the local community and local authority. Excavated trenches/ditches and freshly cut steep side slopes will be clearly marked and fenced for the safety of passersby and workers alike. Project or construction vehicles will be briefed on speed limit within sensitive areas such as schools, commercial and residential areas. In event of accidents, the contractor will be responsible for immediate evacuation of injured person to the nearest medical center. The contractor shall bear medical and other expenses of the injured person.

## **20. Traffic Management**

172. Construction activities are likely to cause hindrance in local traffic flow if not properly planned and executed. Contractor in consultation with PIU; local authorities (such as traffic police, Road Safety & Transport Authority and Thromde); and local communities will come up with traffic management during construction. Work hours and traffic windows will be decided and implemented accordingly. Traffic flow during the rush hours (school and office opening and closing time) will be kept open. Assistance of traffic police will be sought during Pedestrian movement will be allowed uninterrupted; however under the proper guidance by the security personnel.

## **21. Archaeological and cultural artifacts.**

173. No archeological and cultural artifacts are found within the Project area. However, if they are sited during the construction, the work will be immediately halted and the contractor will

notify the PIU. The PIU in turn will inform the relevant authority and take necessary step to conserve the remains.

## **22. Compensatory Plantation**

174. Project or PIU in consultation with local government; Divisional Forest Office (DFO) and community will locate the government or even community barren for compensatory plantation. Compensatory plant using local or native tree species will be carried out to replace the trees felled during the construction. Ratio for compensation will be 1:1 if the area of plantation is small. However, the project can go up to 1:4 if the larger areas available.

### **A. Operational Phase**

175. During the operational phase of the Project, DOR will maintain the PAR and Department of Revenue and Customs (DRC) will maintain Alay LCS.

176. The improvement of the hard shoulders on road the Project roads and the improvement of the asphalt surfaced roads can be expected to reduce road traffic noise and air pollution from dust. The improvement of the Project roads road will be within the existing corridor keeping vehicles away from sensitive receivers and at this stage it is difficult to see that any residences or commercial premises or schools will still be close enough to the Project road to be affected by noise and dust so as to exceed the assessment criteria.

## **1. Illegal Trade of Endangered Species**

177. The improvement of access across the Bhutan-India border may escalate the illegal trade of wildlife between the two countries. The first regional workshop on South Asia Wildlife Trade Initiative (2008) generally described the wildlife poaching in Bhutan. From 1999-2005 on the average there were 25 incidence of illegal poaching and 80 incidences of illegal fishing. Reward for apprehensions on average amounted to NU400,000/year and confiscated specimens included bear, musk deer, leopard, and tiger. The CITES Wildlife Trade Monitoring Network (2008), the India-Bhutan border is an active route for big cat trade involving *Panthera tigris*, *P. Pardus*, and *Uncia uncia*, and red sandalwood *Pterocarpus santalinus*.

178. To mitigate this risk, the capacity building for the Alay Land Custom Station to improve identification skills on species, trophies, and parts to customs officials and police force. The project, through its CSC wildlife specialist, will coordinate with entities involve in the controlling the illegal trade of wildlife and poaching like the CITES- South Asia Wildlife Enforcement Network and the RGoB Ministry of Agriculture, Nature and Conservation Division. The coordination will have an end view of harmonizing monitoring and inspection protocols and sharing of intelligence information for interdiction of wildlife trade across the Bhutan.

## **2. Noise**

179. There is no criterion of for road traffic noise in Bhutan but guidelines on ambient noise have been introduced. The Bhutan ambient noise standard is Leq55dB(A) for sensitive area (same as World Bank<sup>3</sup>). Spot measurements of existing measured noise levels along the road are both above and below the Leq55dB(A) criterion. Therefore the criterion of background +3dB(A) should be applied. The main noise source in most areas is traffic noise and in order for the existing background to be exceeded by +3dB(A) the existing traffic would have to be more than doubled. Traffic forecasts indicate that traffic is expected to double in the coming years but the SRs are set back from the road which will provide noise attenuation. No operational mitigation measures are required.

## **3. Gaseous Emissions**

180. Vehicle emissions (gaseous) as indicated concentration of oxides of nitrogen will be the main air pollution sources during operation. There will be few other sources of emissions near the Project road other than from domestic fuel burning. Sensitive receivers are set far enough back from the Project roads road to allow adequate dispersion that there will be no significant impacts at the sensitive receivers.

## **4. Particulate Emissions**

181. Vehicle emissions (particulate contamination) such as dust and fumes will also be air pollution sources during operation however toxic residues from vehicle emissions near the Project roads road are unlikely to accumulate or create significant impacts under the local conditions. Dust from the existing road will be reduced due to the better asphalt surface for the new road. Therefore the Project is believed to be sustainable in terms of gaseous and particulate emissions and no operational mitigation measures are required.

## **5. Soil Erosion**

182. Soil erosion will be prevented by developing a comprehensive suite of engineering controls in the detailed designs to prevent and maintain erosion. A system will be devised and engineered to control erosion and flooding on either side of the embankments in case of heavy rains. Apart from affecting the community lands and resources, this would otherwise cause natural streams and irrigation channels to become silted.

183. Measures will also be taken during the operational phase to ensure that the frequency of maintenance is increased and that storm drains and highway drainage systems are periodically cleared to maintain clear drainage to allow rapid dispersal of storm water flow. An adequate system of monitoring, reporting and maintenance will be developed.

## **6. Driving Conditions and Community Safety**

184. The rehabilitation and widening of the Project road is likely to increase the vehicle speed on the road. Increases in traffic flow indicate additional future traffic should be moderate and unlikely to create many community safety issues. Overall the condition of the road facilities will be enhanced and driving conditions should improve. Routine safety measures, signage and road markings should be introduced to reduce driving risk further in accident prone areas and provide enhancements to driving conditions.

## **7. Compensatory Tree planting**

185. Environmental enhancements introduced in the detailed designs may include tree planting, as necessary. The planted specimens should be maintained and monitored for three years after planting to ensure their survival in line with the Tree-cutting and Replanting Plan.

## **8. Water Resources**

186. Complaints about the contractors' works will be resolved in the construction phase. The scale of the works indicates that there are unlikely to be any impacts that continue into the operational phase.

### **B. Cumulative Environmental Impact Associated with the Project Locations**

187. There should be no significant adverse cumulative impacts expected from the PAR and other local projects. Overall the improvement in the road system around Phuentsholing will potentially lead to growing traffic, commercial activities, that may indirectly lead to additional pollution. It is not possible to quantify these impacts at this stage. The forestry authorities have indicated some concern that although there are some current problems with the collection of wood for fuel in some areas the protected areas are not subject to excessive pressure due to illegal logging. There is no suggestion that the improved road could bring induced or indirect future impacts that result in additional pressure on forest resources due to illegal logging. There is no perceived additional pressure on forest resources that may be brought about by the Project road improvements, be they direct, induced, indirect or future impacts. The statutory provisions under the laws of Bhutan cover pollution control. These laws are established but institutional strengthening is required and improvements in resources are needed to achieve better enforcement to support strategic management of pollution control and resource exploitation in the long term.

188. The Project road is a part of an already well developed network and although the Project will increase traffic gradually there will be other benefits in improved traveling conditions and vehicle cost savings that will offset the traffic impacts.



## **VI. INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION**

189. The objectives of the stakeholder consultation process was to disseminate information on the Project and its expected impact, long-term as well as short-term, among primary and secondary stakeholders and to gather information on relevant issues so that the feedback received could be used to address these issues at early stages of Project design. Another important objective was to determine the extent of the concerns amongst the community, to address these in the Project implementation and to suggest appropriate mitigation measures. The feedback received has been used to address these issues at early stages of Project design.

### **A. Identification of Stakeholders**

190. The stakeholders consulted for the Project included local affected persons residing near there project and other groups with an interest in the Project corridor where the improvements will be implemented. RGOB departments were also consulted. Individuals representing many persons from numerous family groups in the area along the alignment were informed about the Project and invited to comment on their environmental concerns. These stakeholders were considered to be representative of the community living in the area, the road users, the business associated with the road and the locally elected representatives. Subsequently further public consultations have taken place including meetings and discussions with authorities.

191. The stakeholders included local affected persons near the Project road that individuals consulted included persons representing 6 family groups in 6 settlements. These were considered to be representative of most of the community living in the area. Consultations took place on 30<sup>th</sup> November 2012. Dates and locations are presented in **Appendix B**.

### **B. Consultation with Stakeholders**

192. The results of the public consultations are recorded in Appendix B. The communities along the Project road indicated they would fully support the rehabilitation and improvement project. The main environmental concerns included preserving access, flooding and erosion control. Prompt completion of the works and minimization of land acquisition were also requested by some local stakeholders. Increased traffic noise and controlling project workers and sanitation during construction were not major concerns but this is not surprising as this Project will be the first major project in the area for many years. Compensation for land acquisition was raised by soma as a social issue. No significant operational phase impacts were identified. The affected persons also fully expect that the necessary arrangements to compensate any loss of property are addressed before construction commences. Further information is provided in **Appendix B**.

### **C. Concerns Addressed**

193. Concerns with respect to road alignment and drainage design and the disturbance or destruction of crops and gardens, private property and community disturbance have been brought to the attention of the Project proponent and the relevant parties are well aware of the potential for local disturbance that can result from poorly controlled contractors. The main issues raised are addressed in the environmental management plan, as far as is reasonably practicable at this stage; a resettlement plan has been prepared to compensate for affected persons that can reasonably be predicted at this stage. Unforeseen impacts will also be captured by the requirements to update the environmental management plan and inform ADB in response to any unpredicted impacts that arise periodically as necessary.

**D. Information Disclosure and Participation**

194. PT and DOR will disclose the IEE report to the public through their website to provide public an opportunity to review the project design and engaged in further consultation if necessary. Similarly, ADB will disclose the final IEE on its Website for public dissemination.

## VII. GRIEVANCE REDRESS MECHANISM

195. As both components of the project are closely interlinked a unified Project grievance redress mechanism (GRM) will be established to receive, evaluate and facilitate the resolution of affected people's concerns, complaints and grievances about the social and environmental performance at the level of the Project. The GRM will aim to provide a time-bound and transparent mechanism to voice and resolve social and environmental concerns linked to the project coming from both sides of the border

196. The DOR/PT shall make the public aware of the GRM through public awareness campaigns. The contact phone number of the respective DOR/PT representative (PCU) will serve as a hotline for complaints. Information on the project shall be made available at the PT/DOR office and a brochure/leaflet will be made available to include information on the GRM and it shall be disseminated to the local government offices, temples, schools and residential associations in Phuentsholing by the environmental safeguards officers in the PT and DOR. Grievances can be filed in writing or by phone to any member of the DOR/PT as well as the environmental safeguards officer.

197. **First tier of GRM.** The DOR/PT project management is the first tier of GRM which offers the fastest and most accessible mechanism for resolution of grievances. The Project Managers (PM) of PIUs in PT/DOR shall be designated as the key officer for grievance redress. Resolution of complaints will be done within seven working (7) days. Investigation of grievances will involve site visits and consultations with relevant parties (e.g., affected persons, contractors, police, etc.) Grievances will be documented and personal details (name, address, date of complaint, etc.) will be included unless anonymity is requested.

198. A tracking number shall be assigned for each grievance, including the following elements; (i) initial grievance sheet (including the description of the grievance), with an acknowledgement of receipt handed back to the complainant when the complaint is registered; (ii) grievance monitoring sheet, mentioning actions taken (investigation, corrective measures); (iii) closure sheet, one copy of which will be handed to the complainant after he/she has agreed to the resolution and signed-off.

199. The updated register of grievances and complaints will be available to the public at the PT head office and the PIU office near the Project. Should the grievance remain unresolved it will be escalated to the second tier.

200. **Second Tier of GRM.** The PM of respective PIUs will activate the second tier of GRM by referring the unresolved issue (with written documentation) to the head of the Project Coordination Unit (PCU) in DOR/PT who will pass unresolved complaints upward to the Grievance Redress Committee (GRC). The GRC shall be established by DOR/PT before commencement of site works. The GRC will consist of the following persons: (i) Director of DOR; (ii) Executive Secretary of PT; (iii) Environmental Officer of DOR/PT (iv) representative of the affected person(s); and (v) representative of the National Environment Commission (NEC, Chhukha Dzongkhag environmental officer or DEO) for environmental related grievances. A hearing will be called with the GRC, if necessary, where the affected person can present his/her concern/issues. The process will facilitate resolution through mediation. The local GRC will meet as necessary when there are grievances to be addressed. The local GRC will suggest corrective measures at the field level and assign clear responsibilities for implementing its decision within fifteen (15) working days. The contractor will have observer status on the

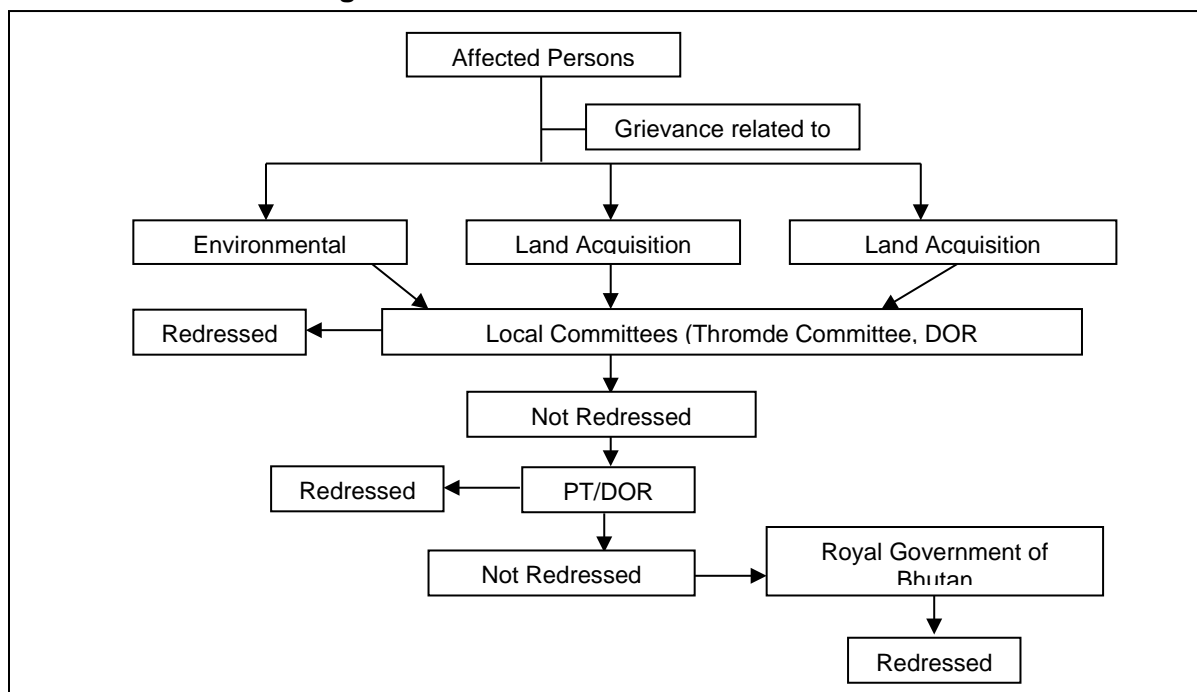
committee. If unsatisfied with the decision, the existence of the GRC shall not impede the complainant's access to the Government's judicial or administrative remedies

201. The functions of the local GRC are as follows: (i) resolve problems and provide support to affected persons arising from various environmental issues and including dust, noise, utilities, power and water supply, waste disposal, traffic interference and public safety as well as social issues land acquisition (temporary or permanent); asset acquisition; and eligibility for entitlements, compensation and assistance; (ii) reconfirm grievances of displaced persons, categorize and prioritize them and aim to provide solutions within a month; and (iii) report to the aggrieved parties about developments regarding their grievances and decisions of the GRC.

202. The Environment officer in DOR/PT will be responsible for processing and placing all papers before the GRC, maintaining database of complaints, recording decisions, issuing minutes of the meetings and monitoring to see that formal orders are issued and the decisions carried out.

203. **Third tier of GRM.** In the event that a grievance cannot be resolved directly by the PIU/PMU (first tier) or GRC (DOR/PT second tier) the affected person can seek alternative redress through an appropriate court. The DOR/PT or GRC will be kept informed by the district, municipal or national authority. The grievance redress mechanism and procedure is depicted in Figure 7 for PAR and Alay LCS below. The monitoring reports of the EMP implementation shall include the following aspects pertaining to progress on grievances: (i) Number of cases registered with the GRC, level of jurisdiction (first, second and third tiers), number of hearings held, decisions made, and the status of pending cases; and (ii) lists of cases in process and already decided upon may be prepared with details such as Name, ID with unique serial number, date of notice, date of application, date of hearing, decisions, remarks, actions taken to resolve issues and status of grievance.

**Figure 7: Grievance Redress Mechanism**



## VIII. ENVIRONMENTAL MANAGEMENT PLAN

### A. Implementation Arrangements

204. The environmental regulations of RGOB are derived from the Environmental Assessment Act (2000) and subsequent rules and regulations. The environmental assessment rules are set out in the Regulation for Environmental Clearance of Projects (2002). For this project the requirement for statutory environmental assessment will be determined by NEC in due course (see Chapter III).

205. Detailed design for PAR has been completed; bidding documents are prepared; and procurement works are being initiated. DOR is in the process of recruiting construction supervision consultant (CSC). As for the LCS, the detailed design will be prepared by the design consultant that will be procured by PT and a contractor will be hired for constructing it. For both components, ADB will assist in capacity building in environmental monitoring and reporting.

206. In order to carryout PAR development, DOR will need to seek Environment Clearance (EC) from the NEC. While for LCS development EC can be issued by MOWHS. For both PAR and LCS; proponents will have to seek related no objection certificates (NOC) from affected persons/community; BPCL; BTL; and Phuentsholing Thromde.

207. The table below defines the responsibilities for EMP implementation.

**Table 8: Responsibilities for EMP Implementation**

Agency	Responsibilities
Project Coordination Units (PCUs) of Department of Road (DOR) and Phuentsholing Thromde (PT)	<ul style="list-style-type: none"> <li>• Executing agency with overall responsibility for project construction and operation</li> <li>• Ensure that sufficient funds are available to properly implement the EMP</li> <li>• Ensure that Project, regardless of financing source, complies with the provisions of the EMP and <i>ADB Safeguard Policy Statement 2009 (SPS)</i></li> <li>• Provide sufficient funding and human resources for proper and timely implementation of required mitigation measures in the EMP.</li> <li>• Project Managers of respective PIUs for DOR and PT will be environmental focal persons of DOR.</li> <li>• Ensure that Construction Supervision Consultant (CSS) is recruited.</li> <li>• Environmental Specialist (ES) part of CSC to ensure proper implementation of EMP provisions. Through these specialists, the DOR AND PT shall: (i) ensure proper and timely implementation of DOR's &amp; PT tasks specified in the EMP, (ii) conduct environmental training as specified in the IEE/EMP for DOR AND PT officers, (iii) conduct contractors workers' orientation on EMP provisions, (iv) undertake regular monitoring of the contractor's environmental performance, as scheduled in the EMP (v) conduct field measurements for dust and noise as if complaints arise, and (v) prepare environmental baseline report and semi-annual environmental monitoring reports, as specified in the EMP, for DOR AND PT submission to ADB</li> <li>• Ensure that Project implementation complies with RGOB/ADB environmental policies and regulations</li> <li>• For project duration ensure that the DOR AND PT retain an ES to oversee EMP implementation.</li> <li>• Ensure that environmental protection and mitigation measures in the EMP are incorporated in the detailed designs</li> <li>• Establish and implement an environmental grievance redress mechanism,</li> </ul>

Agency	Responsibilities
	<p>as described in the IEE, to receive and facilitate resolution of affected peoples' concerns, complaints, and grievances about the Project's environmental performance</p> <ul style="list-style-type: none"> <li>• In case of change in project components that will result in adverse environmental impacts that are not within the scope of the IEE prepared during loan processing, etc.). Obtain environmental approvals and certification under RECOP from NEC prior to award of civil works contracts.</li> <li>• Confirm that bidding and contract documents include the EMP. Submit semi-annual monitoring reports on EMP implementation to ADB and identify environmental corrective actions and prepare a corrective action plan, as necessary, for submission to ADB.</li> </ul>
<p>Project Management Unit (PMU) of DOR</p> <p>Project Implementation Unit (PIU) of PT</p>	<ul style="list-style-type: none"> <li>• Liaise with the Environmental Officer in DOR AND PT to ensure that Project implementation complies with ADB's Safeguards Policy Statement (SPS 2009) principles and requirements;</li> <li>• Ensure that bidding and contract documents include the EMP;</li> <li>• Ensure that the Contractor provide sufficient funding and human resources for proper and timely implementation of required mitigation measures in the EMP and the contractor(s) identify these sums separately in the bidding documents;</li> <li>• Submit quarterly reports on EMP implementation to DOR and PT;</li> <li>• Ensure that EMP provisions are strictly implemented during various project phases (design/pre-construction, construction and operation) to mitigate environmental impacts to acceptable levels;</li> <li>• Check that environmental protection and mitigation measures in the EMP are incorporated in the detailed designs;</li> <li>• Check that necessary environmental clearances and approval(s) from NEC prior to award of civil works contracts;</li> <li>• In case of change in project components that will result in adverse environmental impacts that are not within the scope of the IEE prepared during loan processing, etc.) Assist DOR/PT in obtaining environmental approvals and certification under RECOP from NEC prior to award of civil works contracts;</li> <li>• Participate in an environmental grievance redress mechanism, as described in the IEE, to receive and facilitate resolution of affected peoples' concerns, complaints, and grievances about the Project's environmental performance;</li> <li>• Ensure monitoring of the implementation of the EMP (mitigation and monitoring measures);</li> <li>• Prior to bidding ensure that the contractors agree to implement environmental and safety requirements as required in draft contracts to ensure compliance with environmental statutory and contractual obligations and proper implementation of the EMP;</li> <li>• Conduct environmental management awareness training sessions for Contractor as described in the IEE and EMP.</li> </ul>
<p>Construction Supervision Consultant (CSC) of DOR and PT</p>	<ul style="list-style-type: none"> <li>• Attend environmental management and capacity building training sessions on the IEE and EMP;</li> <li>• Ensure implementation of mitigation and monitoring measures for various project phases in the EMP by contractors;</li> <li>• Undertake day to day environmental management and make observations and keep written record of environmental management activities for DOR AND PT as described in the IEE and EMP.</li> <li>• Participate in an environmental grievance redress mechanism, as described in the IEE, to receive and facilitate resolution of affected peoples' concerns, complaints, and grievances about the Project's environmental performance.</li> </ul>

Agency	Responsibilities
Contractor	<ul style="list-style-type: none"> <li>• Prior to start of bidding agree in writing to implement (if selected) environmental and safety requirements to ensure compliance with environmental statutory and contractual obligations and proper implementation of the EMP.</li> <li>• Provide sufficient funding and human resources for proper and timely implementation of required mitigation measures in the EMP and identify these sums separately in the bidding documents.</li> <li>• Implement environmental and safety requirements to ensure compliance with environmental statutory and contractual obligations and proper implementation of the EMP</li> <li>• Attend environmental management awareness training sessions for Contractor as described in the IEE and EMP.</li> <li>• Implement additional environmental mitigation measures for unexpected impacts, as necessary</li> <li>• Participate in an environmental grievance redress mechanism, as described in the IEE, to receive and facilitate resolution of affected peoples' concerns, complaints, and grievances about the Project's environmental performance.</li> </ul>
DOR authority (operator of PAR)  Department of Revenues and Customs (operator of Alay LCS)	<ul style="list-style-type: none"> <li>• Responsible for operation and maintenance of Project.</li> <li>• Implement EMP monitoring during operations.</li> </ul>
National Environment Commission	<ul style="list-style-type: none"> <li>• Review and approve environmental assessment reports required by the Government.</li> <li>• undertake monitoring of the project's environmental performance based on their mandate</li> </ul>
ADB	<ul style="list-style-type: none"> <li>• Review and approve environmental assessment reports required by ADB.</li> <li>• Undertake monitoring of the project's environmental performance based on above requirements and SPS.</li> </ul>

208. To facilitate effective EMP implementation during construction, the contractors will be oriented on the environmental terms and conditions of the project. The contractor's compliance with the environmental conditions is directly linked with the work progress payments. Clearances for payments will include certification from the Project Manager as to the effective implementation of the EMP and all other mitigation measures specified in the EMP. The completion of implementation of mitigation measures will therefore be linked to payment milestones.

## B. Environmental Mitigation

209. The anticipated environmental impacts and mitigation measures discussed in the previous section are presented in Table 9. The table also shows responsibilities and timeframe/schedule for implementation of mitigation measures and monitoring.

210. Table 9 shows that most mitigation activities during pre-construction are to be implemented by the PCU/PIU/PMU (assisted by CSC). During construction mitigation measures shall be primarily implemented by the contractors and monitored by CSC/PMU/PIU on behalf of DOR/PT. During operation stage, District DOR/PT and Department of Revenues & Customs shall undertake environmental mitigation and monitoring requirements specified in the EMP. To ensure implementation of mitigation measures during construction, the EMP will be included in

the bidding and contract documents for civil works. Contractors' conformity with environmental contract procedures and specifications will be regularly monitored by DOR/PT with assistance from PCU/PIU/PMU and results shall be reported semi-annually to ADB.



**Table 9: Environmental Mitigation and Environmental Performance Monitoring Plan for PAR and Alay LCS**

Table of Environmental Mitigation and Environmental Performance Monitoring Plan for PAR and PIU 200										
		Impact mitigation					Performance and Impact monitoring			
Environmental Concern	Objective	Proposed Mitigation Measures (MM)	Responsible to Implement MM	Timing to Implement MM	Locations Implement MM	Mitigation Cost	Parameter to monitor	Frequency & Verification	Responsible to Monitor	Monitoring Cost
DESIGN & PRE-CONSTRUCTION										
1. Design measures	Incorporate design measures in the project design to minimize environmental impacts. Compliance with GOB statutory environmental assessment process. Establishment of Grievance Redress Mechanism (GRM)	1. IEE for PAR will be submitted to NEC for environmental clearance. 2. IEE for LCS will be submitted to MOWHS for environmental clearance 3. Implement plan for Grievance Redress Mechanism as described in the IEE 4. Detailed design for PAR is complete and IEE recommendations have been incorporated in the design. 5. Detail design for LCS will incorporate the following measures in the project design: i) Minimize acquisition of agricultural land for temporary facilities by selecting preferred locations in detailed designs for construction yards and asphalt plant on barren or marginal land and agree terms with local community. ii) Identify potential solution spaces to ensure sufficient disposal areas for cut surface spoil materials and to avoid fly-tipping. Obtain approval from local authorities and local community for use of land before bidding. iii) Make arrangements to facilitate the timely production and supply of rock and bitumen based materials for construction and to avoid impacts due to unnecessary stockpiling near the Project road. iv) Design extensions and improvements of drainage culverts for the Project road to account for increased rain due to a once in 100 year return storm event and dovetail these designs with design measures incorporated to minimize impacts due to climate change. V) Minimize hydrological and	PCUs of DOR and PT	Detailed design phase  Preconstruction stage	Throughout project site	Cost included in DOR AND PT, PMU and PMU staffing.	Environmental approval for the Project obtained from NEC Response from NEC on permits. Require in PMU contract. Check at detailed design. Complete check of items 1 to 5.	Completion detailed design/prior to start of site works. Once.	PCU/PIU/PMU	DOR/PT Budget

Environmental Concern	Objective	Impact mitigation					Performance and Impact monitoring			
		Proposed Mitigation Measures (MM)	Responsible to Implement MM	Timing to Implement MM	Locations Implement MM	Mitigation Cost	Parameter to monitor	Frequency & Verification	Responsible to Monitor	Monitoring Cost
		<p>drainage impacts during construction by including in the detailed design early phasing of replacement of culverts and other infrastructure.</p> <p>vi) Disruption to current facilities for water supply will be avoided and facilities will be retained or re-provisioned before construction works commence; provisions will be made to preserve the operation of current facilities for water supply in sufficient quantity in agreement with the local community.</p> <p>vii) Plan and implement reprovisioning of power and water supply lines before construction works commence to avoid disruption of services. Ensure that provisions will be made to preserve the operation of current facilities in sufficient quantity in agreement with the local utility company.</p> <p>viii) Prepare plans to minimize disturbance of vehicular traffic and pedestrians during construction. Ensure that phasing for construction will retain a passing lane along part of the road during construction in detailed designs programming and avoid community severance.</p> <p>ix) Prepare plans to minimize removal of trees during construction. Ensure that phasing for tree removal will allow sufficient time before construction for consultation with DOF and local leaders to identify, mark, cut and sell timbers included in detailed designs programming and avoid community disruption.</p> <p>x) Aim to provide enhancements in the design based on ADB policy on environmentally responsible procurement and avoid negative impacts due to unnecessary removal of trees.</p>								
2.	EMP provisions	1. EMP is included in the bid	1 & 2:PCU	Detailed design	Throughout	Included in	1 & 2:	Bid preparation	PCU/PIU/PMU	DOR/PT

Environmental Concern	Objective	Impact mitigation					Performance and Impact monitoring			
		Proposed Mitigation Measures (MM)	Responsible to Implement MM	Timing to Implement MM	Locations Implement MM	Mitigation Cost	Parameter to monitor	Frequency & Verification	Responsible to Monitor	Monitoring Cost
Environmentally responsible procurement	are properly implemented by selected contractors.	documents to ensure that mitigation measures are budgeted and to prepare the contractors for environmental responsibilities. 2. Specify in bid document that Contractors shall engage capable staff or site agent(s) to be trained to take responsibility for the environmental management and safety issues at the working level and to monitor the effectiveness and review mitigation measures as the project proceeds. 3. Contractors recruit qualified / experienced staff to be trained by PMU/PIU to oversee implementation of environmental and safety measures specified in the EMP.	3 Contractor	phase  Preconstruction stage	project site	bid cost	Inclusion in bid docs  3 Check compliance	stage.  Before start of site works		Budget
3. Environmental capacity development	Develop environmental management capacity of DOR/PT to ensure proper EMP implementation and promote environmental awareness among workers.	1. Under the current SASEC road connectivity project, Project Coordination Unit (PCU) staff will be provided on the job training on environmental monitoring and reporting. 2. ADB will provide environmental baseline (air and noise) monitoring equipment and the required training on data collection and assessment. 3. PMU shall conduct awareness training for the contractors and the site agents and workers on implementation of construction mitigation measures in the Project EMP and any additional mitigation measures that may be required during construction phase.	PCUs of DOR and PT	Detailed design phase  Preconstruction stage	Throughout project site	Cost included in PCU cost	Review Contract Document  Review DD  check items 1 to 3	Prior to start of site works and throughout construction phase	PCU/PIU/PMU	DOR/PT Budget
6. Protect and re-provision irrigation and utilities	Minimize interruption to power, water supply telecoms and irrigation system	1. Identify all power, water supply, telecommunications and irrigation systems likely to be interrupted by the works. 2. Relocation and restoration works to be carried out in consultation with BPCL, BT, local authority and affected community. 3. Temporary water and power supply will be provided during the	1: Design Consultant (DC) of DOR  2: Construction Contractor (under Design and Built modality)	Detailed design phase  Preconstruction stage	Throughout project site	Cost included DC and Contractor fees	Review Contract Document  Review DD  check items 1 to 3	Once, detailed design phase	PCU/PIU/PMU	DOR/PT Budget

Environmental Concern	Objective	Impact mitigation					Performance and Impact monitoring			
		Proposed Mitigation Measures (MM)	Responsible to Implement MM	Timing to Implement MM	Locations Implement MM	Mitigation Cost	Parameter to monitor	Frequency & Verification	Responsible to Monitor	Monitoring Cost
		relocation work.								
7. Tree cutting	Minimize tree cutting	1. Tree felling will be carried out in accordance with FNCR 2006. 2. Trees required to be felled will be duly marked. And only marked trees within the Road and Construction ROW will be felled. 3. Economically valuable timbers will be handed over to NRDCL. 4. Remaining logs will be stockpiled to be used for construction of log barriers for slope management.	Contractors of PAR and LCS	Preconstruction stage	Throughout project site	Cost included in Contractor fees	Review Contract Document  Review DD  check items 1 to 2	Once, preconstruction	PCU/PIU/PMU	DOR/PT Budget
<b>CONSTRUCTION STAGE</b>										
1. Orientation for Contractors, Workers on environmental and social management.	Contractors & workers trained to implement mitigation measures and better implementation of EMP.	1. PIU/PMU along with CSC will conduct training/orientation involving construction workers with regard to implementation of mitigation measures in the EMP (i.e., those specified in the IEE) 2. Implement any HIV-AIDS education and disease prevention programs in line with social plans, as required.	1: Contractors 2: PMU/PIU	1: Before start of site works 2: Upon deployment of workers to project site	Throughout project site	Cost included in contracts for CSC and Contractor	Complete check of implementation of items 1 to 2	1: Before start of site works 2: monthly during construction	ES/CSC/PIU	CSC Budget
3. Loss of vegetation and impacts to fauna	Minimize impacts to flora and fauna	1. Monitoring and marking of vegetation that will be removed agreed with forest authority prior to commencement of construction. 2. Forest authority to approve replacement of cut trees to be undertaken based on the tree cutting and replanting plan. 3. Clearing of trees minimized based on Tree-cutting and Replanting Plan. 4. Prohibit cutting of trees for firewood and for use in Project. Provide LPG for fuel in camps. 5. During replanting/revegetation works, new alien plant species (i.e., species not currently established in the country or region of the project) shall not be used unless carried out	Contractors	1 to 2: Before tree-cutting is implemented 3 to 11: Throughout construction phase	Throughout project site	Cost included in contracts	Check implementation of items 1-12	1 to 3: Prior to and during construction (Bi-weekly) 4 to 12: Bi-weekly  1 to 12 (as part of day-to-day project construction supervision)	ES/CSC/PIU/ Divisional Forest Office (DFO)	CSC Budget  DOFPS Budget

Environmental Concern	Objective	Impact mitigation					Performance and Impact monitoring			
		Proposed Mitigation Measures (MM)	Responsible to Implement MM	Timing to Implement MM	Locations Implement MM	Mitigation Cost	Parameter to monitor	Frequency & Verification	Responsible to Monitor	Monitoring Cost
		<p>with the existing regulatory framework for such introduction. Invasive species shall not be introduced into new environments.</p> <p>6. Prohibit workers from hunting wild animals.</p> <p>7. As much as possible, bridge works will be scheduled in dry season to minimize adverse impacts to fishery, river water quality and other aquatic resources.</p> <p>8. The contractors will not use or permit the use of wood as a fuel for the execution of any part of the Works, including but not limited to the heating of bitumen and bitumen mixtures, and to the extent practicable shall ensure that fuels other than wood are used for cooking and water heating in all his camps and living accommodations.</p> <p>9. Contractors shall not buy or use wood from the illegal sources (that come from the illegal logging).</p> <p>10. No construction camps, asphalt mixing plants, material storage sites are to be located in the forest areas</p> <p>11. Contractors will take all precautions necessary to ensure that damage to vegetation is avoided due to fires resulting from execution of the works. The Contractors will immediately suppress the fire, if it occurs, and shall undertake replanting to replace damaged vegetation.</p>								
<b>4. Drainage and Hydrological Impacts</b>	To minimize hydrological impacts flooding and erosion of river banks.	<p>1. Provide adequate drainage facilities at construction sites and project-related facilities (construction camps, borrow areas, etc.) to avoid ponding and flooding.</p> <p>2. Implement agreed designs for bridges and culverts sufficient to control flooding as designed and to dissipate energy of flow to reduce erosion.</p>	Contractors	Throughout construction phase	Throughout project site, particularly at bridges, causeways, irrigation canals and all areas considered prone to	Included in project and bid costs	Check implementation of items 1-8	Bi-weekly  As part of day-to-day project construction supervision	ES/CSC/PIU	PIU/PMU and CSC Budgets

Environmental Concern	Objective	Impact mitigation					Performance and Impact monitoring			
		Proposed Mitigation Measures (MM)	Responsible to Implement MM	Timing to Implement MM	Locations Implement MM	Mitigation Cost	Parameter to monitor	Frequency & Verification	Responsible to Monitor	Monitoring Cost
		<p>3. Protect or re-provision irrigation channels that cross the works areas. Damaged irrigation canals shall be immediately repaired.</p> <p>4. Protect natural streams that may become silted by construction runoff, workshops and equipment washing-yards.</p> <p>6. Minimize alterations in the project corridor's surface drainage patterns as much as possible:</p> <p>7. Drains to be constructed so that the outfalls of the surface run-off from the carriageway are diverted away from the SRs.</p> <p>8. Ensure that storm drains and drainage systems are periodically cleared to maintain storm water flow during construction.</p>			flooding.					
<b>6. Materials exploitation and management of quarry and borrow areas</b>	Minimize impacts from materials extraction, transportation and storage.	<p>1. Stone will be bought from already established government approved quarry.</p> <p>2. Sand will be imported from neighbouring Indian state of West Bengal as there are no feasible sand quarries within the project and within Bhutan.</p> <p>3. However, if some quarry is established within or outside the Project area following measures will be applied:</p> <p>i) Separate application for quarry will be prepared and submitted to the Department of Geology and Mines (DGM) and the NEC for environmental clearance.</p> <p>ii). Quarry operation will be carried out in line with approved environmental condition by NEC/DGM. Principle of balance cut and fill will be applied to minimize the impacts from extraction of aggregates.</p> <p>iii). If the contractors shall operate the quarry site, required environmental permits shall be</p>	Contractors	Throughout construction phase	Project site, quarry and borrow sites	Cost included in contract	Check implementation of items 1-3	Bi-weekly as part of day-to-day project construction supervision	ES/CSC/PIU District Environmental Officer (DEO)	PIU/PMU and CSC Budgets  Dzongkhag budget

Environmental Concern	Objective	Impact mitigation					Performance and Impact monitoring			
		Proposed Mitigation Measures (MM)	Responsible to Implement MM	Timing to Implement MM	Locations Implement MM	Mitigation Cost	Parameter to monitor	Frequency & Verification	Responsible to Monitor	Monitoring Cost
		<p>secured prior to operation of quarry/borrow areas.</p> <p>iv). Compensatory plantation of minimum 1:1 will be carried out. Only native plant species will be used for plantation.</p> <p>v). Stockpile topsoil for later use and fence and re-contour borrow pits after use. Topsoil, overburden, and low-quality materials shall be properly removed, stockpiled near the site, and preserved for rehabilitation.</p> <p>vi). Use quarry with highest ratio between extractive capacity (both in terms of quality) and loss of natural state.</p>								
7. Spoil Disposal	Control spoil and construction waste disposal	<p>1. Total cut and fill of Excavated materials or construction Spoil approach will be applied. Under this project (PAR &amp; LCS) there are possibilities of achieving 100% balance cut and fill.</p> <p>2. However, if there are any excess spoil from the construction activities; it will be disposed off in a pre-identified site.</p> <p>3. Disposal site will be determined and approved Phuentsholing Thromde and local communities.</p> <p>4. Spoil will not be disposed of in rivers and streams or other natural drainage path.</p> <p>5. Spoil will not be disposed of on fragile slopes, flood ways, wetland, farmland, forest, religious or other culturally sensitive areas or areas where a livelihood is derived.</p> <p>6. Surplus spoil will be used where practicable for local repair works to fill eroded gullies and depression areas and degraded land in consultation with local community.</p> <p>7. Disposed spoil will be spread in 15cm layers and compacted to optimum moisture content, covered</p>	Contractors	Throughout construction phase	Project site and spoils disposal sites	Cost included in contracts	<p>Check implementation of items 1-12</p> <p>Spoils disposal will be monitored by PMU and recorded using a written chain of custody (trip-ticket) system to the designated disposal sites.</p>	<p>Bi-weekly</p> <p>as part of day-to-day project construction supervision</p>	<p>ES/CSC/PIU</p> <p>MOWHS Environmental Officer,</p> <p>Dzongkhag Environmental Officer, NEC</p>	<p>PIU/PMU and CSC Budgets</p> <p>MOWHS Budget</p> <p>Dzongkhag budget NEC budget</p>

Environmental Concern	Objective	Impact mitigation					Performance and Impact monitoring			
		Proposed Mitigation Measures (MM)	Responsible to Implement MM	Timing to Implement MM	Locations Implement MM	Mitigation Cost	Parameter to monitor	Frequency & Verification	Responsible to Monitor	Monitoring Cost
		with topsoil, landscaped and provided with drainage and vegetation to prevent erosion in line with best practice.								
<b>8. General Construction Waste Disposal</b>	Reduce, reuse and recycle waste and contamination due to poor waste disposal practices.	<p>Uncontrolled waste disposal operations can cause significant impacts. Mitigation measures will seek to reduce, recycle and reuse waste as far as practicable. The contractors will ensure implementation of following measures.</p> <ol style="list-style-type: none"> <li>1. In principle, the waste generation will be minimized at source.</li> <li>2. Waste products will be segregated, recycled and reused whenever possible.</li> <li>3. Recyclable waste will be sold to the scrap dealers.</li> <li>4. Organic waste such as plant materials will be composted</li> <li>5. Residual non-hazardous waste will be disposed off in the municipal landfill.</li> <li>6. Construction/workers' camps will be provided with sufficient refuse bins.</li> <li>7. Burning of construction and domestic wastes will be prohibited.</li> <li>8. Disposal of solid wastes into flood ways, wetland, rivers, other watercourses, farmland, forest and associated places of worship or other culturally sensitive areas or areas where a livelihood is derived canals, agricultural fields and public areas will be prohibited.</li> </ol>	Contractors	Throughout construction phase	Project site and waste disposal areas	Cost included in contracts	Check implementation of items 1-8	Bi-weekly  as part of day-to-day project construction supervision	ES/CSC/PIU  MOWHS Environmental Officer,  Dzongkhag Environmental Officer, NEC	PIU/PMU and CSC Budgets  MOWHS Budget  Dzongkhag budget NEC budget
<b>9. Use of hazardous substances and hazardous waste disposal</b>	Minimize contamination due to use and storage of hazardous substances	Use of hazardous substances such as oils and lubricants can cause significant impacts if uncontrolled or if waste is not disposed correctly. Oils and lubricants discharged to woodland can kill the roots and destroy the trees. Mitigation measures will seek to control access to and the use of hazardous	Contractors	Throughout construction phase	Project site and waste disposal areas	Cost included in contracts	Check implementation of items 1-7	Bi-weekly  as part of day-to-day project construction supervision	ES/CSC/PIU  MOWHS Environmental Officer,  Dzongkhag Environmental Officer,	PIU/PMU and CSC Budgets  MOWHS Budget  Dzongkhag



Environmental Concern	Objective	Impact mitigation					Performance and Impact monitoring			
		Proposed Mitigation Measures (MM)	Responsible to Implement MM	Timing to Implement MM	Locations Implement MM	Mitigation Cost	Parameter to monitor	Frequency & Verification	Responsible to Monitor	Monitoring Cost
		<p>substances such as oils and lubricants and control waste disposal. Contractor will carry out following measures to minimize the impacts:</p> <ol style="list-style-type: none"> <li>1. Oil and lubricants will be safely stored. Secondary containment around fuel storage area will be ensured.</li> <li>2. Hydrocarbon, toxic material and explosives (if required) will be stored in adequately protected sites as per the Explosive and Hazardous Rules of RGOB to prevent soil and water contamination.</li> <li>3. Equipment/vehicle maintenance and refueling areas will be confined to areas in construction sites designed to contain spilled lubricants and fuels. Such areas will be provided with drainage leading to an oil-water separator that will be regularly skimmed of oil and maintained to ensure efficiency.</li> <li>4. Fuel and other hazardous substances will be stored in areas provided with roof, impervious flooring and bund/containment wall to protect these from the elements and to readily contain spilled fuel/lubricant.</li> <li>5. Hazardous wastes (oil, used batteries, fuel drums) will be segregated, labeled and safely stored. The spent oil and batteries will be sold to recycling dealers.</li> <li>6. Hazardous materials will be stored away from water bodies and above flood level.</li> </ol> <p>Cleanup operation using readily available absorbent such as sawdust will be carried out immediately during accidental spillage of hazardous waste</p> <ol style="list-style-type: none"> <li>7. All areas intended for storage of hazardous materials will be</li> </ol>							NEC	budget NEC budget

Environmental Concern	Objective	Impact mitigation					Performance and Impact monitoring			
		Proposed Mitigation Measures (MM)	Responsible to Implement MM	Timing to Implement MM	Locations Implement MM	Mitigation Cost	Parameter to monitor	Frequency & Verification	Responsible to Monitor	Monitoring Cost
		quarantined and provided with adequate facilities to combat emergency situations complying with all the applicable statutory stipulation.								
10. Asphalt plant rock crushers, bitumen usage and soil contamination	Avoid air pollution, nuisances, traffic obstacles and contamination	<p>1. Locate asphalt plant and rock crushers (wherever practical) at least 500m from nearest sensitive receivers (residential areas, schools, hospital, etc.) and rivers and install and maintain dust suppression equipment.</p> <p>2. Bitumen as well as firewood will not be used as fuel for heating bitumen. Bitumen drums stored in dedicated area not scattered along Project roads and other project facilities.</p> <p>3. Bitumen will not be allowed to enter drainage system.</p> <p>4. Bitumen storage and mixing areas shall be protected against spillage.</p> <p>5. All accidental spills of bitumen or chemicals should be cleaned up immediately with the top 2cm of any contaminated soil underneath and disposed of as chemical waste to a site approved by the local authority.</p> <p>6. Recycle debris generated by dismantling of existing pavement subject to the suitability of the material.</p>	Contractors	Throughout construction phase	Project site and waste disposal areas	Cost included in contracts	<p>Check implementation of items 1-9</p> <p>Monthly monitor TSP within the plant site</p>	<p>1: Before establishment of facilities, 2 to 6: Bi-weekly</p> <p>1 to 6: as part of day-to-day project construction supervision</p>	<p>ES/CSC/PIU</p> <p>MOWHS Environmental Officer,</p> <p>Dzongkhag Environmental Officer, NEC</p>	<p>PIU/PMU and CSC Budgets</p> <p>MOWHS Budget</p> <p>Dzongkhag budget NEC budget</p>
11. Noise and dust nuisances	To minimize air impacts effectively and avoid complaints due to the airborne dust.	<p>Although temporary in nature, construction activities generate noise and dust pollution affecting local communities as well as other establishments. Following mitigation measure will be applied to reduce nuisances:</p> <p>1. Water sprinkling or spraying using tanker will be done twice a day to reduce dust generation.</p> <p>2. Water is available in the study</p>	Contractors CSC/ES	Throughout construction phase	Project site and waste disposal areas	Cost included in contracts	<p>Check implementation of items 1-9</p> <p>Monthly Monitor noise (dBA) levels at sensitive areas within 200m from active construction front(s).</p>	<p>1: Before establishment of facilities, 2 to 9: Bi-weekly</p> <p>1 to 7: as part of day-to-day project construction supervision</p>	<p>ES/CSC/PIU</p> <p>MOWHS Environmental Officer,</p> <p>Dzongkhag Environmental Officer, NEC</p>	<p>PIU/PMU and CSC Budgets</p> <p>MOWHS Budget</p> <p>Dzongkhag budget NEC budget</p>

Environmental Concern	Objective	Impact mitigation					Performance and Impact monitoring			
		Proposed Mitigation Measures (MM)	Responsible to Implement MM	Timing to Implement MM	Locations Implement MM	Mitigation Cost	Parameter to monitor	Frequency & Verification	Responsible to Monitor	Monitoring Cost
		<p>area from the Pasakha River.</p> <p>3. No work will be carried out within 500m of any settlement during the night (2100 hrs to 0700 hrs).</p> <p>4. If works have given rise to complaints over dust, the contractor shall investigate the cause, report it in the monthly progress reports and review and propose alternative mitigation measures before works recommence.</p> <p>5. Fuel-efficient and well-maintained haulage trucks will be employed to minimize exhaust emissions. Regular maintenance will be carried out.</p> <p>6. Vehicles transporting soil, sand and other construction materials will be covered with tarpaulin sheets to reduce the release of dust and avoid impacts from dust. Speed limits of such vehicles within the works site and on unpaved edge areas of the Project road will be established and agreed with the PMU.</p> <p>7. Noise and dust monitoring will be required carried out during the construction.</p>					Ambient TSP levels monthly within 300m from active construction front(s), and materials handling, and storage areas.			
12. Blasting (if required)	Perform safe blasting and prevent damage and nuisances from blasting	<p>With high degree certainty, the project will not involve blasting activities as there are no boulders or rock cutting requirements. However, if blasting is required due to unforeseen problems, then it will take following measure to reduce the impacts of blasting:</p> <p>2. Procurement, transport and storage of blasting material will be done in accordance with Explosive Rules of Ministry of Home and Cultural Affairs.</p> <p>3. Detonators fuse, and gelatin will be stored in separate fire proof steel containers.</p> <p>4. Store keeper will maintain up-to-date record of issuance and usage of blasting materials. The reports on</p>	Contractors CSC/ES	Throughout construction phase	Project site and blasting site	Cost included in contracts	Check implementation of items 1-12	<p>1: Before construction</p> <p>2 to 11: Bi-weekly and spot checks</p> <p>1 to 12: as part of day-to-day project construction supervision</p>	<p>ES/CSC/PIU</p> <p>MOWHS Environmental Officer,</p> <p>Dzongkhag Environmental Officer, NEC</p>	<p>PIU/PMU and CSC Budgets</p> <p>MOWHS Budget</p> <p>Dzongkhag budget NEC budget</p>

Environmental Concern	Objective	Impact mitigation					Performance and Impact monitoring			
		Proposed Mitigation Measures (MM)	Responsible to Implement MM	Timing to Implement MM	Locations Implement MM	Mitigation Cost	Parameter to monitor	Frequency & Verification	Responsible to Monitor	Monitoring Cost
		usage and storage will be submitted by the contractor as part of monthly work progress report. 5. People living near blasting sites will be informed of blasting times prior to the blasting. 6. Warning sirens will be sounded before blasting. 7. Pre-splitting shall be undertaken. 8. Blast blankets will be laid over the blast area to reduce flying rock 9. Where the vibration from blasting is exceeding the maximum permissible level, or damage occurs to local property information from the blasting shall be used to modify blasting patterns and calculate a reduced charge for future blasts 10. Blasting <u>will not</u> be undertaken at night. 11. Blasting shall be under careful and strict management of properly trained and licensed personnel. Workers at blasting sites will be trained prior to blast operations and provided with safety equipment and earplugs. 12. Observe proper warning and precautionary measures to ensure safety of residents, pedestrians, motorists and structures during blasting.								
13. Erosion control / run-off	Protect established works.	Excavation and earthworks during construction will trigger soil erosion and landslides. To minimize the impacts following measure will be implemented: 1. Stockpile topsoil for use in immediate replanting and bioengineering after completion of engineering work. 2. Minimize damage and cutting of surrounding vegetation during slope formation. 3. Protect the cut slope with planted vegetation, bioengineering or	Contractors  CSC/ES	Throughout construction phase	Throughout project site and all vulnerable slopes	Cost included in contracts	Check implementation of items 1-12	Bi-weekly  as part of day-to-day project construction supervision	ES/CSC/PIU  MOWHS Environmental Officer,  Dzongkhag Environmental Officer, NEC	PIU/PMU and CSC Budgets  MOWHS Budget  Dzongkhag budget NEC budget

Environmental Concern	Objective	Impact mitigation					Performance and Impact monitoring			
		Proposed Mitigation Measures (MM)	Responsible to Implement MM	Timing to Implement MM	Locations Implement MM	Mitigation Cost	Parameter to monitor	Frequency & Verification	Responsible to Monitor	Monitoring Cost
		<p>conventional civil engineering structures as soon as practicable after cutting.</p> <p>4. Prevent erosion and protect the cut slope with temporary or permanent drainage as soon as practicable after cutting.</p> <p>5. If new erosion occurs accidentally, back fill immediately to restore original contours.</p> <p>6. Low embankments will be protected from erosion by seeding and planting indigenous grasses that can flourish under local conditions.</p> <p>7. High embankments, i.e. 2m high and above, will be considered for protection by constructing stone pitching or a riprap across the embankment immediately after the works are completed. This practice will also be applied along cross-drainage structures where embankments are more susceptible to erosion by water runoff.</p> <p>7. Payments will be linked to the completion of the works as indicated by the installation of erosion control measures to protect the works to the satisfaction of PCU/PIU/PMU</p>								
<b>14. River protection and bridge repair</b>	Protect rivers and maintain river flow	<p>At bridges and in road stretches within 50m near rivers and streams:</p> <p>1. Schedule all works for the dry season may to November.</p> <p>2. Rocks and stones will not be disposed to block rivers and streams.</p> <p>3. In bridge repair and demolition sites, the bridge structure will not be dropped into the river but alternative means will be used to avoid "dropping the bridge" into rivers/streams. This will be done by "sawing" appropriate sections of the bridge and using cranes to lift these sections away or alternatively by construction of a platform onto which the bridge could be lowered.</p>	Contractors	At all times	All rivers and streams with repair and reconstruction works.	Cost included in contracts	Check implementation of items 1 to 4	Bi-weekly  as part of day-to-day project construction supervision	<p>ES/CSC/PIU</p> <p>MOWHS Environmental Officer,</p> <p>Dzongkhag Environmental Officer, NEC</p>	<p>PIU/PMU and CSC Budgets</p> <p>MOWHS Budget</p> <p>Dzongkhag budget NEC budget</p>

Environmental Concern	Objective	Impact mitigation					Performance and Impact monitoring			
		Proposed Mitigation Measures (MM)	Responsible to Implement MM	Timing to Implement MM	Locations Implement MM	Mitigation Cost	Parameter to monitor	Frequency & Verification	Responsible to Monitor	Monitoring Cost
		<p>4. Cofferdams, silt fences, sediment barriers or other devices will be used as appropriate based on the design to prevent migration of silt during excavation and boring operations within streams. If cofferdams are used, these will be dewatered and cleaned to prevent siltation by pumping from cofferdams to a settling basin or a containment unit.</p> <p>5. Other erosion control measures above and covering open surfaces with grasses and creepers to reduce runoff will be implemented as early as possible in construction.</p>								
15. Water quality	Prevent water quality impacts due to negligence and ensure unavoidable impacts managed effectively.	<p>1. Store lubricants, fuels in dedicated enclosures at least 50 m from water bodies.</p> <p>2. Solid waste from construction activities and workers camps will not be thrown in rivers and other water courses (drainage, irrigation, etc.)</p> <p>3. Construction storage/stockpiles shall be provided with bunds to prevent silted run-off.</p> <p>4. Stockpiled materials will be covered to reduce silted run-off.</p> <p>5. No stockpiling or borrow sites at least 100m of water body.</p> <p>6. Work in rivers will be scheduled during dry season and work duration shall be as short as possible.</p> <p>7. Immediate stabilization of bare slopes shall be undertaken.</p> <p>8. Construction storage/stockpiles shall be provided with bunds to prevent silted run-off.</p> <p>9. Stockpile areas and storage areas for hazardous substances shall be located away from water bodies.</p> <p>10. Washing of machinery and vehicles in surface waters shall be prohibited.</p>	Contractors	Throughout construction phase	All Project road stretches and project-related facilities	Cost included in contracts	Check implementation of items 1 to 10	Bi-weekly as part of day-to-day project construction supervision	ES/CSC/PIU MOWHS Environmental Officer, Dzongkhag Environmental Officer, NEC	PIU/PMU and CSC Budgets MOWHS Budget Dzongkhag budget NEC budget
16. Water resources	Mitigate the impact of using local community	1. Assess availability of water and evaluate impact on use of local water resources to ensure that water	Contractors	Throughout construction phase	Throughout project site, construction	Cost included in contracts	Check implementation of items 1 to 11	Bi-weekly as part of day-	ES/CSC/PIU MOWHS	PIU/PMU and CSC Budgets

Environmental Concern	Objective	Impact mitigation					Performance and Impact monitoring			
		Proposed Mitigation Measures (MM)	Responsible to Implement MM	Timing to Implement MM	Locations Implement MM	Mitigation Cost	Parameter to monitor	Frequency & Verification	Responsible to Monitor	Monitoring Cost
	water resources.	<p>utilization for Project shall not deplete local village supplies.</p> <p>2. Bring in project water by tanker as necessary.</p> <p>3. Worker camps will be located at least 500m from the nearest settlement to prevent the contamination of community-owned water resources.</p> <p>4. Maintain close liaison with local communities to ensure that any potential conflicts related to common resource utilization for project purposes are resolved quickly.</p> <p>5. Establish and implement guidelines to minimize the wastage of water during construction and at campsites.</p> <p>6. Avoid or minimize use of river bed for construction materials.</p> <p>7. Confine winning river materials to 20% of river width in any location and keep away from river banks.</p> <p>8. Reinstall river banks if necessary.</p> <p>9. Re-provision irrigation channels affected by works two weeks before commencement of works to the satisfaction of local community.</p> <p>10. All irrigation canals along the alignment shall be clearly marked on the ground to prevent accidental dumping of fill materials into these canals.</p> <p>11. In case of accidental obstruction or damage, irrigation ditches and ponds shall be cleaned or repaired immediately.</p>			camps			to-day project construction supervision	Environmental Officer,  Dzongkhag Environmental Officer, NEC	MOWHS Budget  Dzongkhag budget NEC budget
<b>17. Operation of workers camps</b>	Worker facilities not to cause nuisance or exploit forest of wildlife resources.	<p>1. Worker camp location and facilities located at least 500m from settlements and agreed with local communities and facilities approved by PMU and managed to minimize impacts.</p> <p>2. Construction camps will be established in areas with adequate natural drainage channels in order to</p>	Contractors	1 & 2: During selection of locations for workers camps. 3 to 16: Throughout construction phase	Project site, construction camps	Cost included in contracts.	Check implementation of items 1 to 16	1 & 2: Once for each location, prior to establishment of facilities 3 to 16: Bi-weekly  1 to 16: as part	ES/CSC/PIU  MOWHS Environmental Officer,  Dzongkhag Environmental Officer,	PIU/PMU and CSC Budgets  MOWHS Budget  Dzongkhag

Environmental Concern	Objective	Impact mitigation					Performance and Impact monitoring			
		Proposed Mitigation Measures (MM)	Responsible to Implement MM	Timing to Implement MM	Locations Implement MM	Mitigation Cost	Parameter to monitor	Frequency & Verification	Responsible to Monitor	Monitoring Cost
		<p>facilitate flow of the treated effluents.</p> <p>3. Hire and train as many local workers as possible.</p> <p>4. Provide adequate housing for all workers at the construction camps and establish clean canteen/eating and cooking areas.</p> <p>5. Portable lavatories (or at least pit latrines in remote areas) shall be installed and open defecation shall be prohibited and prevented by cleaning lavatories daily and by keeping lavatory facilities clean at all times.</p> <p>6. Provide separate hygienic sanitation facilities/toilets and bathing areas with sufficient water supply for male and female workers.</p> <p>7. Wastewater effluents from contractors' workshops and equipment washing-yards will be passed through gravel/sand beds and all oil/grease contaminants will be removed discharging it into natural streams. Oil and grease residues shall be stored in drums awaiting disposal in line with the agreed Waste Management Plan and consistent with national and local regulations.</p> <p>8. Predictable wastewater effluent discharges from construction works shall have the necessary permits from NEC and local authorities before the works commence.</p> <p>9. Borrow pits and natural depressions with pre-laid impervious liners will be used to dispose of scarified/scraped asphalt, and then covered with soil. This will check potential groundwater contamination.</p> <p>10. Options for completely or partially recycling scraped scarified materials will also be taken into account.</p> <p>11. As much as possible, food shall be provided from farms nearby and</p>						of day-to-day project construction supervision	NEC	budget NEC budget



Environmental Concern	Objective	Impact mitigation					Performance and Impact monitoring			
		Proposed Mitigation Measures (MM)	Responsible to Implement MM	Timing to Implement MM	Locations Implement MM	Mitigation Cost	Parameter to monitor	Frequency & Verification	Responsible to Monitor	Monitoring Cost
		bush meat supplies will be banned to discourage poaching. 12. Ban use of guns and hunting equipment by workers and dismiss workers taking or using green timber or hunting or in possession of wildlife. 13. Camp site will be cleaned up to the satisfaction of and local community after use. 14. Solid and liquid waste will be managed in line with Waste Management Plan. 15. All waste materials shall be removed and disposed to disposal sites approved by local authorities 16. Land used for campsites shall be restored to the original condition as far as practicable and the area shall be planted with appropriate trees / shrubs as soon as practicable after it is vacated and cleaned.								
18. Sanitation and Diseases	Control of infectious diseases.	1. Standing water will not be allowed to accumulate in the temporary drainage facilities or along the roadside to prevent proliferation of mosquitoes. 2. Temporary and permanent drainage facilities will be designed to facilitate the rapid removal of surface water from all areas and prevent the accumulation of surface water ponds. 3. Malaria controls ((e.g., provision of insecticide treated mosquito nets to workers, installation of proper drainage to avoid formation of stagnant water, etc.) and HIV/AIDS education will be implemented in line with social plans for the project. 4. HIV/AIDS awareness and prevention program shall be implemented in line with social plans under the Project	Contractors	Throughout construction.	Throughout project site, workers camps	Cost included in contracts.	Check implementation of items 1 to 4	Bi-weekly as part of day-to-day project construction supervision	ES/CSC/PIU MOWHS Environmental Officer, Dzongkhag Environmental Officer, NEC	PIU/PMU and CSC Budgets MOWHS Budget Dzongkhag budget NEC budget
19. Safety Precautions for	Ensure worker safety.	Worker's occupational health and safety will be generally governed	Contractors	Throughout construction	Throughout project site	Cost included in	Check implementation	Bi-weekly	ES/CSC/PIU	PIU/PMU and CSC

Environmental Concern	Objective	Impact mitigation					Performance and Impact monitoring			
		Proposed Mitigation Measures (MM)	Responsible to Implement MM	Timing to Implement MM	Locations Implement MM	Mitigation Cost	Parameter to monitor	Frequency & Verification	Responsible to Monitor	Monitoring Cost
the Workers		<p>Labour and Employment Act of Bhutan 2007. Construction works will generally result in accidents and injuries or even demise of the workers if no health and safety measures are followed. General Rules and Regulations on Occupational Health and Safety (OHS) in Construction, Manufacturing, Mining and Service Industries 2006 will be applied for occupation safety.</p> <p>Mitigation measures to be implemented by contractors to ensure health and safety of workers are as follows:</p> <ol style="list-style-type: none"> <li>1. The contractor will conduct of training (assisted by PIU) for all workers on safety and environmental hygiene at no cost to the employees. The contractor will instruct workers in health and safety matters as required by law and by good engineering practice and provide first aid facilities.</li> <li>2. The contractors will instruct and induct all workers in health and safety matters (induction course) including construction camp rules and site agents/foremen will follow up with toolbox talks on a weekly basis. Workforce training for all workers starting on site will include safety and environmental hygiene.</li> <li>3. Fencing on all areas of excavation greater than 1m deep and sides of temporary works shall be observed.</li> <li>4. Workers shall be provided with appropriate personnel safety equipment such as safety boots, helmets, gloves, protective clothes, dust mask, goggles, and ear protection at no cost to the workers.</li> <li>5. Reversing signals (visual and</li> </ol>		phase		contracts	Item 1 to 7.  Compliance with OHS 2006	as part of day-to-day project construction supervision	<p>MOWHS Environmental Officer,</p> <p>Dzongkhag Environmental Officer, NEC</p>	<p>Budgets</p> <p>MOWHS Budget</p> <p>Dzongkhag budget</p> <p>NEC budget</p>

Environmental Concern	Objective	Impact mitigation					Performance and Impact monitoring			
		Proposed Mitigation Measures (MM)	Responsible to Implement MM	Timing to Implement MM	Locations Implement MM	Mitigation Cost	Parameter to monitor	Frequency & Verification	Responsible to Monitor	Monitoring Cost
		audible) shall be installed on all construction vehicles and plant. 6. Contractor will at all-time keep the first aid kit at the construction sites. 7. Contractor will be responsible for evacuation injured person to the nearest medical center and bear all the medical expenses								
20. Public safety	Prevent accident with public in local community	1. Install barriers (e.g., temporary fence) at construction areas to deter pedestrian access to the roadway except at designated crossing points. 2. The general public/local residents shall not be allowed in high-risk areas, e.g., excavation sites and areas where heavy equipment is in operation and such sites have a watchman to keep public out. 3. Speed restrictions shall be imposed on Project vehicles and equipment when traveling within 50 m of sensitive receptors (e.g. residential, schools, temples, etc.). 4. Upon completion of construction works, borrow areas will be backfilled (if suitable materials are available, e.g., excavation spoils) or fenced.	Contractors	At all times throughout construction phase	Throughout project road, borrow areas and other areas utilized for the Project	Cost included in contracts	Check implementation of items 1 to 4	Bi-weekly  as part of day-to-day project construction supervision	ES/CSC/PIU  MOWHS Environmental Officer,  Dzongkhag Environmental Officer, NEC	PIU/PMU and CSC Budgets  MOWHS Budget  Dzongkhag budget NEC budget
21. Traffic Conditions	Minimize disturbance of traffic and traffic congestion	1. Communicate to the public through local officials regarding the scope and schedule of construction, as well as certain construction activities causing disruptions or access restrictions. 2. In coordination with local traffic authorities, implement appropriate traffic diversion schemes to avoid inconvenience due to project operations to road users, ensure smooth traffic flow and avoid or minimize accidents, traffic hold ups and congestion 3. In coordination with local traffic officials, schedule transport of materials to avoid congestion, set up clear traffic signal boards and traffic advisory signs at the roads going in	Contractors	Throughout construction phase	Throughout project site	Cost included in contracts	Check implementation of items 1 to 7	Bi-weekly  as part of day-to-day project construction supervision	ES/CSC/PIU  Road Safety and Transport Authority (RSTA)  Royal Bhutan Police (RBP)	PIU/PMU and CSC Budgets  RSTA Budget  RBP Budget

Environmental Concern	Objective	Impact mitigation					Performance and Impact monitoring			
		Proposed Mitigation Measures (MM)	Responsible to Implement MM	Timing to Implement MM	Locations Implement MM	Mitigation Cost	Parameter to monitor	Frequency & Verification	Responsible to Monitor	Monitoring Cost
		and out the road and bridge construction sites to minimize traffic build-up. 4. Provide safe vehicle and pedestrian access around construction areas. 5. Install bold diversion signs that would be clearly visible even at night and provide flag persons to warn of dangerous conditions (24 hours, as necessary) 6. Provide sufficient lighting at night within and in the vicinity of construction sites... 7. Designate traffic officers in construction sites.								
22. Archaeological and cultural artifacts.	Preservation of chance finds of cultural and archaeological relics. identified during construction	There are no known archeological or cultural sites within the project area. However, in the event, it is sited, then following measures will be applied: 1. Should any potential items be located, the PMU and DOR will immediately be contacted and work will be temporarily stopped in that area. 3. If the site supervisor determines that the item is of potential significance, an officer from the MOHCA will be invited to inspect the site and work will be stopped. 4. Until MOHCA has responded to this invitation work will not re-commence in this location until agreement has been reached between MOHCA, PMU and DOR/PT as to any required mitigation measures, which may include excavation.	Contractors	Throughout construction. Check and report on same day.	Throughout project site	Cost included in contracts.	Check implementation of items 1 to 4	Before construction and Bi-weekly checks.  as part of day-to-day project construction supervision	ES/CSC/PIU  MOWHS Environmental Officer,  Dzongkhag Environmental Officer, NEC	PIU/PMU and CSC Budgets  MOWHS Budget  Dzongkhag budget NEC budget
23. Compensatory Plantation	Provide environmental enhancement of the project	Project or PIU in consultation with local government; Divisional Forest Office (DFO) and community will locate the government or even community barren for compensatory plantation. Compensatory plantation using local or native tree species will	Contractors	Throughout construction.	Throughout project site	Cost included in contracts.	Confirmed implementation of required enhancements	Before construction & Bi-weekly checks in day-to-day project construction supervision	ES/CSC/PIU  MOWHS Environmental Officer, Dzongkhag Environmental	PIU/PMU and CSC Budgets  MOWHS Budget

Environmental Concern	Objective	Impact mitigation					Performance and Impact monitoring			
		Proposed Mitigation Measures (MM)	Responsible to Implement MM	Timing to Implement MM	Locations Implement MM	Mitigation Cost	Parameter to monitor	Frequency & Verification	Responsible to Monitor	Monitoring Cost
		be carried out to replace the trees felled during the construction. Ratio for compensation will be 1:1 if the plantation area is small. However, the project can go up to 1:4 if the larger areas available.							Officer, NEC	Dzongkhag budget NEC budget
<b>OPERATIONAL STAGE</b>										
<b>1. Soil erosion</b>	To minimize excessive erosion.	1. Ensure that storm drains and highway drainage systems are periodically cleared to maintain clear drainage to allow rapid dispersal of storm water flow. 2. Ensure rapid response in case of landslips and implement thorough maintenance programme along erosion-prone areas. 3. undertake surveillance and re-vegetation for areas prone to erosion and landslips.	District Department of Transport (DDOR)/PT/and Department of Revenues and Customs	Throughout operation	Slopes with protection measures and new wash out.	Included in operation and maintenance cost	Check implementation of items 1 to 3	Semi-annual	DOR/PT/and Department of Revenues and Customs	Cost met by DOR/PT staffing
<b>2. Road Safety</b>	Minimize road accidents.	1. undertake road safety awareness campaigns for local residents and other road users of the Project road. 2. Install and maintain road warning signs and markings. 3. Monitor road accidents and implement necessary preventive measures (awareness campaigns, provision of appropriate road furniture to enhance road safety and control traffic).	District Department of Transport (DDOR)	Throughout operation	Entire project road	Included in operation and maintenance cost	Check implementation of items 1 to 3	Semi-annual	DOR	Cost met by DOR staffing
<b>3. Tree survival</b>	Ensure survival of planted trees.	Monitor survival of trees / shrubs and grass in bioengineered slopes (e.g. at landslides, also transplanted / compensatory planting trees) and replant, as necessary.	DDOR and District Forestry Office (DFO)	During operation.	Throughout project site	Included in operation and maintenance cost	Survival rate of planted vegetation	Semi-annual for 1 <sup>st</sup> 3 years of operation	DDOR and DFO/PT/	Cost met by DDOR and DFO staffing

## C. Environmental Monitoring

### 1. Compliance Monitoring

211. Table 9 above also shows the program for monitoring the compliance on various provisions of the EMP during pre-construction, construction and operation phases. Detail design for PAR has incorporated the IEE recommendations while LCS detailed design is yet to be carried out. During construction, most of the mitigation measures shall be implemented by the contractors and their environmental performance, in terms of implementation of such measures, shall be monitored by CSC/PIU. The timing or frequency of monitoring is also specified in Table 9. During operation EMP implementation shall be the responsibility of the DOR/PT as operator of facilities.

212. **Design Stage.** Detailed design for PAR has been completed. IEE recommendations have been incorporated in the project design. EMP will form part of the bidding and contract documents.

213. For LCS, the detailed design will be prepared by the design consultant (procured by PT) and a construction contractor will be engaged for construction.. During detailed design, the design consultant will update the EMP.

214. **Pre-construction Stage.** During pre-construction, DOR will need to obtain environment clearance (EC) from the NEC for the improvement and widening of Pasakha Access Road. While PT will need to obtain EC from the Ministry of Works and Human Settlement (MOWHS) for construction of LCS. PT and DOR's compliance with environmental conditions will be monitored. PCU/PIU/CSC will assess the contractor's understanding of Environmental Conditions and EMP that needs to be implemented during pre-construction and construction stages.

215. **Construction Stage.** The updated EMPs/method statement prepared by the contractors, with assistance from the CSC, will be reviewed and approved by PCU/PIUs before any construction activity is initiated to take account of any subsequent changes and fine tuning of the draft EMP. The PCU/PIU through CSC will undertake regular monitoring of the contractor's implementation of mitigation measures specified in the EMP.

216. **Operational Stage.** The DOR/PT & Department of Revenues and Customs assisted by the Environmental Officers will implement the EMP mitigation and monitoring requirements during operation such as monitoring of waste management, health and safety plan, drainage management measures, survival of planted trees, etc. Accidents within the PAR jurisdiction shall also be monitored as basis for implementation of mitigation measures to improve site safety. (For avoidance of doubt road safety shall remain within the purview of the PT and RBP).

### 2. Environmental Effects Monitoring

217. DOR/PT assisted by the Environment Officers will implement the EMP mitigation and monitoring requirements during operation such as monitoring of waste management, health and safety plan, drainage management measures, enhancements to traffic management and survival of planted trees, etc. Accidents within PAR jurisdiction shall also be monitored as basis for implementation of mitigation measures to improve site safety. (For avoidance of doubt road safety shall remain within the purview of the PT government unit and RBP).

## D. Reporting

218. DOR/PT will submit the following environmental monitoring reports to ADB:

219. **Environmental Monitoring Reports:** Environmental monitoring reports shall cover the status of EMP implementation in terms of required mitigation measures for different project phases, necessary remedial actions to effectively address negative environmental impacts due to project implementation, status of environmental capacity building activities as well as documentation of complaints received and corresponding action/resolution. The environmental monitoring reports will be submitted to ADB semi-annually during the construction period and annually for two years after completion of construction.

220. **Environmental Costs.** Under current SASEC Road Connectivity Project, the environmental management cost for PAR is amounting Nu.10.74million which about 3% of the total project cost (Refer Table 10). This cost is totally integrated into the overall project cost. Similar, costing will be done for LCS. The environmental mitigation measures will be itemized and will be put into BOQ for budgeting. This will ensure the proper implementation of environmental mitigation measures. The environmental monitoring, supervision and reporting costing will be part of the overall construction supervision consulting cost.

**Table 10: Summary of Estimate Costs for EMP Implementation of Pasakha Access Road**

Sl.No.	Item	Costs (Nu.)	Remarks
1	Installation of site camps, stores etc.	875,000.00	
2	Provision for water supply, toilets & solid waste disposal	350,000.00	
3	Construction on fill, embankments etc.	4,437,914.88	
4	Disposal of spoil materials	1,599,142.84	
5	Log and boulder barriers	0.00	
6	Bio-engineering & Compensatory Plantation	171,639.80	
7	Water management - French drains & catch drains	607,040.00	
8	Controlled blasting	-	Not quantifiable
11	Environmental Specialist	2,700,000.00	
	<b>Total Amount (Nu.)</b>	<b>10,740,737.52</b>	

221. Total estimated civil construction cost of the PAR is Nu. 371.513 million only. This estimate does not include project management and hiring of supervision consultants.

222. As per the detail design costing, the environmental management cost comes to around Nu.10.74 million which is about 3% of the total project cost.

## E. Capacity Assessment

223. In Bhutan, the environmental assessment process is established but environmental awareness and capability for implementation of EMP in infrastructure projects of both the executing agencies - DOR and PT are in the very early stages of development.

224. Although DOR's environment unit is understaffed, but as an institution it has long experience in environmental assessment and management through the donor assisted projects. It has, to some extent, been successful in institutionalizing the environmental examination studies; implementation of mitigation measures; and carrying out compliance monitoring.

However, to sustain and further promote, the DOR will need to increase the number of staffs and their capacity through in-country (on-the-job) and ex-country trainings.

225. PT's current approach in tackling environmental issues is only on a project basis. There is no dedicated office which is responsible tackling environmental issues with regard to ongoing and future projects. Therefore, through this project, there is an opportunity to establish Environmental Unit perhaps under the Engineering Division of PT. Engineering Division is responsible for planning, designing, and execution of various infrastructure projects under PT. Environment unit with trained environmental officer would be able to institutionalize the environmental assessment process; implementation of mitigation measures; and carry out compliance and effect monitoring.

## **F. Capacity Building**

226. Under the current SASEC Road Connectivity Project, executing agencies (DOR and PT) has agreed to assimilate the environmental assessment and monitoring under the projects' institutional setup. At the project coordination level, the project coordinators (of SASEC Project) under DOR and PT will assume responsibilities of environmental focal persons; who will be answerable to the DOR, ADB and other relevant agencies. At the PIU or PMU level (or at the sub-project levels); the respective project managers (PMs) will act as environmental focal persons who will report to their respective PCs. PCU and PIU/PMU will be assisted by Construction Supervision Consultant (CSC) which includes Resident Engineers (REs), Site Inspectors (Sis) and Environmental Specialist (ES). RE and SI of respective subprojects (PAR and LCS) will be the main environmental persons carrying out day to day monitoring and supervision of implementation of environmental management plans. While ES will carry out the intermittent environmental monitoring and reporting. RE, SI and ES will report to the PIU/PMU through their respective team leaders.

227. Further under the current project, ADB has committed to enhance the EMP implementation and monitoring capacity of the project staffs. During the pre-construction stage; all relevant project staffs will be trained in baseline environmental data collection particularly on air and noise. ADB will also train the contractors, project engineers, ES, REs and SIs on EMP implementation, monitoring and reporting.



## IX. CONCLUSION AND RECOMMENDATIONS

228. This IEE study reveals that the construction impacts are predictable and manageable through implementation of mitigation measures. The IEE report which was prepared during project feasibility study stage has been updated as part of the detailed design study. Detailed design for PAR is complete and the IEE recommendations have been incorporated into the project design. For LCS, the detailed design will be prepared by the design consultant (procured by PT) and a contractor will be engaged for construction. The current EMP will be further reviewed and updated by PIU or CSC of the respective subprojects (PAR and LCS) prior to the construction and even during the construction if necessary. Institutionalization of environmental compliance monitoring and capacity building of project and related staffs will be carried out.

229. The development of Pasakha Access Road (PAR) and the Land Customs Station at Alay is expected to:

- i) ease traffic congestion inside Phuentsholing town (currently all vehicles to and from India passes through only border crossing at Phuentsholing);
- ii) reduce travel distance for heavy trucks (traveling through Jaigaon bypass road)
- iii) reduce transportation cost
- iv) reduce fuel consumption and thereby lower greenhouse gas emission
- v) reduce vehicular noise and exhaust pollution
- vi) allow smooth and faster trading between India and Bhutan; leading to better economic out of the country

230. Further, under the current project the climate change adaptation measures will be implemented since there are major threats to both PAR and LCS. The erosion, landslide and debris flows from the upstream or catchments of Bhawanihora stream and Bhalujhora River have destroyed hectares of prime land within Bhutan and damaged the down aquatic life altogether. Project proposes to carry out catchment area management and slope protection works with civil and bioengineering applications. In addition, the project will also carry out river training and flood protection works along the Bhawanihora stream and Bhalujhora River. All these activities will result in improvement of downstream aquatic environment and prevent flood damages.

231. Therefore, this project is recommended for implementation as its implementation will benefit both natural and man-made environment in the long run.

### Selected Photographs (Pasakha Access Road)



**Photograph 1**  
Bridge (east end of Pasakha Access road)



**Photograph 4**  
Land slide area



**Photograph 2**  
2<sup>nd</sup> Pole to 4<sup>th</sup> Pole



**Photograph 5**  
Temporary road across land slide



**Photograph 3**  
Petrol Station



**Photograph 6**  
Public Consultation along Pasakha Access road

**Summary of Information Disclosure, Consultation and Participation with local people**  
**A x B 1 – Introduction to the project (December 2012)**

Ref.	Information Provided
1	As consultants for the ADB Project Regional Transport Development in South Asia we are collecting information from interested parties.
2	The main part of the project is the reconstruction of part of the Access Road to Pasakha Industrial Estate near Phuentsholing. Do you know about the proposed the Road Project? Let me clarify
3	The Project will reconstruct parts of the Access Road to Pasakha Industrial Estate near Phuentsholing to facilitate access and relieve traffic congestion on the Access Road to Pasakha Industrial Estate near Phuentsholing. Final Access Road alignment will be designed by consultants by 16 March, 2012
	Phuentsholing Pasakha Access Road (PAR): <ul style="list-style-type: none"> <li>- Construct earthworks, retaining walls, level and seal road with asphalt, construct roadside drainage and lead off drains to outfalls.</li> <li>- Construct junction modifications to road access for connection to nearest roads.</li> <li>- Reconstruct the bridge to facilitate crossing of Pasakha River.</li> <li>- Install street signage.</li> </ul>
4	The Project will construct Pasakha Access Road consisting of the above facilities so that traffic can move faster from Phuentsholing to Pasakha. The road drains will be constructed and surfaces will be paved. Road signs will be included as necessary.
5	The project will introduce drainage measures.
6	The Project will be near and will cross the Pasakha River and there will be improvements and a new road access and egress leading to the Pasakha border road connections to India.
7	The project will be detailed designed later in 2013 and contractors will be selected in 2013/2014.
8	Construction will be for a two tears and is targeted for completion in late 2016.
9	We would like to ask about your opinions on the Project and if you have any other comments / suggestions or ideas?

## QUESTIONNAIRE Location No-1: 100 from start of Pasakha Access Road

<b>Name:</b>	Mr. Chanda Tamang
<b>Province/District/Locality</b>	Allay, Phuentsholing (House at Bhutan/India border, but at Bhutan side)
<b>Workplace / Home</b>	Home
<b>Position / Occupation</b>	Job in Industry at Pasakha
<b>Location - Distance to project boundary (approx.)</b>	100 m from start of proposed Pasakha Access road
<b>Time / Date</b>	9:30 AM 30 <sup>th</sup> Nov, 2012

**Questions asked during the Public Consultation to local people to get their reactions and comments on the proposed project activities.**

Ref.	Questions	Response / Comments
1	What are your general comments and observations regarding the Project construction and works? / Agree disagree / comment.	Agree with the proposed project and happy to understand the proposed development of Pasakha Access road.
2	What are your observations and do you have a comment on the design of the facilities and alterations / improvements	No comments, as no information about design.
3	How will the upgraded facilities benefit local community, contribute to local development / local commerce.	Due to improvement of Pasakha Access road, the local transportation facilities will increase. Due to land slide in monsoon period, people gets disconnected with Pasakha, which will be resolved. It is an important issue as the habitation is dependent on Pasakha and Phuentsholing for day to day activities including their job in Pasakha Industry, school & market at Pasakha.
4	How will Project benefit / affect your local transport? / Community. Will the project cause any local problems? What are your comments on the local access for the project lorries/ trucks?	As on date, there is limited local transportation from Phuentsholing to Pasakha industry due to poor road condition, which will increase upon improvement of Pasakha Access road. There will be more economical development of surrounding areas with the same.
5	Are there any cultural archaeological, religious, or historical sites nearby or within 100m from the Project? Is there any cemetery or other site with religious or cultural or heritage significance nearby, Where / what is the distance to the project from that site (Approximately in meters).	Not any
6	Please tell us about nearest sensitive structures such as school & college, hospital clinic, place of worship, cemetery nearby to the Project.	Pasakha Lower Secondary school about 3 Km from India/Bhutan border. Other Higher Secondary School And General Hospital is at Phuentsholing.
7	In your opinion, what will be THE environmental problems we should pay attention to? What will be the environmental problems you expect from the project?	There shall be air and noise pollution during construction stage, which shall be minimized by adopting good construction practice.
8	Will construction of the Project affect your working and / or home life?	Not any
9	Do you as a local representative / resident / worker have any specific observation on environmental changes & impacts that will take place?	Not any
10	Is there any water /air/ noise pollution due to current activities on this Project site? If, yes, please indicate the specific location, so that mitigation measures can be proposed.	Due to poor road condition, there is major air pollution.
11	As part of project, what you expect from DOR Authority? If there are improvements how can they	Better drainage facility and good construction practice is importance to minimize air and noise pollution due to proposed project. Landscaping shall also be done along the project road.

Ref.	Questions	Response / Comments
	be enhanced? Better cultural facilities? / Better waste disposal? / better drainage?	A major structure shall be provided for smooth flow of water in monsoon, otherwise the road will be dismantled every year and also very important to treat the land slide area before construction of proposed access road.
12	Do you have any other suggestions to reduce such environmental impacts? Or general comments	The local people suggested that tree cutting should be minimized during the implementation of improvement proposals.

### QUESTIONNAIRE Location No-2: 100 from start of Pasakha Access Road

<b>Name:</b>	Mr.Ram Bahadur Groom
<b>Province/District/Locality</b>	Upper Khokala, Jaigoan (House at Bhutan/India border, but at Indian side)
<b>Workplace / Home</b>	Home & Workplace
<b>Position / Occupation</b>	Businnes (Shop)
<b>Location - Distance to project boundary (approx.)</b>	100 m from start of Pasakha Access road
<b>Time / Date</b>	10:00 AM 30 <sup>th</sup> Nov, 2012

### Questions asked during the Public Consultation to local people to get their reactions and comments on the proposed project activities.

Ref.	Questions	Response / Comments
1	What are your general comments and observations regarding the Project construction and works? / Agree disagree / comment.	Agree with the proposed project and happy to understand the proposed development of Pasakha Access road.
2	What are your observations and do you have a comment on the design of the facilities and alterations / improvements	No comments, as no information about design. However, villagers residing at Upper Khokala have major impact on monsoon due to land slide. They always suffer from flood due to river water and land slide. An embankment is made by India Government, so that during monsoon the water shall not enter into the village. As per villagers suggestion the embankment shall be strengthened and easy flow of hill water shall be allowed, so that there shall ne be any impact to villagers in monsoon period.
3	How will the upgraded facilities benefit local community, contribute to local development / local commerce.	Due to improvement of Pasakha Access road, the local transportation facilities will increase. Due to land slide in monsoon period, people gets disconnected with Pasakha, which will be resolved. It is an important issue as the habitation is dependent on Pasakha for day to day activities including their job in Pasakha Industry & market.
4	How will Project benefit / affect your local transport? / Community. Will the project cause any local problems? What are your comments on the local access for the project lorries/ trucks?	As on date, there is limited local transportation from Phuentsholing to Pasakha industry due to poor road condition, which will increase upon improvement of Pasakha Access road. There will be more economical development of surrounding areas with the same.
5	Are there any cultural archaeological, religious, or historical sites nearby or within 100m from the Project? Is there any cemetery or other site with religious or cultural or heritage significance nearby, Where / what is the distance to the project from that site (Approximately in meters).	Not any
6	Please tell us about nearest sensitive structures such as school & college, hospital clinic, place of worship, cemetery nearby to the Project.	Primary school, Srijara Committee about 1 km and other Higher School are at Jaigoan. General hospital at Jaigoan.
7	In your opinion, what will be THE environmental problems we should pay attention to? What will be the environmental problems you expect from the project?	There shall be air and noise pollution during construction stage, which shall be minimized by adopting good construction practice.

Ref.	Questions	Response / Comments
8	Will construction of the Project affect your working and / or home life?	Not any
9	Do you as a local representative / resident / worker have any specific observation on environmental changes & impacts that will take place?	Not any
10	Is there any water /air/ noise pollution due to current activities on this Project site? If, yes, please indicate the specific location, so that mitigation measures can be proposed.	Due to poor road condition, there is major air pollution.
11	As part of project, what you expect from DOR Authority? If there are improvements how can they be enhanced? Better cultural facilities? / Better waste disposal? / better drainage?	Better drainage facility and good construction practice is importance to minimize air and noise pollution due to proposed project. Landscaping shall also be done along the project road. A major structure shall be provided for smooth flow of water in monsoon, otherwise the road will be dismantled every year and also very important to treat the land slide area before construction of proposed access road.
12	Do you have any other suggestions to reduce such environmental impacts? Or general comments	The local people suggested that tree cutting should be minimized during the implementation of improvement proposals.

**QUESTIONNAIRE Location No-3: 200 from start of Pasakha Access Road**

<b>Name:</b>	Mr. Gyembo & Mr. Budharaj
<b>Province/District/Locality</b>	Allay, Pasakha, Phuentsholing
<b>Workplace / Home</b>	Home
<b>Position / Occupation</b>	Casual labourer to Pasakha Industry
<b>Location - Distance to project boundary (approx.)</b>	200 m from start of Pasakha Access road
<b>Time / Date</b>	10:30 AM 30 <sup>th</sup> Nov, 2012

**Questions asked during the Public Consultation to local people to get their reactions and comments on the proposed project activities.**

Ref.	Questions	Response / Comments
1	What are your general comments and observations regarding the Project construction and works? / Agree disagree / comment.	Agree with the proposed project and happy to understand the proposed development of Pasakha Access road.
2	What are your observations and do you have a comment on the design of the facilities and alterations / improvements	No comments, as no information about design.
3	How will the upgraded facilities benefit local community, contribute to local development / local commerce.	Due to improvement of Pasakha Access road, the local transportation facilities will increase. Due to land slide in monsoon period, people gets disconnected with Pasakha, which will be resolved. It is an important issue as the habitation is dependent on Pasakha and Phuentsholing for day to day activities including their job in Pasakha Industry, school & market.
4	How will Project benefit / affect your local transport? / Community. Will the project cause any local problems? What are your comments on the local access for the project lorries/ trucks?	As on date, there is limited local transportation from Phuentsholing to Pasakha industry due to poor road condition, which will increase upon improvement of Pasakha Access road. There will be more economical development of surrounding areas with the same.
5	Are there any cultural archaeological, religious, or historical sites nearby or within 100m from the Project? Is there any cemetery or other site with religious or cultural or heritage significance nearby, Where / what is the distance to the project from that site (Approximately in meters).	Not any

Ref.	Questions	Response / Comments
6	Please tell us about nearest sensitive structures such as school & college, hospital clinic, place of worship, cemetery nearby to the Project.	Pasakha Lower Secondary school about 2 Km and other Higher Secondary School And General Hospital is at Phuentsholing.
7	In your opinion, what will be THE environmental problems we should pay attention to? What will be the environmental problems you expect from the project?	There shall be air and noise pollution during construction stage, which shall be minimized by adopting good construction practice.
8	Will construction of the Project affect your working and / or home life?	Not any
9	Do you as a local representative / resident / worker have any specific observation on environmental changes & impacts that will take place?	Not any
10	Is there any water /air/ noise pollution due to current activities on this Project site? If, yes, please indicate the specific location, so that mitigation measures can be proposed.	Due to poor road condition, there is major air pollution.
11	As part of project, what you expect from DOR Authority? If there are improvements how can they be enhanced? Better cultural facilities? / Better waste disposal? / better drainage?	Better drainage facility and good construction practice is importance to minimize air and noise pollution due to proposed project. Landscaping shall also be done along the project road. A major structure shall be provided for smooth flow of water in monsoon, otherwise the road will be dismantled every year.
12	Do you have any other suggestions to reduce such environmental impacts? Or general comments	The local people suggested that tree cutting should be minimized during the implementation of improvement proposals.

#### QUESTIONNAIRE Location No-4: 200 from start of Pasakha Access Road

<b>Name:</b>	Mr. Sonam Duba
<b>Province/District/Locality</b>	Allay, Pasakha, Phuentsholing
<b>Workplace / Home</b>	Home
<b>Position / Occupation</b>	Casual labourer to Pasakha Industry
<b>Location - Distance to project boundary (approx.)</b>	200 m from start of Pasakha Access road
<b>Time / Date</b>	11:00 AM 30 <sup>th</sup> Nov, 2012

#### Questions asked during the Public Consultation to local people to get their reactions and comments on the proposed project activities.

Ref.	Questions	Response / Comments
1	What are your general comments and observations regarding the Project construction and works? / Agree disagree / comment.	Agree with the proposed project and happy to understand the proposed development of Pasakha Access road.
2	What are your observations and do you have a comment on the design of the facilities and alterations / improvements	No comments, as no information about design.
3	How will the upgraded facilities benefit local community, contribute to local development / local commerce.	Due to improvement of Pasakha Access road, the local transportation facilities will increase. Due to land slide in monsoon period, people gets disconnected with Pasakha, which will be resolved. It is an important issue as the habitation is dependent on Pasakha and Phuentsholing for day to day activities including their job in Pasakha Industry, school & market.
4	How will Project benefit / affect your local transport? / Community. Will the project cause any local problems? What are your comments on the local access for the project lorries/ trucks?	As on date, there is limited local transportation from Phuentsholing to Pasakha industry due to poor road condition, which will increase upon improvement of Pasakha Access road. There will be more economical development of surrounding areas with the same.

Ref.	Questions	Response / Comments
5	Are there any cultural archaeological, religious, or historical sites nearby or within 100m from the Project? Is there any cemetery or other site with religious or cultural or heritage significance nearby, Where / what is the distance to the project from that site (Approximately in meters).	Not any
6	Please tell us about nearest sensitive structures such as school & college, hospital clinic, place of worship, cemetery nearby to the Project.	Pasakha Lower Secondary school about 2 Km and other Higher Secondary School And General Hospital is at Phuentsholing.
7	In your opinion, what will be THE environmental problems we should pay attention to? What will be the environmental problems you expect from the project?	There shall be air and noise pollution during construction stage, which shall be minimized by adopting good construction practice.
8	Will construction of the Project affect your working and / or home life?	Not any
9	Do you as a local representative / resident / worker have any specific observation on environmental changes & impacts that will take place?	Not any
10	Is there any water /air/ noise pollution due to current activities on this Project site? If, yes, please indicate the specific location, so that mitigation measures can be proposed.	Due to poor road condition, there is major air pollution.
11	As part of project, what you expect from DOR Authority? If there are improvements how can they be enhanced? Better cultural facilities? / Better waste disposal? / better drainage?	Better drainage facility and good construction practice is importance to minimize air and noise pollution due to proposed project. Adequate number of culverts shall be provided with along the access road for easy flow of monsoon water.
12	Do you have any other suggestions to reduce such environmental impacts? Or general comments	The local people suggested that tree cutting should be minimized during the implementation of improvement proposals.

#### QUESTIONNAIRE Location No-5: 350 from start of Pasakha Access Road

<b>Name:</b>	Mr. Bal Kumar Bishwa
<b>Province/District/Locality</b>	Bawani Jhora, Pasakha, Phuentsholing
<b>Workplace / Home</b>	Home
<b>Position / Occupation</b>	Casual labourer to Pasakha Industry
<b>Location - Distance to project boundary (approx.)</b>	350 m from start of Pasakha Access road
<b>Time / Date</b>	11:30 AM 30 <sup>th</sup> Nov, 2012

#### Questions asked during the Public Consultation to local people to get their reactions and comments on the proposed project activities.

Ref.	Questions	Response / Comments
1	What are your general comments and observations regarding the Project construction and works? / Agree disagree / comment.	Agree with the proposed project and happy to understand the proposed development of Pasakha Access road.
2	What are your observations and do you have a comment on the design of the facilities and alterations / improvements	No comments, as no information about design.
3	How will the upgraded facilities benefit local community, contribute to local development / local commerce.	Due to improvement of Pasakha Access road, the local transportation facilities will increase. Due to land slide in monsoon period, people gets disconnected with Pasakha, which will be resolved. It is an important issue as the habitation is dependent on Pasakha and Phuentsholing for day to day activities including their job in Pasakha Industry,



Ref.	Questions	Response / Comments
		school & market.
4	How will Project benefit / affect your local transport? / Community. Will the project cause any local problems? What are your comments on the local access for the project lorries/ trucks?	As on date, there is limited local transportation from Phuentsholing to Pasakha industry due to poor road condition, which will increase upon improvement of Pasakha Access road. There will be more economical development of surrounding areas with the same.
5	Are there any cultural archaeological, religious, or historical sites nearby or within 100m from the Project? Is there any cemetery or other site with religious or cultural or heritage significance nearby, Where / what is the distance to the project from that site (Approximately in meters).	Not any
6	Please tell us about nearest sensitive structures such as school & college, hospital clinic, place of worship, cemetery nearby to the Project.	Pasakha Lower Secondary school about 2 Km and other Higher Secondary School and General Hospital is at Phuentsholing.
7	In your opinion, what will be THE environmental problems we should pay attention to? What will be the environmental problems you expect from the project?	There shall be air and noise pollution during construction stage, which shall be minimized by adopting good construction practice.
8	Will construction of the Project affect your working and / or home life?	Not any
9	Do you as a local representative / resident / worker have any specific observation on environmental changes & impacts that will take place?	Not any
10	Is there any water /air/ noise pollution due to current activities on this Project site? If, yes, please indicate the specific location, so that mitigation measures can be proposed.	Due to poor road condition, there is major air pollution.
11	As part of project, what you expect from DOR Authority? If there are improvements how can they be enhanced? Better cultural facilities? / Better waste disposal? / better drainage?	Better drainage facility and good construction practice is importance to minimize air and noise pollution due to proposed project. Adequate number of culverts shall be provided with along the access road for easy flow of monsoon water.
12	Do you have any other suggestions to reduce such environmental impacts? Or general comments	The local people suggested that tree cutting should be minimized during the implementation of improvement proposals.

#### QUESTIONNAIRE Location No-6: 400 from start of Pasakha Access Road

<b>Name:</b>	Mr. Sherub Dorji
<b>Province/District/Locality</b>	BOD, Bawani Jhora, Pasakha, Phuentsholing
<b>Workplace / Home</b>	Work place (Petrol Station )
<b>Position / Occupation</b>	Manager, Petrol Station
<b>Location - Distance to project boundary (approx.)</b>	Next to Pasakha Access road
<b>Time / Date</b>	12:15 PM 30 <sup>th</sup> Nov, 2012

**Questions asked during the Public Consultation to local people to get their reactions and comments on the proposed project activities.**

Ref.	Questions	Response / Comments
1	What are your general comments and observations regarding the Project construction and works? / Agree disagree / comment.	Agree with the proposed project and happy to understand the proposed development of Pasakha Access road.
2	What are your observations and do you have a comment on the design of the facilities and alterations / improvements	No comments, as no information about design.

Ref.	Questions	Response / Comments
3	How will the upgraded facilities benefit local community, contribute to local development / local commerce.	Due to improvement of Pasakha Access road, the local transportation facilities will increase. Due to land slide in monsoon period, people gets disconnected with Pasakha, which will be resolved. It is an important issue as the habitation is dependent on Pasakha and Phuentsholing for day to day activities including their job in Pasakha Industry, school & market.
4	How will Project benefit / affect your local transport? / Community. Will the project cause any local problems? What are your comments on the local access for the project lorries/ trucks?	As on date, there is limited local transportation from Phuentsholing to Pasakha industry due to poor road condition, which will increase upon improvement of Pasakha Access road. There will be more economical development of surrounding areas with the same.
5	Are there any cultural archaeological, religious, or historical sites nearby or within 100m from the Project? Is there any cemetery or other site with religious or cultural or heritage significance nearby, Where / what is the distance to the project from that site (Approximately in meters).	Not any
6	Please tell us about nearest sensitive structures such as school & college, hospital clinic, place of worship, cemetery nearby to the Project.	Pasakha Lower Secondary school about 2 Km and other Higher Secondary School and General Hospital is at Phuentsholing.
7	In your opinion, what will be THE environmental problems we should pay attention to? What will be the environmental problems you expect from the project?	There shall be air and noise pollution during construction stage, which shall be minimized by adopting good construction practice.
8	Will construction of the Project affect your working and / or home life?	Not any
9	Do you as a local representative / resident / worker have any specific observation on environmental changes & impacts that will take place?	Not any
10	Is there any water /air/ noise pollution due to current activities on this Project site? If, yes, please indicate the specific location, so that mitigation measures can be proposed.	Due to poor road condition, there is major air pollution.
11	As part of project, what you expect from DOR Authority? If there are improvements how can they be enhanced? Better cultural facilities? / Better waste disposal? / better drainage?	Better drainage facility and good construction practice is importance to minimize air and noise pollution due to proposed project. Adequate number of culverts shall be provided with along the access road for easy flow of monsoon water.
12	Do you have any other suggestions to reduce such environmental impacts? Or general comments	The local people suggested that tree cutting should be minimized during the implementation of improvement proposals.

#### QUESTIONNAIRE Location No-7: 0 m from end of Pasakha Access Road

<b>Name:</b>	Miss. Sangeeta Sharma
<b>Province/District/Locality</b>	Bhala Jhora, Pasakha, Phuentsholing
<b>Workplace / Home</b>	Work place
<b>Position / Occupation</b>	Businnes (Shop)
<b>Location - Distance to project boundary (approx.)</b>	End to Pasakha Access road
<b>Time / Date</b>	12:45 PM 30 <sup>th</sup> Nov, 2012

Questions asked during the Public Consultation to local people to get their reactions and comments on the proposed project activities.

Ref.	Questions	Response / Comments
1	What are your general comments and observations regarding the Project construction and works? / Agree disagree / comment.	Agree with the proposed project and happy to understand the proposed development of Pasakha Access road.

Ref.	Questions	Response / Comments
2	What are your observations and do you have a comment on the design of the facilities and alterations / improvements	No comments, as no information about design.
3	How will the upgraded facilities benefit local community, contribute to local development / local commerce.	Due to improvement of Pasakha Access road, the local transportation facilities will increase. Due to land slide in monsoon period, people gets disconnected with Pasakha, which will be resolved. It is an important issue as the habitation is dependent on Pasakha and Phuentsholing for day to day activities including their job in Pasakha Industry, school & market.
4	How will Project benefit / affect your local transport? / Community. Will the project cause any local problems? What are your comments on the local access for the project lorries/ trucks?	As on date, there is limited local transportation from Phuentsholing to Pasakha industry due to poor road condition, which will increase upon improvement of Pasakha Access road. There will be more economical development of surrounding areas with the same.
5	Are there any cultural archaeological, religious, or historical sites nearby or within 100m from the Project? Is there any cemetery or other site with religious or cultural or heritage significance nearby, Where / what is the distance to the project from that site (Approximately in meters).	Not any
6	Please tell us about nearest sensitive structures such as school & college, hospital clinic, place of worship, cemetery nearby to the Project.	Pasakha Lower Secondary school about 1 Km and other Higher Secondary School and General Hospital is at Phuentsholing.
7	In your opinion, what will be THE environmental problems we should pay attention to? What will be the environmental problems you expect from the project?	There shall be air and noise pollution during construction stage, which shall be minimized by adopting good construction practice.
8	Will construction of the Project affect your working and / or home life?	Not any
9	Do you as a local representative / resident / worker have any specific observation on environmental changes & impacts that will take place?	Not any
10	Is there any water /air/ noise pollution due to current activities on this Project site? If, yes, please indicate the specific location, so that mitigation measures can be proposed.	Due to poor road condition, there is major air pollution.
11	As part of project, what you expect from DOR Authority? If there are improvements how can they be enhanced? Better cultural facilities? / Better waste disposal? / better drainage?	Better drainage facility and good construction practice is importance to minimize air and noise pollution due to proposed project. Adequate number of culverts shall be provided with along the access road for easy flow of monsoon water.
12	Do you have any other suggestions to reduce such environmental impacts? Or general comments	The local people suggested that tree cutting should be minimized during the implementation of improvement proposals.

#### QUESTIONNAIRE Location No-8: 600 m from start of Pasakha Access Road

<b>Name:</b>	Mr. Kharkha Bahadur Ghale
<b>Province/District/Locality</b>	BOD, Bawani Jhora, Pasakha, Phuentsholing
<b>Workplace / Home</b>	Home
<b>Position / Occupation</b>	Job in Pasakha Industry
<b>Location - Distance to project boundary (approx.)</b>	600 m from start of Pasakha Access Road
<b>Time / Date</b>	1:15 PM 30 <sup>th</sup> Nov, 2012

Questions asked during the Public Consultation to local people to get their reactions and comments on the proposed project activities.

Ref.	Questions	Response / Comments
1	What are your general comments and observations regarding the Project construction and works? / Agree disagree / comment.	Agree with the proposed project and happy to understand the proposed development of Pasakha Access road.
2	What are your observations and do you have a comment on the design of the facilities and alterations / improvements	No comments, as no information about design.
3	How will the upgraded facilities benefit local community, contribute to local development / local commerce.	Due to improvement of Pasakha Access road, the local transportation facilities will increase. Due to land slide in monsoon period, people gets disconnected with Pasakha, which will be resolved. It is an important issue as the habitation is dependent on Pasakha and Phuentsholing for day to day activities including their job in Pasakha Industry, school & market.
4	How will Project benefit / affect your local transport? / Community. Will the project cause any local problems? What are your comments on the local access for the project lorries/ trucks?	As on date, there is limited local transportation from Phuentsholing to Pasakha industry due to poor road condition, which will increase upon improvement of Pasakha Access road. There will be more economical development of surrounding areas with the same.
5	Are there any cultural archaeological, religious, or historical sites nearby or within 100m from the Project? Is there any cemetery or other site with religious or cultural or heritage significance nearby, Where / what is the distance to the project from that site (Approximately in meters).	Not any
6	Please tell us about nearest sensitive structures such as school & college, hospital clinic, place of worship, cemetery nearby to the Project.	Pasakha Lower Secondary school about 2 Km and other Higher Secondary School and General Hospital is at Phuentsholing.
7	In your opinion, what will be THE environmental problems we should pay attention to? What will be the environmental problems you expect from the project?	There shall be air and noise pollution during construction stage, which shall be minimized by adopting good construction practice.
8	Will construction of the Project affect your working and / or home life?	Not any
9	Do you as a local representative / resident / worker have any specific observation on environmental changes & impacts that will take place?	Not any
10	Is there any water /air/ noise pollution due to current activities on this Project site? If, yes, please indicate the specific location, so that mitigation measures can be proposed.	Due to poor road condition, there is major air pollution.
11	As part of project, what you expect from DOR Authority? If there are improvements how can they be enhanced? Better cultural facilities? / Better waste disposal? / better drainage?	Better drainage facility and good construction practice is importance to minimize air and noise pollution due to proposed project. Adequate number of culverts shall be provided with along the access road for easy flow of monsoon water.
12	Do you have any other suggestions to reduce such environmental impacts? Or general comments	The local people suggested that tree cutting should be minimized during the implementation of improvement proposals.

**QUESTIONNAIRE Location No-9: 600 m from start of Pasakha Access Road**

<b>Name:</b>	Ms.Namgay
<b>Province/District/Locality</b>	BOD, Bawani Jhora, Pasakha, Phuentsholing
<b>Workplace / Home</b>	Home
<b>Position / Occupation</b>	House wife
<b>Location - Distance to project boundary (approx.)</b>	600 m from start of Pasakha Access Road
<b>Time / Date</b>	1:45 PM 30 <sup>th</sup> Nov, 2012

**Questions asked during the Public Consultation to local people to get their reactions and comments on the proposed project activities.**

Ref.	Questions	Response / Comments
1	What are your general comments and observations regarding the Project construction and works? / Agree disagree / comment.	Agree with the proposed project and happy to understand the proposed development of Pasakha Access road.
2	What are your observations and do you have a comment on the design of the facilities and alterations / improvements	No comments, as no information about design.
3	How will the upgraded facilities benefit local community, contribute to local development / local commerce.	Due to improvement of Pasakha Access road, the local transportation facilities will increase. Due to land slide in monsoon period, people gets disconnected with Pasakha, which will be resolved. It is an important issue as the habitation is dependent on Pasakha and Phuentsholing for day to day activities including their job in Pasakha Industry, school & market.
4	How will Project benefit / affect your local transport? / Community. Will the project cause any local problems? What are your comments on the local access for the project lorries/ trucks?	As on date, there is limited local transportation from Phuentsholing to Pasakha industry due to poor road condition, which will increase upon improvement of Pasakha Access road. There will be more economical development of surrounding areas with the same.
5	Are there any cultural archaeological, religious, or historical sites nearby or within 100m from the Project? Is there any cemetery or other site with religious or cultural or heritage significance nearby, Where / what is the distance to the project from that site (Approximately in meters).	Not any
6	Please tell us about nearest sensitive structures such as school & college, hospital clinic, place of worship, cemetery nearby to the Project.	Pasakha Lower Secondary school about 2 Km and other Higher Secondary School and General Hospital is at Phuentsholing.
7	In your opinion, what will be THE environmental problems we should pay attention to? What will be the environmental problems you expect from the project?	There shall be air and noise pollution during construction stage, which shall be minimized by adopting good construction practice.
8	Will construction of the Project affect your working and / or home life?	Not any
9	Do you as a local representative / resident / worker have any specific observation on environmental changes & impacts that will take place?	Not any
10	Is there any water /air/ noise pollution due to current activities on this Project site? If, yes, please indicate the specific location, so that mitigation measures can be proposed.	Due to poor road condition, there is major air pollution.
11	As part of project, what you expect from DOR Authority? If there are improvements how can they be enhanced? Better cultural facilities? / Better waste disposal? / better drainage?	Better drainage facility and good construction practice is importance to minimize air and noise pollution due to proposed project. Adequate number of culverts shall be provided with along the access road for easy flow of monsoon water.
12	Do you have any other suggestions to reduce such environmental impacts? Or general comments	The local people suggested that tree cutting should be minimized during the implementation of improvement proposals.

## Environmental Criteria and Standards

### a) Ambient Air Quality Standards (Maximum Permissible Limits in $\mu\text{g}/\text{m}^3$ )

*Environmental Standards, National Environmental Commission, Royal Government of Bhutan, Nov 2010*

Parameter	Industrial Area	Mixed Area*	Sensitive Area**
<i>Total Suspended Particulate matter</i>			
24 Hour Average	500	200	100
Yearly Average	360	140	70
<i>Respirable Particulate matter (PM10)</i>			
24 Hour Average	200	100	75
Yearly Average	120	60	50
<i>Sulfur Dioxide</i>			
24 Hour Average	120	80	30
Yearly Average	80	60	15
<i>Nitrogen Oxides</i>			
24 Hour Average	120	80	30
Yearly Average	80	60	15
<i>Carbon Monoxide</i>			
8 Hour Average	5,000	2,000	1,000
1 Hour Average	10,000	4,000	2,000

\* **Mixed Area** means where residential, commercial or both activities take place

\*\* **Sensitive Area** means where sensitive targets are in place like hospitals, Schools, sensitive ecosystems.

**Source:** Environmental Standards, National Environmental Commission, Royal Government of Bhutan, Nov 2010

### b) Noise Level Limits:

Industrial Area		Mixed Area		Sensitive Area	
Day *	Night **	Day	Night	Day	Night
75 dB (A)	65 dB (A)	65 dB (A)	55 dB (A)	55 dB (A)	45 dB (A)

**Note:** All the values are maximum values

\*Day time is from 0600 hours to 2200 hours (human activities)

\*\*Night time is from 2200 hours to 0600 hours (no human activities)

**Source:** Environmental Standards, National Environmental Commission, Royal Government of Bhutan, Nov 2010

### c) Vehicle Emission Standards:

Fuel Type	Vehicle registered prior to 01 <sup>st</sup> Jan 2005	Vehicle registered after 01 <sup>st</sup> Jan 2005	Type Approval
Petrol (% CO)	4.5	4	Euro II
Diesel (% HSU)	75	70	

**Source:** Environmental Standards, National Environmental Commission, Royal Government of Bhutan, Nov 2010

**d) Ambient Water Quality Criteria for various uses (September, 2010)**

Sl. No.	Parameters	A	B	C
1	pH	6.5-8.5	6-9	6-9
2	Colour, Hz Units	5	50	-
3	TSS mg/l	25	100	-
4	Conductivity, $\mu\text{S}/\text{cm}$	800	1000	2000
5	Odour	Unobjectionable	Unobjectionable	-
6	Mineral Oil	No film	No film	-
7	Nitrate, mg/l	10	50	-
8	Flouride, mg/l	1.0	2.0	-
9	Sulphates, mg/l	25	100	-
10	Chloride, mg/l	50	200	-
11	Surfactants, mg/l	0.1	0.2	-
12	Phosphates, mg/l	0.5	<1.0	-
13	DO, mg/l	6	4	-
14	BOD, mg/l	2	5	50
15	TKN, mg/l	0.5	2	
16	Ammonia, mg/l	0.05	0.5	
17	T. Coliform, MPN/100 ml*	50	5000	10000
18	F. Coliform, MPN/100 ml*	20	2000	5000
19	F.streptococci, MPN/100 ml*	20	1000	1000
20	Dissolved Iron, mg/l	0.2	0.5	-
21	Copper, mg/l	0.05	0.1	-
22	Zinc, mg/l	0.2	0.5	
23	Arsenic, mg/l	0.01	0.05	-
24	Cadmium, mg/l	0.003	0.003	-
25	Total-Chromium, mg/l	0.05	0.05	-
26	Lead, mg/l	0.02	0.02	-
27	Selenium, mg/l	0.01	0.01	-
28	Mercury, mg/l	0.0005	0.0005	-
29	Phenol, mg/l	0.001	0.002	-
30	Cyanides	0.05	0.05	-
31	PAH, mg/l	0.0002	0.0002	0.001
32	Total Pesticides, mg/l	0.0005	0.0005	0.001
33	PCB mg/l	0.0002	0.0002	-
34	SAR	-	-	-
35	Boron	-	-	1
36	Floating Materials such as wood, plastic, rubber, excreta, garbage etc.	Absent	Absent	Absent

**Source:** Environmental Standards, National Environmental Commission, Royal Government of Bhutan, Nov 2010

**Note:**

**A:** (Very good) Drinking water source without conventional treatment, but after disinfection whenever necessary.

**B:** (Good) Drinking water source without conventional treatment.

**C:** (Moderate) Use for irrigation, industrial cooling etc.

*\*To achieve the drinking quality standards, disinfection/ boiling of the water is recommended. The total coli form may be high due to their contribution from natural sources like soil, litter, etc., which does not relate to pathogen. If MPN of total coli form is noticed to be more than the limit suggested, than regular test should be carried out. The criteria would be satisfied if during a period not more than 5 % sample shows greater than prescribed limit.*