

# Summary Environmental Impact Assessment

## National Highways Sector Project in Sri Lanka

August 2005

## **CURRENCY EQUIVALENTS**

(As of 31 July 2005)

Currency Unit	–	Sri Lanka rupee/s (SLRe/SLRs)
SLRe 1.00	=	\$0.009933
\$1.00	=	SLRs 100.675

## **ABBREVIATIONS**

ADB	–	Asian Development Bank
CEA	–	Central Environmental Authority
EIA	–	environmental impact assessment
EMP	–	environmental management plan
ESD	–	Environmental and Social Division
GSMB	–	Geological Survey and Mines Bureau
IEE	–	initial environment examination
KRWS	–	Karuwalagaswewa Wildlife Sanctuary
RDA	–	Road Development Authority
SEIA	–	summary environmental impact assessment
UNESCO	–	United Nations Educational, Scientific and Cultural Organization

## **WEIGHTS AND MEASURES**

km	–	kilometer
km <sup>2</sup>	–	square kilometer
m	–	meter
mm	–	millimeter
vpd	–	vehicles per day

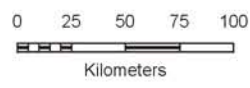
## **NOTES**

- (i) The fiscal year (FY) of the Government ends on 31 December.
- (ii) In this report, "\$" refers to US dollars.

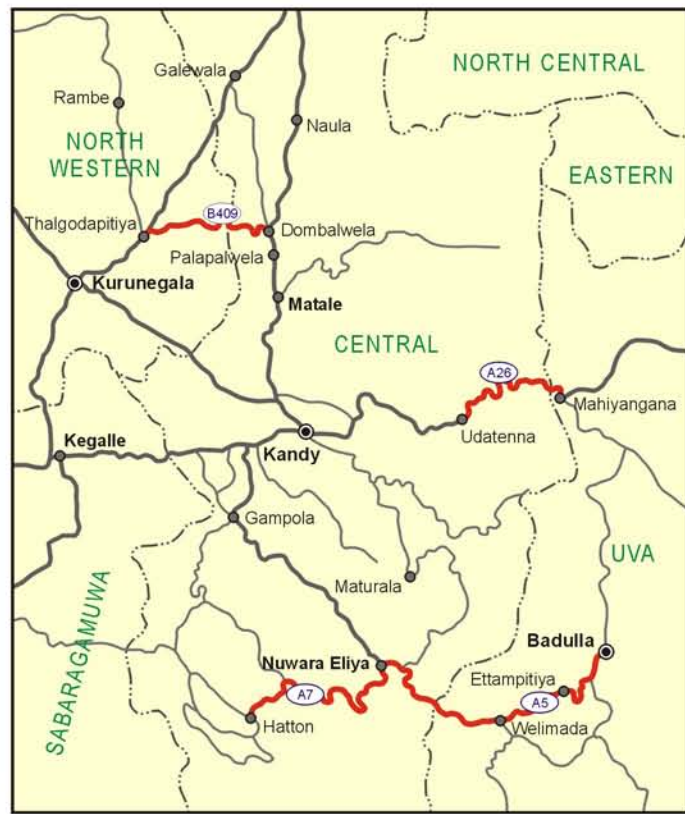
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# SRI LANKA NATIONAL HIGHWAYS SECTOR PROJECT



- Project Area
  - National Capital
  - Provincial Capital
  - City/Town
  - A7 Road Number
  - Project Road
  - Southern Highway
  - National Road
  - Other Road
  - River
  - District Boundary
- Boundaries are not necessarily authoritative.



# SRI LANKA NATIONAL HIGHWAYS SECTOR PROJECT PUTTALAM-ANURADHAPURA ROAD SUBPROJECT



## I. INTRODUCTION

1. The proposed National Highways Sector Project (the Project) in Sri Lanka is categorized as a category A project according to the *Environmental Assessment Guidelines* (2003) of the Asian Development Bank (ADB). However, some subprojects may require only initial environmental examinations (IEEs). Three road sections were selected as sample subprojects and were assessed during project preparation.

2. This Summary Environmental Impact Assessment (SEIA) has been prepared for the use of the ADB. This report contains a general overview of the Project, a brief description of environmental impacts associated with it, and an environmental assessment and review framework based on consultation with the Road Development Authority (RDA). The report also summarizes an environmental assessment of three sample subprojects, based on the following reports: (i) the IEE for Low-Land Road Groups that covers the Matara to South Highway; (ii) the IEE for South Highway to Aluthagama, and (iii) the environmental impact assessment (EIA) for the road from Puttalam to Anuradhapura. These three subprojects were classified as activities that require an IEE in accordance to the Government's environmental assessment requirement. However, the subproject road connecting Puttalam to Anuradhapura, which passes through a national park, is categorized as an "A" project in accordance to the ADB's *Environmental Assessment Guidelines*, 2003.

3. The assessment studies for these three subprojects were carried out between February and July 2005, in which the subprojects were at the feasibility study stage. The EIA study of the Project was carried out by ADB's technical assistance consultant on behalf of RDA. The environmental assessment reports were prepared in accordance with the relevant laws and Government regulations and were also in accordance with ADB's *Environment Policy* (2002) and *Environmental Assessment Guidelines*.

## II. OVERVIEW OF THE PROJECT

4. The main impact of the Project is expansion of economic opportunities leading to higher income. The Project outcome is improvement of the national highway network efficiency in Sri Lanka. The Project components are (i) policy and institutional support component, and (ii) national highways upgrading and maintenance component.

5. The policy and institutional support component will include strengthening of the RDA, focusing on implementing a new organizational structure and business processes, and on reviewing the human resource development policy and strategy. A new Environmental and Social Division (ESD) will be established to address environmental and social aspects of road development.

6. The national highways to be upgraded (about 270 kilometers [km]) will be selected from RDA's public investment program, in accordance with the road sector master plan. These include (i) lowland (coastal) roads, (ii) hilly roads, and (iii) urban roads, which include Colombo link roads and south highway link roads. However, some coastal roads have been incorporated into tsunami projects, and were replaced by the Puttalam to Trincomalee road (part of the northern east-west corridor). This component will include upgrading, widening, and, if necessary, realigning the following roads: (i) A 012: Puttalam-Anuradhapura (70 km), (ii) A 005: Nuwara Eliya-Badulla (54.9 km); (iii) A 007: Nuwara Eliya-Hatton (44.8 km), (iv) A 026: Udatenna-Mahiyangana (40.8 km), (v) B 409: Thalgodapitiya-Dombawela (26.4 km), (vi) B 157:

south highway–Aluthagama (10.5 km), (vii) B 153: Hikkaduwa–South Highway (13.3 km), (viii) A 024: Matara–South Highway (4 km), and (ix) B 207: Katukurunda–Nagoda (2.7 km).

7. The Project may also include land acquisition and resettlement of Colombo link roads. Upgrading of these links to four-lane roads is also being considered. These subprojects will involve: (i) A 001: Kiribathogoda–Nittambuwa (25.5 km), (ii) A 004: Kirulapone– Godagama (19.7 km), (iii) B 084: Pamankanda Bridge–Horana (27.6 km), and (iv) Orugodawatta–Ambatale (7.7 km).

8. To pilot performance-based maintenance, 100–200 km of roads will be selected for a 4-year road maintenance program. This will include periodic maintenance in the first year and routine maintenance thereafter to be contracted to a domestic private company.

9. Some of the roads to be upgraded pass through environmentally-sensitive areas, which is why this is a category A project. To comply with the Government’s environmental assessment requirements, the RDA has submitted a basic information questionnaire for each subproject to the Central Environmental Authority (CEA) to obtain a decision on its environmental classification. In cases where the ADB and Government classifications differ, the subproject will be classified according to the strongest requirements.

10. The RDA will be the Executing Agency for the Project. The Project will be implemented over 5 years and is expected to be completed by 31 December 2010.

### **III. ENVIRONMENTAL IMPACTS OF THE SECTOR**

11. As a sector environmental impact assessment is not mandatory, it was not undertaken, but an overall sector assessment was carried out as part of project preparation.

12. Improvements to the national highway network are designed to meet traffic demand projections for the next 20 years. Paved surfaces will be designed to last for 10 years, and longer if proper maintenance is carried out. Overall, the Project will improve the performance of the road sector, contributing to transport efficiency, and widening access to economic opportunities. It will benefit the public, companies, government agencies, and other direct or indirect users of transport services. Users will benefit directly from better road conditions, lower costs, time savings, and better access to economic opportunities and social services.

13. The Project will have environmental consequences. The most direct impact of an increase in traffic will be an increase in accidents. Road safety audits need to be carried out during the detailed design and construction period to ensure that road safety features are incorporated. The Government’s strategic plan for road safety and the Motor Traffic Act need to be fully enforced. Air pollution from vehicle emissions and greenhouse gases will also increase due to increasing traffic. The RDA will need to work closely with the CEA to monitor air pollution systematically throughout the construction and operation of each subproject. In addition, the RDA needs to strengthen its participation in national efforts to reduce air pollution related to vehicle emissions.

14. At the local level, implementation of the Project will also have environmental consequences, especially during construction. Assessing impacts at the subproject level will be an integral part of managing the Project. The summary environmental assessment of the sample subprojects is described in the following section.

#### **IV. SUMMARY ENVIRONMENTAL ASSESSMENT OF THE SAMPLE SUBPROJECTS**

##### **A. Description of the Sample Subprojects**

###### **1. Matara to Southern Highway (A 024)**

15. The improvement of the A 024 will start from 4 km out of Matara and end at the South Highway. Traffic levels vary from 9,000 vehicles per day (vpd), at the junction between A 024 and A 002 at Nupe, to 3,000 vpd, at km 4 just outside the urban area. It is expected that once the South Highway is completed, the volume will rise to 12,000 vpd at Nupe and 6,000 vpd at km 4. The road needs to be improved to cater to this anticipated increase in traffic.

16. Civil works will involve widening 4 km of road from its existing 5–7 meter (m) width to a two-lane standard road (3.5 m each lane), 2 m cycle lanes, 2.4 m curbside parking lanes within the commercial area, and 2 m paved sidewalk. The existing paved surface will be overlaid with 125 millimeter (mm) asphalt concrete and the widened sections will be constructed to asphalt concrete standard over a granular base. Improvements will be made to a side drainage and culvert.

###### **2. South Highway to Aluthagama (B 157)**

17. The B 157 is a rural road serving the inland area of Kalutara District and linking Horana to Matugama. From there it continues to the coast where it meets the A 002 at Aluthgama. The project section is from the interchange with the South Highway near Welipenne to Aluthgama. The total length of the project road in this section is around 10.5 km. Traffic levels are 3,000 vpd at the South Highway to 6,000 vpd at Aluthgama. Once the South Highway is connected, these levels are projected to rise to 6,000 at the South Highway and 8,000 vpd at Aluthgama.

18. The civil works in this road section will involve (i) widening the existing 4–6 m road width to a two-lane standard road (3.5 m each lane), with 2 m cycle lanes, 2.4 m parking and stopping lanes through urban center of Dharga and Aluthgama towns, and (ii) improvements to the side drainage and culvert. At the design stage, an alternative route may be considered for the last 1 km section through Aluthgama, via a widened local road to avoid the busy commercial centre. This would involve less resettlement and improve the geometry of the road.

###### **3. Puttalam–Anuradhapura (A 012)**

19. The A 012 is part of an important road connecting Puttalam and Trincomalee. Improvements to this road will improve connections between the North Western Province and the North East Province. The total length of the road is around 70 km. Civil works will involve widening the existing road to a two-lane standard road (3.5 m each lane) with 2 m sealed shoulders.

##### **B. Description of the Environment of the Sample Subprojects**

###### **1. Environmental Conditions along A 024 and B 157**

20. The roads in the lowland group are mostly situated on the southern coastal fringe of the island, and are on flat terrain. The B 157 lies within the wet zone of the island, which is characterized by an average monthly rainfall in excess of 250 mm. The A 024 lies within the

intermediate zone, which is characterized by an average monthly rainfall of 125–190 mm. The soils in the flood plain close to the coast are sulfaquants, which can take a potentially hazardous acid sulphate form (sulfuric acid is produced when the soil is exposed to the air). Such soils may be found near the A024. Other common soils in the area are regosols, of recent beach sand origin and unconsolidated, and bog soils which are very poorly drained, black in color, and have a high organic matter content.

21. Drainage is poor for roads on river flood plains, and flooding can occur during the wet season. The Nilwala Ganga runs close to the A 024. Groundwater occurs in alluvial aquifers, which are prolific on the Nilwala River flood plain, and is used as a water source in some parts of the subproject area. Intrusion of seawater and reduced sand replenishment is a serious concern, especially in Nilwala Ganga. The B 157 is located on flat terrain of the flood plain of the Bentota and Welipenne Rivers.

22. The A 024 and B 157 are near urban and industrial areas, so it is likely that the air is contaminated by pollutants from both urban and industrial activities.

23. Vegetation alongside and surrounding the roads has been strongly influenced by human habitation. Trees near the road are generally on private land, and not immediately adjacent to the road. No endangered flora or fauna have been reported along the roadside.

24. The A 024 and B 157 are located in the relatively densely populated coastal area to the southwest. The population density is around 600 people per km<sup>2</sup>. A number of cultural and religious sites can be found near the roads. These include a large temple, the Galapata Vihara near the B 157.

## **2. Environmental Conditions along Puttalam–Anuradhapura**

25. The topography of the subproject area is predominantly flat. The area belongs to the dry and intermediate zones, with a rainy season from late September to January. The high intensity of rainfall, which mostly exceeds 25 mm per hour during the rainy seasons, leads to serious erosion. There are some important drainage basins in the subproject area, which has good groundwater potential. The road passes through Tabbowa tank. The soil conditions along the coastal belt and lower flood plains are regosol and alluvial. The soil type in area further off the coastal belt is dominated by yellow latosol, and red yellow podzolic.

26. The district of Puttalam, where the road is mainly located, has about 10% forest cover. However, along the road only secondary forest growth is found between km 17 and km 31. The distance from the road varies from 300 m to 1 km. No endangered flora has been reported in the project area. However, around 2 km of the road passes through the Karuwalagaswewa Wildlife Sanctuary (KRWS) and known also as Tabbowa Sanctuary. The most important species in this sanctuary is elephant. This stretch of the road (at km 15 to km 17) is part of the most important roaming area for these elephants. At present, there is an electric fence along this road. Therefore, elephants cross to the road in several human settlements along the road outside the KRWS's boundaries. According to the park manager, there is a plan to concentrate the elephant crossing of the road by removing the existing fence along the project road at the stretch that passes Tabbowa tank, which is located within KRWS.

27. The KRWS is also a sanctuary for migratory birds, which lay their eggs and take care of their chicks from July to November. However, there are not many trees on the stretch of road that passes KRWS and none is used for laying eggs by the migratory birds.

28. The population density in the subproject area varies from 106 to 207 people per km<sup>2</sup>. Along the subproject roads, there are a number of small temples, shrines, and religious trees. There is a big Buddhist temple by the roadside at around km 60. However, the widening of the road is not expected to affect this temple.

## **C. Alternative Analysis**

### **1. Without the Project**

29. Without the Project, all three existing roads would continue to be the main transportation links. Road conditions would continue to deteriorate because of the increasing traffic. Traffic congestion would probably increase, affecting people living alongside the road. Without the project, the ambient concentrations of gaseous pollutants and noise would increase gradually in response to the increase in population and the number of vehicles. The improvement proposed under the Project is a better option.

### **2. Alternative Transport Modes**

30. There is no other transport mode that could replace these roads. Improving the road conditions is the only way to improve transportation of goods and passengers for both private and public transportation facilities.

### **3. Alternative Improvements**

31. Alternative routes have not been considered for these roads. The existing roads are mostly two-lane roads, although they have yet to meet the two-lane standard. The needs for land acquisition and resettlement will be less than those of building a new road because most of the existing rights of way for these roads are available. It was therefore decided to improve and upgrade the existing roads.

### **4. Alternative Rerouting**

32. Two options to partly re-route A 012 to reduce traffic congestion in Puttalam city have been examined. The first option is to improve and widen the existing A 012 within the Puttalam city and the second option is to improve and widen the existing outer road that has been used by heavy vehicles to avoid a railway crossing and city centre. The second option is preferable because it will require less extensive land acquisition and resettlement compare to the first option.

## **D. Anticipated Environmental Impacts and Mitigation Measures**

### **1. Environmental Impacts associated with Construction**

#### **a. Extraction and Supply of Construction Materials**

33. For all three subproject roads, nearby rivers are a source of sand. However, using sand from rivers could lower riverbeds, collapse riverbanks, lead to the intrusion of sea water, and reduce sand replenishment at coastal beaches. To minimize the environmental problems associated with supplying sand for these subprojects, it is recommended that (i) alternatives to sand, such as screened crusher fines, be used as much as possible; (ii) only sources of sand

approved by the Geological Survey and Mines Bureau (GSMB) be used;<sup>1</sup> and (iii) offshore sand be used, in accordance with the draft national policy on sand as a resource for the construction industry, produced by the Ministry of Environment and Natural Resources in March 2005.

34. Local sources of rock and gravel for construction are abundant. However, mining of rock and gravel could lead to slope failure, damage to private property, and look unsightly. To minimize such impacts, it is recommended that the Project use only quarries registered by the GSMB, or, where necessary, open new quarries in compliance with the requirements of the GSMB. The need to open borrow pits is likely to be very limited because of the geology of the area. Borrow pits can damage cultivable land and create adverse visual impacts, and unfilled pits can collect stagnant water in which disease vectors may breed. These impacts can be avoided by (i) not using cultivable land and residential areas for borrow pits; (ii) obtaining agreement from landowners and the appropriate permits; and (iii) replacing topsoil, landscaping, and replanting.

35. To minimize the need for filling materials, it is recommended that materials from dismantling the existing road be recycled as much as possible. The excess materials from the cut and fill should not be disposed of in nearby rivers, streams or other water bodies. The contractor should be required to submit a disposal plan for excess and spoil materials.

36. Other impacts may be caused by transportation of materials from the extraction site to the construction site, which could disturb local traffic, damage minor roads, and increase dust and noise nuisance. In order to minimize these impacts, the bidding document should require the contractor (i) to propose sources of quarries and borrow areas and the routes to be used; (ii) not to locate temporary storage of materials near residential areas; (iii) not to transport materials during peak traffic hours, or at night in urban areas; and (iv) to use covers to guard against dust blow and spray water to dampen dust.

#### **b. Hazards Associated with Exposure to Sulfaquant Soils**

37. It is suspected that sulfaquant soil may exist in the project areas of A 024 and B 157, especially in some pockets of the flood plain and in coastal areas. Sulfaquants can form sulphuric acid on exposure to the air and therefore present a safety hazard to workers, as well as a potential source of pollution of water and surrounding soils. These risks can be mitigated by rapid recognition of sulfaquant soils by the contractor and by ensuring such soils are kept covered by an earth layer at all times.

#### **c. Water Resources**

38. To avoid affecting water sources used by local residents in the project area, construction should use sources far from residential areas. Potential contamination of surface water by construction activities includes pollution from vehicles, equipment and materials stores; poor sanitation at worksites; or disposing of excess or spoiled materials adjacent to water bodies. In order to prevent this, the following measures should form part of the contract conditions and specification of the works: (i) all toxic and hazardous materials required for construction, including asphalt, fuel and caustic substances, should be stored at secure and managed sites, sited away from water bodies; (ii) vehicles and equipment should be maintained in good operable condition, ensuring no undue leakage of oil or fuel; (iii) vehicles and equipment should

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<sup>1</sup> The Geological Survey and Mines Bureau is the authority mandated to regulate minerals extraction, under the Mines and Minerals Act (No.33) of 1992.

be serviced at properly managed and equipped workshops; (iv) waste oil should be collected and disposed of at approved locations; (v) sanitation facilities should be made available at worksites and at any accommodation facilities provided for workers, and no raw sewage should be released into drains or water bodies; and (vi) where earthworks take place adjacent to water bodies, silt traps should be installed before earthwork activity begins.

#### **d. Public Utilities**

39. Within urban areas such as in Aluthgama and Matara, existing water supply and sewage pipes may need to be relocated or extended, temporarily cutting services. There is also a danger that such pipes may be damaged accidentally during construction. Poles supporting overhead power and telephone lines will generally need to be relocated along most of the road length. Where utilities need to be relocated or extended, effects of cuts in services will be mitigated by obtaining clearance and coordinating construction works with the concerned authority, providing information to the affected public stating when services will be disrupted, and minimizing the duration of the disruption of services in each case. Risks of accidental disruption can be reduced by ensuring that machines such as excavators are operated by trained personnel, and that operations are adequately supervised.

#### **e. Flora and Fauna**

40. Destruction of some roadside trees by road widening is inevitable, but (i) road widening should be done on one side of the road as much as possible, (ii) trees that serve religious purposes or are particularly old should not be cut down, (iii) roadside trees should be replanted as soon as possible and responsibility for such replanting should be incorporated into the contractor's obligations.

41. For the A 012, efforts should be concentrated on minimizing the impacts of construction works on the KRWS. The stretch that passes through the KRWS will not be widened and the civil work will focus only on improving the existing paved surface without totally dismantling of the existing road foundation. Construction work will cease at around 16:00 so the movement of elephants that usually come to the Tobbawa tank at around that time is not disturbed. The following measures will be also be adopted: (i) all hotmix plant, crushing plant, workshops, depots and temporary workers' accommodation facilities shall be sited in approved locations, away from sanctuaries, forested areas, or other areas where there may be significant wildlife populations nearby; (ii) workers shall be prohibited from hunting, gathering fuel wood, or otherwise affecting forests or wildlife communities; (iii) toxic and hazardous materials required for construction, including asphalt, will be properly stored and secured, and sited in approved locations away from sanctuaries, forested areas, or other areas where there may be significant wildlife populations nearby; (iv) vehicles and equipment shall be well-maintained, ensuring no leakage of oil or fuel, and exhaust baffles will be fitted.

#### **f. Disruption of Traffic**

42. Existing traffic flows will be impeded by improvement works to the paved surface, widening operations, and any widening of culverts that may be necessary. In addition, vehicles involved in construction will increase traffic flows, resulting in congestion, delays and an increase in noise and exhaust emissions. In built-up areas, levels of pedestrian traffic are very high, and these will also be subject to disruption. These impacts can be mitigated by: (i) providing advance information to the public about planned construction works; (ii) planning construction activities to minimize disruption and maintaining at least one open lane (there is no

viable alternative route for any of the three subprojects); (iii) providing adequate and visible signposting of temporary traffic diversions and disruption; (iv) using flagmen and/or temporary traffic lights to control traffic flows at constricted sites, including providing a safe crossing for pedestrians; and (v) limiting, as far as possible, the movement of large trucks and plant to off-peak traffic times.

#### **g. Site Safety**

43. Construction activities pose potential hazards to both workers and the public. These include land slides due to construction work (especially where blasting is necessary), excavation, movement of plant and equipment in confined spaces, and the use of hazardous substances. Safety for workers and the public can be enhanced by (i) proper training of workers on safety precautions and their responsibilities for the safety of themselves and others; (ii) provision of protective clothing to workers, including hard hats, protective footwear, and high visibility jackets for use when construction takes place at night; (iii) ensuring that plant and vehicle operators are properly licensed and trained; (iv) providing first aid facilities, readily available trained paramedical personnel, and emergency transport to the nearest hospital with accident and emergency facilities, and allocating responsibility for ensuring that these arrangements are continually in place; (v) arranging for regular safety checks of vehicles and materials, and allocating responsibility for this; (vi) ensuring that blasting is carried out and supervised by trained personnel, that explosives are stored in a secure location, and that all due precautions are taken; and (vii) providing hazard warning signs around construction sites, and directing vehicle and pedestrian traffic away from worksites.

#### **h. Air Quality**

44. Earthworks, improvements to paved surfaces, quarry-related operations, asphalt production, and operations of construction vehicles and plant will all release aerial contaminants, with potential effects on air quality. Impacts from emissions from hotmix plant can be brought to acceptable levels by ensuring that the plant is located as far as possible from residential areas and ecologically sensitive areas, that high-quality plant is used, and that the plant is operated by trained and qualified personnel. Impacts from dust emissions at quarry sites may be mitigated by siting quarries away from residential areas, and by using water sprinklers at crushing plant. Emissions from vehicles and plant can be minimized by ensuring all vehicles and plant are well-maintained, in a good condition, and that they comply with national emissions standards.<sup>2</sup>

#### **i. Noise and Vibration**

45. Noise and vibrations from construction machinery, quarrying operations, and blasting can cause a nuisance to local residents and workers as well as to wildlife. In towns and villages, schools and places of worship are particularly vulnerable to noise nuisance. The impact of construction noise can be mitigated by (i) ensuring that construction plant and equipment are well-maintained, and that exhaust baffles are fitted and well-maintained; (ii) all reasonable measures are taken to limit noise generation near schools and places of worship, in consultation with key personnel at these institutions, limiting operations to times when they have least impact; and (iii) all the work at the sanctuary will cease at 16:00. To minimize noise and

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<sup>2</sup> These are set out in *Gazette Extraordinary No 1.137/35* dated 23 June 2000 relating to sections 23J and 23K of the National Environmental Act.

vibration from blasting, as little explosive material as possible will be used and the schedule of blasting will be provided to nearby communities.

#### **j. Cultural Property**

46. A number of religious and cultural sites, such as temples and shrines, occur near the roads and are vulnerable to accidental damage during construction. Risks of damage during construction can be minimized by providing notice to the temple organizer, briefing workers, and ensuring adequate supervision of the works.

### **2. Environmental Impacts and Mitigation Measures Associated with Operation**

#### **a. Water Resources**

47. Improvements to road drainage systems will improve storm water flows, and reduce blockages in roadside drains. Risks to public health from the accumulation of stagnant water in drains, in which disease vectors such as mosquitoes can breed, will be reduced. The drainage system will be designed to withstand storms. Drainage systems will be regularly maintained.

#### **b. Road Safety**

48. Improvements to road surfaces will include adjustments to vertical and horizontal road geometry, which make the roads safer. Although these improvements will permit higher vehicle speeds, which may increase the severity of accidents, the design of the subprojects will offset this risk by (i) widening roads to full two-lane operations, thus reducing head-on conflicts; (ii) providing centerline road marking and studs, edge delineation on wider stretches of road, and guard railings and chevron markers on bends; (iii) providing sealed shoulders where the volume of cycle and other slow and non motorized traffic is significant; (iv) providing footpaths through urban areas; (v) providing indented bus-stops and pedestrian crossings; and (vi) providing traffic signs.

49. However, enforcement of speed limits and other traffic rules will also be necessary. Similarly, laws on licensing, reporting, and monitoring for handling hazardous materials<sup>3</sup> will need to be complied with. In towns, clearly marked pedestrian crossings, including signaling equipment, will be needed.

50. For the stretch that passes through KRWS, special traffic signs will be provided to warn road users about the possibility of elephants crossing. Traffic users will be warned at least 200 m from the entrance to the KRWS that they are entering a sanctuary. A speed limit will be employed along the stretch within KRWS.

#### **c. Air Quality**

51. At present, the quality of the ambient air is impaired by vehicle emissions, particularly in towns and villages. Emissions from idling engines during periods of congestion are a contributory factor. The proposed improvements are designed to decrease congestion and allow smoother traffic flows, reducing the amount of time that vehicles remain stationary, and reducing the number of times they accelerate or decelerate. The project is therefore expected have a positive effect on overall air quality, provided traffic is managed, and traffic rules enforced to

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<sup>3</sup> *Gazette Extraordinary No. 924/13 of 23 May 1996.*

reduce behavior that causes congestion, such as obstructive parking. Maintenance during the operational phase will also reduce the release of air and dust. Such maintenance should take place as much as possible during off peak traffic periods. Dust emissions need to be suppressed, and plant and equipment well-maintained.

52. Improving the Project roads will increase traffic volumes, which will increase overall vehicle emissions. Therefore national measures are needed to monitor overall vehicle emissions.

#### **d. Noise**

53. The proposed improvements are not expected to result in significant changes to noise levels, which will be monitored throughout the project. Noise from maintenance activities may be significant, but can be mitigated by ensuring high standards of planning and management.

### **E. Environmental Management Plan and Monitoring Plan**

#### **1. Environmental Management Plan and Responsible Authorities**

54. The environmental management plan (EMP) attached in Appendixes 1 and 2 will guide the environmental measures to be carried out by RDA, project managers, contractors, and other parties concerned with mitigating possible impacts of the Project. The EMP needs to be updated at the beginning of the project implementation stage, after the detailed engineering design has been completed so that locations and frequency of monitoring can be defined more specifically.

55. The RDA through the project manager and in close coordination with the ESD will ensure that (i) all mitigation measures that need to be incorporated into the project design are passed on to the engineering consultants, (ii) the bidding document for the contractor contains all the required mitigation measures to be implemented during the construction period and the obligations for contractor to implement EMP during the construction period, (iii) the environmental clearance is obtained before any civil work contract is granted, (iv) implementation of the EMP is regularly monitored and the annual report on implementation of the EMP is well documented, (v) there is coordination with other parties and government agencies in implementing the EMP at all stages of the Project, (v) remedial actions are undertaken in response to unpredicted environmental impacts, and (vi) additional environmental assessment will be undertaken if any change in alignment or project design has taken place.

56. To ensure that contractors comply with the EMP, the following specifications will be incorporated into all construction bidding documents: (i) the environmental mitigation measures and environmental monitoring that need to be implemented by the contractor, and (ii) environmental clauses for contract conditions and specifications. The IEE and EIA reports will be made available for potential bidders.

57. ESD will be responsible for implementing the monitoring plan and for preparing a semiannual report for submission to the relevant government agencies and to ADB.

#### **2. Institutional Capacity to Address Environmental Concerns**

58. Currently, RDA does not have an environmental unit. However, under the new organization structure that forms part of RDA reform under the ongoing loan, the ESD will be

established and will report directly to the RDA's general manager. An assessment of the division's workload and resource needs (human resources, budget, and facilities) will be carried out during the Project. At present the RDA has several environmental officers assigned to projects funded by external financing agencies and the assessment will include their possible redeployment. It is anticipated that the ESD will be able to address the RDA's environmental concerns in a more coherent and effective manner than previously.

59. Staff of the ESD will be trained in environmental management. During the transition period, a number of environmental consultants will be hired.

#### **F. Public Consultation and Disclosure**

60. Consultations with affected people took place during the fieldwork in preparing the IEE and EIA report for the three subproject roads. The consultation during preparation of the IEE was carried out between September and November 2004, in conjunction with consultations for social and poverty assessment. Locations were selected to represent various community characteristics in terms of urban and rural locations, and access to basic services. The focus of the discussions was participants' perceptions and concerns about the subprojects. Respondents suggested the inclusion of signage to discourage fast driving, improvements to crossings for pedestrians, and the inclusion of sidewalks. These measures have been included in the EMP.

61. The consultations for the EIA of the A 012 were carried out in May and July 2005. During the first consultation in May, similar concerns were raised, such as the need for proper signage to discourage fast driving and to the provision of crossings for pedestrians. These have been included in the EMP. The consultations with affected people living near the KRWS focused on potential problems related to the presence of wildlife in the project area. The local people pointed out that the elephants mostly come in groups to the project area at late noon and in the evening, although sometimes an elephant would come on its own in the morning. The communities and the officers of the KRWS confirmed that there had been no traffic collisions involving wildlife in the last 5 years.

62. The second consultation for EIA of the A012 was carried by focusing the discussion on the proposed EMP. The EMP has addressed the environmental concerns related to construction works of general affected people. However, people lives along the rerouting road in Puttalam city raised their concerns related to land acquisition required for widening the road. Therefore, it is recommended that further consultations needed prior to finalizing the detailed engineering design.

#### **G. Conclusions and Recommendations**

63. Almost all significant adverse impacts of the proposed Project are predicted to occur during construction. The impacts will be short-term and reversible. They should be manageable and almost all of them can be minimized through engineering solutions that can easily be incorporated into the project design. However, the EMP and monitoring plan must be properly implemented.

64. The IEE, EIA, and EMP will be reviewed during the detailed design stage to examine whether remedial actions are needed to deal with any unforeseen impacts and to identify the location specific for EMP. Should the engineering design require changes to the existing project plan envisaged in the feasibility study, the RDA will re-assess the potential impacts. If they are

significant, an environmental impact assessment study, including an EMP, will be prepared and submitted to relevant government agencies and ADB.

## V. ENVIRONMENTAL CRITERIA FOR SUBPROJECTS

65. The Project involves upgrading existing roads to two-lane standard roads, with cycle lanes and shoulders. In commercial areas, roads will have sidewalks and parking lanes. The subprojects have been selected from the RDA's priority list (annexed to the Report and Recommendation of the President of the Project) taking into consideration the following criteria:

- (i) The subprojects should avoid, as much as possible, passing through any designated wildlife sanctuaries, national parks, other sanctuaries, or areas with national or international significance (e.g., protected wetlands designated by the Wetland Convention).
- (ii) The subproject should avoid, as much as possible, passing through any cultural heritage site designated by the national authorities or the United Nations Educational, Scientific and Cultural Organization (UNESCO).

## VI. ENVIRONMENTAL ASSESSMENT AND REVIEW FRAMEWORK

### A. Environmental Assessment Requirement

66. Taking into account (i) the potential impacts of the Project, (ii) ADB's *Environmental Assessment Guidelines*, (iii) ADB's *Environment Policy*, (iv) the Government notification on environmental impact assessment requirements, and (v) the National Environmental Act No. 47 of 1980, the subprojects will be classified according to the following criteria.

- (i) A subproject will be classified as category A, which requires an EIA, including an EMP, if the subproject:
  - (a) requires complex mitigation measures, which need to be prepared through an in-depth assessment of the impacts, and needs a detailed study to prepare these mitigation measures;
  - (b) generates impacts on ecologically sensitive areas that could be caused by the subproject passing through or being located less than 100 m from any designated wildlife sanctuaries, national parks, other sanctuaries, botanical gardens or any area of international significance (e.g., protected wetland designated by Wetland Convention), located 300 m from the coastline, or passing through any cultural heritage site designated by UNESCO; and
  - (c) involves establishing a by-pass or re-alignment, or if the by-pass or realignment passes through any ecologically-sensitive areas (hilly, mountainous, forested, wetlands, nearby estuarine, or other important ecological areas).
- (ii) Subprojects that are not included in (i) above will be classified as category B and will require an IEE, including an EMP. In addition, if the land acquisition and resettlement program involves relocation, the development of the relocation area will require an IEE, including an EMP.

## **B. Review Procedure for Environmental Assessment of Subprojects and Responsibilities of RDA and ADB**

67. To ensure that the remaining subprojects will be prepared in accordance with the ADB's *Environmental Assessment Guidelines* and the Government notification on environmental assessment requirements and that implementation of the Project complies with the safeguard policies of ADB and the Government, the RDA and ADB agreed on the following division of responsibilities.

- (i) RDA's will assume the following responsibilities:
  - (a) Prepare an environmental screening checklist and classify the subprojects in accordance to the Government and ADB's environmental assessment requirements.
  - (b) Based on the environmental classification of the subprojects, prepare the terms of reference of an IEE or EIA study.
  - (c) Hire environmental consultant(s) to prepare an IEE or EIA report, including an EMP, and an SEIA for public disclosure.
  - (d) Undertake an initial review of the IEE and SIEE or EIA and SEIA.
  - (e) Submit the IEE or EIA report and the result of reviewing these reports to ADB .
  - (f) Obtain necessary permits from relevant government agencies (e.g., environmental clearance, forest clearance, and water board clearance).
  - (g) Ensure that all necessary regulatory clearances are obtained before civil work begins on a subproject.
  - (h) Submit the IEE and SIEE or the EIA and SEIA as well as all the required clearances obtained from the relevant government agencies to ADB.
  - (i) Ensure that the mitigation measures that need to be incorporated into the construction stage are included in the bidding document.
  - (j) Ensure that contractors have access to the EIA or IEE and EMP reports of the subproject.
  - (k) Ensure that the environmental management and monitoring plan, including all proposed mitigation measures, is properly implemented.
  - (l) Monitor implementation of the environmental management plan and present findings in an environmental monitoring report.
  - (m) In case unpredicted environmental impacts occur during project implementation, provide an environmental emergency program and implement this program.
  - (n) In case a subproject needs to have its alignment change, revise/reconfirm environmental classification, and review whether a supplementary IEE or EIA study is required. If it is required, prepare the terms of reference for a supplementary IEE or EIA and hire an environment consultant to carry out the study.
  - (o) Submit a semiannual report on implementing the EMP and include implementation of the environmental emergency program (if any) to the CEA, the relevant project approving authority and to ADB.
  - (p) For sample subprojects, update the EMP to identify location specific for implementation.

- (ii) ADB will assume the following responsibilities.
  - (a) Review the IEE or EIA report as the basis for approving the subprojects
  - (b) Issue environmental approval for subprojects.
  - (c) Undertake annual monitoring of the implementation of EMP and due diligence as part of the overall project review mission.

### **C. Environmental Due Diligence to Ensure Compliance with ADB's Environment Policy**

68. The RDA should ensure that ADB be given access to undertake environmental due diligence for all subprojects, if necessary. However, RDA has primary responsibility for undertaking environmental due diligence and for monitoring implementation of environmental mitigation measures for all subprojects. The due diligence report and monitoring of the implementation of the environmental management plan need to be systematically documented.

### **D. Public Disclosure**

69. In the context of disclosing environmental documentation to the public, the RDA and ADB agree on the following:

- (i) The RDA is responsible for ensuring that public consultations, particularly with affected people, are undertaken adequately during preparation of IEE and EIA for the remaining subprojects.
- (ii) The RDA is responsible for ensuring that all environmental assessment documentations, including the environmental due diligence and monitoring reports, are properly and systematically kept as part of RDA records on each subproject.
- (iii) All environmental documents are subject to public disclosure and should be made available to the public, if requested.
- (iv) For category A subprojects, the summary of the EIAs (SEIAs) need to be made available to the public and posted on ADB's website at least 120 days before the approval of the respective subproject(s). The SEIA has to be reviewed by ADB before it is disclosed to the public.

### **E. Staffing Requirements and Budget**

70. Under the RDA's new organization structure, an ESD will be established and will report directly to the general manager. The environment consultant will be hired to assist the environment officers at the ESD to ensure that the environmental assessment and review framework is strictly implemented. In addition, this consultant will also assist the Project implementation unit to (i) ensure that all bidding documents cover the contractor's obligation to implement mitigation measures, (ii) supervise implementation of mitigation measures and the EMP, (iii) assist in monitoring implementation of EMP for this Project, and (iv) prepare a semiannual report on implementation of the EMP. At the chief resident engineer level, an environmental consultant will be hired to prepare the IEE or EIA for the follow up subprojects.

71. The project budget covers (i) implementation of the environmental review procedure, (ii) undertaking IEE and EIA studies for the remaining subprojects, (iii) monitoring implementation of the mitigation measures and EMP, and (iv) undertaking environmental monitoring.

## **VII. CONCLUSION**

72. The potential environmental impacts generated by the sample subprojects are expected to be temporary and reversible. The proposed mitigation measures for the sample subprojects are sufficient. However, the mitigation measures and the EMP must be strictly implemented, and continued monitoring of EMP implementation needs to be properly carried out. A semiannual report on EMP implementation should be submitted to ADB and the relevant government agencies.

73. The environmental assessment and review framework has been formulated for the upgrading of the national highway network. This framework was developed to ensure that the Project will be implemented in accordance with the environmental policies of ADB and the Government.

## ENVIRONMENTAL MANAGEMENT PLAN FOR A 024 AND B 157

Project Activity and Potential Environmental Impacts	Mitigation Measures	Approximate Location	Cost Estimate	Institutional Responsibility	
				Implementation	Supervision
<i>Design/Preconstruction:</i>					
Effects on private property and items of cultural and religious significance	Minimize required land by widening in one side of the road as much as possible.  Prepare detail resettlement plan for the project, under which compensatory measures are determined with the affected community.	Throughout project roads, particularly within urban areas.	Design cost	Design team in close consultation with the local communities	RDA  RDA and Local Authority
Loss of some roadside trees from widening and realignment operations	Plan roadside trees according to a plan developed with local communities at least double the number of trees that will be cut	Sections of the projects roads in peri-urban and semi rural areas	Design cost	Design team in close consultation with the local communities	RDA and Local Authority
Effects of the extraction of materials on stability and visual appearance of their sources, and nuisance to local communities	Restriction of extraction of materials sources approved by the Geological Survey and Mines Bureau, and consultations with local communities	All potential materials sources for the project roads	Design cost	Detailed design team	RDA, Local Authority, and GSMB
Exacerbation of the current effects of a shortage of sustainable sources of sand for construction in Sri Lanka generally	Use of alternatives to sand, including the re-use of pavement materials, to the extent practicable	All project roads	Design cost	Detailed design team	RDA
Long term road safety, particularly of pedestrian road users	Provide signage to enhance safety of pedestrian crossings. Provide improvements pedestrian walkways where feasible.	Throughout the roads and attention should be given in settlement area	Design cost	Detailed design team in close consultation with local communities.	RDA and local authority
d. Possible change of alignment	Should the engineering design require changes to the alignment envisaged in the feasibility study, re-assess the potential impacts and prepare additional study as necessary.	All project roads	Design cost	Design consultants	PIU, RDA
<i>Construction:</i>					
Risk of accidental damage to trees and property	Minimize risks of accidental damage by ensuring that works are properly supervised on site, that vehicles and equipment are operated by trained and licensed personnel, that workers are briefed as to the importance of minimizing damage.  Mark vulnerable assets such as mature trees clearly to identify them to workers	Throughout project roads	Engineering cost	Contractor	RDA and local authority

Project Activity and Potential Environmental Impacts	Mitigation Measures	Approximate Location	Cost Estimate	Institutional Responsibility	
				Implementation	Supervision
Damage to land, visual impacts and collection of stagnant water from borrowing of earth	Choice of borrow sites to avoid cultivable land, obtaining agreements with landowners and appropriate permits, siting borrow pits away from residential areas, site restoration by landscaping	Materials source sites	Engineering Cost	Contractor	RDA, local authority, and GSMB
Hazards associated with exposure of sulfaquant soils	Rapid identification of sulfaquant soils, ensuring that they are covered by suitable soil material to reduce contact with the air	Throughout the road area near the coast	Engineering Cost	Contractor	RDA and CCD
Disruption to traffic, damage to minor roads, increased dust and noise nuisance from haulage of materials	Choice of quarries and borrow sites that are served by roads of adequate capacity for heavy trucks. Where minor roads are used, provision for repair and restoration	Roads linking materials source sites to construction sites	Engineering Cost	Contractor	RDA
Compaction of soil by construction plant and equipment	Limiting movement and stationing of plant and vehicles to the Right of Way, and specific sites where appropriate leases have been negotiated, and/or clearances obtained	Throughout project roads	Engineering Cost	Contractor	RDA
Potential competition with local residents for water sources	Select sources of water for construction use that are distant from residential areas, and obtaining agreements with local communities.	Throughout project roads	Engineering Cost	Contractor	RDA
Pollution of water bodies from spills and leakages from stores, vehicles and equipment and from temporary workers' toilet facilities.	Secure and controlled storage of all toxic and hazardous materials Management of vehicles and equipment in good condition, ensuring no undue leakage of oil or fuel Servicing of vehicles and equipment at properly managed and equipped workshops, where waste oil is collected and disposed of at approved locations Sanitation arrangements at work sites and temporary accommodation facilities, such that no raw sewage is released into drains or water bodies	Depots, stores, work sites, and workers' accommodation facilities	Engineering Cost	Contractor	RDA
Release of silt into water bodies resulting from earthworks operations and bridge replacement works	Use of silt traps where earthworks take place adjacent to water bodies Proper disposal of waste and excavated material Re-use of concrete from dismantled bridges to the extent practicable.	Throughout project roads	Engineering Cost	Contractor	RDA

Project Activity and Potential Environmental Impacts	Mitigation Measures	Approximate Location	Cost Estimate	Institutional Responsibility	
				Implementation	Supervision
Severance of utilities during construction, where relocation is necessary and as a result of accidental damage.	<p>Information the public on timing and duration of any disruption to water, power, telecommunication or other services.</p> <p>Reduction of risk of accidental damage by ensuring that vehicles and equipment are operated by trained and licensed personnel, and that operations are adequately supervised.</p>	In urban areas such as Aluthgama and Matara	Engineering Cost	Contractor	RDA
Impedance of traffic flows by construction operations and the movement of construction vehicles and equipment	<p>Provision of advance information to the public on the timing and duration of construction operations that will affect traffic flows.</p> <p>Preparation of a traffic management plan in co-operation with local traffic police.</p> <p>Planning and management of construction operations to minimize disruption and maintain at least one lane in operation.</p> <p>Use of flagmen and/or temporary traffic lights to control traffic flows at constricted sites, including safe crossings for pedestrians.</p> <p>Limiting movements of large trucks to off-peak traffic times to the extent possible.</p>	Throughout project roads	Engineering Cost	Contractor	RDA
Safety hazards to works and the public	<p>Training and briefing of works on safety precautions, their responsibility for their safety and the safety of others.</p> <p>Provision of protective clothing and equipment to workers.</p> <p>Ensuring that vehicle and equipment operators are properly licensed and trained.</p> <p>Arranging for provision of first aid facilities, rapid availability of trained paramedical personnel, and emergency transport to nearest hospital with accident and emergency facilities.</p> <p>Allocation of responsibilities to ensure that the arrangements are kept in place.</p>	Throughout project roads	Engineering Cost	Contractor	RDA

Project Activity and Potential Environmental Impacts	Mitigation Measures	Approximate Location	Cost Estimate	Institutional Responsibility	
				Implementation	Supervision
	<p>Arranging for regular safety checks of vehicles and material, and allocation of responsibility for checking.</p> <p>Ensuring that storage materials are supervised and inspected routinely by trained personnel, that harmful and explosive substances are stored in a secure location</p> <p>Provision of hazard warning signs at construction sites, and directing vehicle and pedestrian traffic away from work sites.</p>	Throughout project roads	Engineering Cost	Contractor	RDA
Emissions of dust and exhaust fumes from construction operations	<p>Sitting of hot mix plant at locations distant from residential areas.</p> <p>Procurement of high quality plant, maintenance of them in good condition, and operation by trained and qualified personnel.</p> <p>Maintenance of all plant and vehicles in compliance with national emissions standards</p> <p>Choice of sites for materials extraction away from residential areas.</p>	Throughout project roads	Engineering Cost	Contractor in consultation with local communities	RDA and local authority
Noise and vibration nuisance from construction operations.	<p>Maintenance of construction plant and equipment to high standards, ensuring that exhaust baffles are fitted and maintained in serviceable condition.</p> <p>All reasonable measures are taken to limit noise generation near schools and places of worship, consultations with key personnel at each institution to agree acceptable times for carrying out construction operations, when they will have least impact.</p> <p>Limit the working time No work at night time unless special permit obtain from local communities</p>	<p>Throughout project roads</p> <p>At schools and places of worship</p>	Engineering Cost	Contractor in consultation with local communities	RDA and local authority

Project Activity and Potential Environmental Impacts	Mitigation Measures	Approximate Location	Cost Estimate	Institutional Responsibility	
				Implementation	Supervision
Effects associated with temporary worker populations	<p>Awareness-raising among temporary workers of important social and health issues, including the spread of sexually transmitted and other disease.</p> <p>Provision of counseling and medical staff for workers as appropriate.</p> <p>Assurance that arrangements for worker accommodation are satisfactory in terms of hygiene, cleanliness and safety.</p>	Sites where workers are accommodated	Engineering Cost	Contractor	RDA
<i>During Operation:</i>					
Risks of pollution and flooding of water bodies by failures in the road drainage system	Design of the drainage system to withstand design year storm events	Throughout project roads	Inclusion in cost estimates for drainage improvement works	Detailed Design Team	RDA
	Regular maintenance of drains and culverts	Throughout project roads		RDA	RDA
Safety of road and roadside users and residents	Compliance with law on licensing, reporting and monitoring for handling hazardous materials.				
Effects on air quality	Monitoring to determine changes in air quality during operation	Throughout project roads	To be determined	Contractor	RDA
	Management of maintenance operations to ensure that they take place during off-peak traffic periods, that dust and fume emissions are suppressed, and that plant and equipment are maintained in good serviceable order.	Throughout project roads	Engineering cost	Contractor or unit responsible for maintenance	RDA
Noise	Monitoring to determine changes in noise levels	Throughout project roads	To be determined		RDA

## ENVIRONMENTAL MANAGEMENT PLAN FOR PUTTALAM – ANURADAPHURA

### A. Design/Preconstruction Stage

Issue/ Component	Remedial Measure	Approximate Location	Mitigation Cost	Institutional Responsibility	
				Implementation	Supervision
<b>1. General</b>					
a. Alignment Selection Criteria (Social, Environmental, Engineering, & Economic)	<ul style="list-style-type: none"> <li>i. Minimize interference to elephant sanctuary, reserve forests, human settlements, and centers of commercial and industrial activity (Social and Environmental).</li> <li>ii. Choose alignment which offers balance between shortest distance between two points effecting economies in construction operation and maintenance (Economic).</li> <li>iii. Where unavoidable minimize impacts to Wildlife Sanctuaries by minimizing widening and realignment and provide traffic calming to minimize disturbance to WLS (Environmental).</li> <li>iv. Avoid interference to schools, hospitals, primary health clinics, places of worship, archaeological sites and cultural centers, playgrounds, and other public facilities (Environmental and Social)</li> <li>v. Facilitate compliance with highway alignments standards for curvature and grading (Technical).</li> <li>vi. Avoid utility services, reservoirs, water pipes, electricity supply, telecommunications and waste disposal infrastructure (Technical).</li> <li>vii. Keep to major river crossings but adjust position of large bridges to facilitate compliance with alignment criteria for curvature and grading, avoid interference to sensitive receivers and to prevent increased siltation (Technical, Social and Environmental)</li> <li>viii. Realign in wet areas to facilitate creation of sufficient space for meaningful buffer tree planting (over and above statutory requirements) where alignment passes within 500m of the high water mark for water bodies.</li> <li>ix. Redesign small culverts and bridges to be widened on the downstream side to prevent increased siltation (Tech. &amp; Environmental).</li> </ul>	<p>Puttalam reroutes, Km 127.0 on A03 to km 3.0 on A012 Use alternative roads south of Puttalam to facilitate rerouting, e.g. using selected existing alignments south of Puttalam and east of railway crossings to minimize land take.</p> <p>Road within sanctuary</p>	Included in the design cost	Design consultant	PIU, RDA

Issue/ Component	Remedial Measure	Approximate Location	Mitigation Cost	Institutional Responsibility	
				Implementation	Supervision
	<p>x. Choose realignment to facilitate release of flood flows after heavy rains, but with water harvesting and features to facilitate retention of water to recharge groundwater, at other times (Technical and Social).</p> <p>xi. Avoid Cultivated Forest by choose left or right side widening to avoid land take in large stretches of Forest and on either side (Environmental).</p> <p>xii. Realign along edge of property boundaries and with left or right side widening to minimize impacts to trees and agricultural, commercial or industrial activities and cultivated forest (Environmental, Economic and Social).</p> <p>xiii. Realignments to be curvilinear to optimize sub-base conditions, minimize cut and fill requirements, reduce visual impacts and driver fatigue (Social, Technical and Environmental)</p> <p>xiv. Realign road to move away from low-lying avoid localized areas of poor drainage, wetland areas, reservoirs and areas of ecological interest, watering holes, within forests, specimen trees (Technical and Environmental).</p>		Design cost	Design consultant	PIU, RDA
b. Animal sanctuary	<p>Consider / facilitate / introduce alternative additional tank(s) in Tabbowa elephant sanctuary, north of A012. To provide alternative watering place to tanks near villages south of the road.</p> <p>Traffic calming, wild animal warning signs and speed breakers every 500m.</p> <p><b>IN SANCTUARY</b></p> <p>Traffic calming, speed limit sign 30km/hr, no horn signs, wild animal warning signs and speed breakers every 500m</p> <p>Demolish and remove uninhabited settlers' homes, fences and other barriers to elephant movement</p> <p>Additions and modifications to position and type of elephant repellent fencing (electric / other) to be designed in coordination with Tabbowa Sanctuary Warden and other local user groups.</p> <p><b>OUT of SANCTUARY</b></p> <p>Traffic calming, wild animal warning signs and speed breakers every 500m</p>	<p>Between Km 19+500 to 22+500, about 1km north of A012.</p> <ol style="list-style-type: none"> <li>1. Start from West of Tabbowa tank km14+500 up to km16+500,</li> <li>2. Karuwalagas Wewa tank km17+000 on A012 to the East of Karuwalagas tank km17+500</li> <li>3. From West to East of Ittiwatana Wewa tank km18+000 to km20+500</li> <li>4. From West to East of Thahikada Wewa tank km21+000 to km21+500</li> <li>5. From west to east of Palukoruwalagas Wewa tank km22+000 to km23+500.</li> </ol>	Design cost	Design consultant, TS Warden, PAP	PIU, RDA

Issue/ Component	Remedial Measure	Approximate Location	Mitigation Cost	Institutional Responsibility	
				Implementation	Supervision
c. Constricted sections, town and settlements	<p>To avoid social disruption to daily routine provide service lanes, parking facilities - off road lay-bys.</p> <p>Reduce speed in all settlement areas.</p> <p>Adjust road centerline within settlement area to facilitate passage of through traffic and avoid trees.</p> <p>Provide service lanes, parking facilities - off road lay-bys Reduce median width and reduce speed as a fall back option where other safety and engineering constraints permit.</p> <p>Compensation will be given to PAPs based on the RAP's entitlement policy.</p>	<p>Throughout project corridor</p> <p>Within 5km of Puttalam.</p> <p>Within 5km of Puttalam (notwithstanding bypass arrangements).</p> <p>Aluthgama Junction km28+000 to km28+000</p> <p>Salyawewa km33+500 to km35+000</p> <p>Kala Oya km37+700 to km39+000</p> <p>Tammanewa km40+500 to km41+500</p> <p>Nochchiyangama Km51+000 to km53+000</p>	Design cost	Design consultant	PIU, RDA
d. Possible change of alignment	<p>Should the engineering design require changes to the alignment envisaged in the feasibility study, re-assess the potential impacts and prepare additional study as necessary.</p>	All project roads.	Design cost	Design consultants	PIU, RDA
e. Land and Property Losses	<p>To avoid social disruption and damage to religious structures, the road centerline has been adjusted.</p> <p>The bridge on River Kala Oya between km37+300 and km37+800 to have <b>additional lane on south side</b> to avoid disturbance to temple on north side of road and several large trees.</p> <p>Adopting suitable cross-sections and adjustment of median width.</p> <p>Compensation will be given to PAPs based on the RAP's entitlement policy.</p>	<p>Throughout project corridor</p> <p>Between km37+300 and km37+800 south of the existing bridge to avoid the religious structure and a specimen champion tree</p> <p>Reduced median width within settlement area</p> <p>Retaining walls will be provided where required.</p>	Design cost	Design consultant	PIU, RDA
<b>2. Land</b>					
a. Embankment slopes	<p>At all critical slopes along the roadsides throughout the project, to be subject to re-vegetation or re-turfing at the earliest opportunity. To be carried out before the start of the rainy season as per best practice and as recommended in the feasibility study (FS) with bio-engineering treatments of embankment slopes for erosion control.</p> <p>Especially the slopes across/along river/rivulets crossings the more undulating terrain.</p>	<p>Based on existing pavement and 2m embankments.</p> <p>Location of moderate slopes near bridges.</p> <p>All locations as per FS</p>	Design cost	Design consultant	PIU, RDA

Issue/ Component	Remedial Measure	Approximate Location	Mitigation Cost	Institutional Responsibility	
				Implementation	Supervision
b. Road inundation	The planned alterations and improvements vertical alignment or increases in the vertical elevation from the existing roadway shall include suitable sizes of cross drainage structures e.g., box culverts and pipe culverts.  Bridges will also be improved to avoid inundation.	Locations for the 129 Pipe culverts and 50 box culverts as per the FS.  75 bridges as per the FS.	Design cost	Design consultant	PIU, RDA
c. Quarries and borrow areas	No rock, gravel or sand materials shall be extracted or supplied from within the Tabbowa Sanctuary area.  The position of the rock quarry No.12 as identified in FS (Table 5.11.3 pp228) to be carefully verified at the design stage. Use this source only as a last resort.  Extraction of rock sand or gravel materials within 1km of the boundary of the Tabbowa Sanctuary shall be avoided as far as reasonably practicable. Use alternative sources.  Proposed extraction of rock sand or gravel materials within 1km of the TS boundary to be notified to the TS Warden at the detailed design stage and discussed to develop detailed mitigation measures.  Nonproductive lands, barren lands, raised lands, riverbeds, wastelands have been recommended for borrowing earth materials; no productive land shall be used for this purpose.  Through community consultation with the villagers and interactions with state fisheries authorities, low lying areas and wastelands that could be developed into fish ponds are recommended for borrow areas.	All selected borrow pits as identified in the FS  1 km south (RHS) from 17km post.  1km south (RHS) from 17km post.  Use other selected quarries and borrow pits as identified in the FS.  All selected borrow pits as identified in the FS and at detailed design stage.  All selected borrow pits as identified in the FS and at detailed design stage.	Design cost	Design consultant	PIU, RDA
d. Modification of landform	Minor modifications of the present landuse will take place due to the proposed project. However, against the total environmental setting this change is so small that it is insignificant and will not necessitate any special remedial measures.	All along the project corridor	Design cost	Design consultant	PIU, RDA
<b>3. Water</b>					
a. Water resources	The existing courses of the river and canals or streams have been maintained at all the locations. Most of the bridges have been retained and widening has been proposed or shall be modified at the detailed design stage to be on the downstream side wherever practicable so as to prevent increased siltation.	All rivers/streams will be potentially impacted along the project corridor at location for the 129 pipe culverts, 50 box culverts, and 75 bridges as per the FS.	Design cost	Design consultant	PIU, RDA

Issue/ Component	Remedial Measure	Approximate Location	Mitigation Cost	Institutional Responsibility	
				Implementation	Supervision
	<p><b>Protection of Water Bodies</b></p> <p>There are numerous perennial community ponds en-route of the proposed project.</p> <p>Suitable sizes of retaining structures, drainage, bridges and cross drainage structures will be provided at all tanks and on all river / rivulets crossing the project road.</p> <p>There are numerous perennial community ponds en-route of the proposed project.</p> <p>Suitable sizes of retaining structures, drainage, bridges and cross drainage structures will be provided at all tanks and on all river / rivulets crossing the project road.</p>	<ol style="list-style-type: none"> <li>1. tanks near Puttalam depending on detailed design for rerouting.</li> <li>2. Periya Villu tank km3+0500</li> <li>3. Sellankarrdal Wewa tank km10+500</li> <li>4. At small tank km11+300</li> <li>5. Tabbowa tank km15+500 to 16+500.</li> <li>6. At Karuwalagas Wewa tank km17+000</li> <li>7. West of Ittiwatana Wewa tank km18+500</li> <li>8. Palukoruwalagas Wewa tank km22+000.</li> <li>9. Tinbir Wewa tank km45+200</li> <li>10. Lindo Wewa tank km48+500- km49+200. Dunudambu Wewa km49+900- km50+500.</li> <li>11. Dunudambu Wewa km49+900- km50+500.</li> <li>12. Kude Wewa tank km51+900</li> <li>13. Tank at Relapanawa km55+600.</li> <li>14. Sinharagame Wewa km57+000.</li> <li>15. Ikiri Wewa km57+500.</li> <li>16. Maha Bulankulama Wewa km64+100.</li> <li>17. Ulukkulama Wewa km66+500.</li> <li>18. Slyambalagaswewa km68+300.</li> <li>19. Korakaha Wewa tank km69+500- km70+000.</li> </ol>	Design cost	Design consultant	PIU, RDA  Local ground water authority, PIU, RDA

Issue/ Component	Remedial Measure	Approximate Location	Mitigation Cost	Institutional Responsibility	
				Implementation	Supervision
b. Drainage	<p>Natural drains will be suitably modified so that the proposed highway does not obstruct them.</p> <p>Provision of adequate size and number of cross drainage structures.</p> <p>Sections of the corridor that flood have been proposed to be raised suitably along with the cross drainage structures and adequate side drains have been proposed.</p> <p>The proposed alignment has been adequately provided with necessary engineering solutions, on the basis of the highest flood level data.</p>	All through the project corridor	Design cost	Design consultant	PIU, RDA
<b>4. Flora and Fauna</b>					
a. Roadside plantation	<p>Trees shall be saved by constructing / expanding the road on one side in uninhabited stretches and in bypass sections care shall be taken (as far as possible) to avoid planted areas. Minimise width at Tabowwa tank.</p> <p>Even then some of trees will need to be cut subject to detailed design.</p> <p>Road side trees will be removed with prior approval of DFO. Suitable number of trees will be planted for each tree felled as per regulatory compliance.</p> <p>No forest land is required based on the current alignments however in case of acquisition of forest land for the project, compensatory afforestation as per statutory forestry requirements (Forest Ordinance as amended) will be adopted.</p>	<p>Throughout project corridor within ROW. Review at detail design stage:</p> <ol style="list-style-type: none"> <li>1. Specimen Ficus spp Puttalam 0+200 south.</li> <li>2. Specimen front of school Puttalam km0+500 north.</li> <li>3. Specimen front of Siambalawa temple Puttalam km5+500 north.</li> <li>4. Specimen front of Syrambiyadi temple Puttalam km5+650 north.</li> <li>5. Religious (Bodi) tree km6+600north side</li> <li>6. Specimen Palu (Manilkahar haxiandra) kn8+600 north.</li> <li>7. Specimen tree km9+500 north.</li> <li>8. Specimen (Tectona grandis) km14+550 north</li> <li>9. Specimen (Ficus sp.) km154+450 north</li> <li>10. Numerous roadside trees km15+500 to km16+500 (visual barrier for tank birds).</li> <li>11. Specimen tree km18+000 south.</li> <li>12. Large tree km18+500 south.</li> </ol>	<p>Cost of felling of trees SLRs&lt;0.5 million</p> <p>Road side plantation cost SLRs&lt;1.0 million.</p>	DFO, Design consultant, PIU, RDA	PIU, RDA

Issue/ Component	Remedial Measure	Approximate Location	Mitigation Cost	Institutional Responsibility	
				Implementation	Supervision
	<p>Trees shall be saved by constructing / expanding the road on one side in uninhabited stretches and in bypass sections care shall be taken (as far as possible) to avoid planted areas.</p> <p>Minimise width at Tabowwa tank.</p> <p>Even then some of trees will need to be cut subject to detailed design.</p> <p>Road side trees will be removed with prior approval of DFO. Suitable number of trees will be planted for each tree felled as per regulatory compliance.</p> <p>No forest land is required based on the current alignments however in case of acquisition of forest land for the project, compensatory afforestation as per statutory forestry requirements (Forest Ordinance as amended) will be adopted.</p>	<p>Throughout project corridor within ROW. Review at detail design stage:</p> <p>13. Numerous large specimens km19+000 to km23+500 north and south.</p> <p>14. Large tree km28+000 south</p> <p>15. Large Ficus tree km30+200 south front RDA office</p> <p>16. Large tree km36+300 and religious tree to km36+500 south, Saliyawewa Junction</p> <p>17. Large trees north side of bridge Kala Oya km37+500 to 37+800 (widen to south to avoid temple).</p> <p>18. Numerous small trees to km39+000 to 40+200 south</p> <p>19. Large tree km40+500 front of Mahasen Central College, Tammannewa.</p> <p>20. Large religious tree km40+800 south, Tammannewa Junction</p> <p>21. Numerous small trees to km40+800 to 42+000 south, Tammannewa..</p> <p>22. Numerous trees to km43+000 to 46+000 south, Nekategemma.</p> <p>23. Numerous trees to south side opposite Londo Wewa km48+000 to 50+000.</p> <p>24. Large tree to south side at Dunudambu Wewa km50+300.</p>	<p>Cost of felling of trees SLRs&lt;0.5 million</p> <p>Road side plantation cost SLRs&lt;1.0 million.</p>	DFO, Design consultant, PIU, RDA	PIU, RDA
b. Wildlife migration	<p>To mitigate disturbance to wildlife and accidents, traffic calming, speed limit (25km/h) and speed breakers in Tabbowa Sanctuary.</p> <p>Electric fencing to satisfaction of TS Warden and local used groups.</p>	<p>Between km14+000 and km24+000.</p> <p>Intermittent between km14+000 and km24+000.</p>	Design cost	DFO, Design consultant, PIU, RDA	PIU, RDA

Issue/ Component	Remedial Measure	Approximate Location	Mitigation Cost	Institutional Responsibility	
				Implementation	Supervision
c. Trespass into Tabbowa Sanctuary	Areas near habitation along road where vehicles are more likely to stop for refreshments etc in Tabbowa Sanctuary to be electric fenced to prevent egress of vehicle occupants and ingress of elephants to inhabited areas. To prevent wild animal collision accidents on the A012 and also prevent trespassers from entering the TS.	Intermittently between km18+000 and km23+500, subject to detailed advice from TS Warden.	Design cost	DFO, Design consultant, PIU, RDA	PIU, RDA
<b>5. Environmental Quality</b>					
a. Air quality	Improving road geometry, curves, slopes, etc and widening of road to smoothen traffic flow. Pavement roughness will be improved. This will be done through appropriate pavement designs and resurfacing. Additional trees will be planted on both sides of the road where there is opportunity space. These areas will be planted with shrubs of suitable species to subdue dust and to provide a visual barrier.	Throughout project corridor, especially at villages and settlements.	Included in the Project costs	Design consultant	PIU, RDA
b. Solid waste	Solid waste disposal sites will be properly designed and must be at least 250m away from the ROW to the satisfaction of the Engineer and local stakeholders and user groups.	Near the construction sites	Design cost	Design consultant	PIU, RDA
c. Noise levels	At detailed design stage predicted traffic flows at SRs to conform with Schedule 1 for Prescribed Projects. To be confirmed not to exceed noise criteria for e.g. schools, temples. If noise exceeds criteria, propose noise mitigation measures at source (not trees). Removal of bottlenecks and relieving congestion in built-up stretches through improved design. Improvement of junctions/intersections. Separation of bicycles from fast moving traffic.	Throughout project corridor, especially at sensitive locations	Design cost	Design consultant	PIU, RDA
d. Best practice and long term environmental improvement.	Trees to be planted wherever opportunity spaces permit near the road.	Through out the project corridor where minor habitation is within 50m of the proposed road	Design cost	Design consultant	
<b>6. Utilities</b>					
Utility lines community utilities	All utilities likely to be impacted will be relocated with prior approval of the concerned agencies. All community utilities likely to be impacted, such as water sources will be provided at suitable places.	To be identified based on community needs	Project cost	PIU, RDA, concerned government departments	PIU, RDA

Issue/ Component	Remedial Measure	Approximate Location	Mitigation Cost	Institutional Responsibility	
				Implementation	Supervision
<b>7. Cultural heritage</b>					
Cultural property	Major human habitation and religious structures and trees generally well set back and impact on culturally valuable property avoided.  Alignment of additional lane can be suitably adjusted and routed to avoid/minimize impact to cultural property as positioning the additional lane for the bridge on Kala Oya to the south km37+500 to km37+800.  Public consultation has been carried out to obtain opinions about shifting of religious structures.	Major Religious structures in congested human settlements have been avoided  At crossing of Kala Oya to km37+500 to km37+800.	Project cost	PIU, RDA, NGOs and R&R unit	PIU, RDA
<b>B. Construction Stage</b>					
<b>1. Soil</b>					
a. Soil erosion	Stone pitching and retaining walls will be made on steep embankments in critical areas.  Revegetation and hydroseeding of low embankments and planting of grasses and shrubs will be done to slopes.  The depths In borrow pits will be regulated so that the sides will not be steeper than 25%, from the edge of the final section of bank.	Throughout Project corridor, borrow pits (location given above) and service roads, and at bridges on Rivers	Project cost	Contractor	SC, PIU, RDA
b. Loss of topsoil	Agricultural areas will not be used for borrowing of materials, unless requested by the landowner for making ponds or for lowering the land for making it irrigable.	In all the proposed borrow areas located	Project cost	Contractor	SC, PIU, RDA
c. Compaction of soil	Construction vehicles, machinery, and equipment will move, or be stationed in the designated ROW, to avoid unnecessary compaction of soil.	Throughout project corridor	Project cost	Contractor	SC, PIU, RDA
d. Borrowing of earth	No earth will be borrowed from within the ROW. Nonproductive lands, barren lands, raised lands, riverbeds, waste lands will be used for borrowing earth.  If new borrow areas are to be selected, then measures will be taken so that there will be no loss of productive soil, and all environmental considerations will be met.  Unpaved surfaces used for the haulage of borrow materials will be maintained properly.  Precautionary measures such as covering vehicles will be taken to avoid dust and spilling of borrow materials. In borrow areas, three trees will be replaced for every one felled.	In all the proposed borrow areas located  <i>Borrow Pits</i> 6+550km 8+550km	Project cost	Contractor	SC, PIU, RDA

Issue/ Component	Remedial Measure	Approximate Location	Mitigation Cost	Institutional Responsibility	
				Implementation	Supervision
e. Quarry	<p>No quarrying of sand, gravel or rock shall be permitted in the Tabbowa Sanctuary.</p> <p>New quarries will only be opened with prior permission from local/district authorities</p> <p>The quarry material will be obtained from licensed sites with proper environmental clearances.</p>	<p>All proposed quarry sites in FS.</p> <p><i>Except at 17km+100 which is too near Tabbowa Sanctuary</i></p> <p>Rock Quarries</p> <p>30+175km</p> <p>57+050km</p> <p>60+150km</p> <p>60+250km</p>	Project cost	Contractor	Local/district authority, SC, PIU, RDA
f. Contamination of soil from fuel and lubricants	<p>Construction vehicles and equipment will be maintained and refueled so that spillage does not contaminate the soil.</p> <p>Fuel storage and refueling sites will be kept at least 500m away from tanks and 100m from drainage channels and rivers and streams crossing the A012.</p>	Throughout project corridor and especially near tanks, rivers and streams borrow areas	Engineering cost	Contractor	SC, PIU, RDA
g. Contamination of soil from construction wastes and quarry materials.	<p>No waste or spoil disposal shall take place in the Tabbowa Sanctuary or within the national forest areas (Forest Ordinance) or on any productive agricultural land.</p> <p>Surplus earth shall be reused as far as possible. If not usable in construction it shall be stockpiled for use in landscaping works and tree planting.</p> <p>Earth disposal, if absolutely essential, shall be to area areas selected and approved area by the supervision consultant in consultation with the local authorities. All spoils will be removed and disposed of as required and the site will be fully cleaned before handing over.</p> <p>Non-bituminous wastes from construction activities will be disposed of in borrow pits at approved locations at least 500m from water courses and tanks and covered with a layer of topsoil conserved from opening the pit.</p> <p>Bituminous wastes will be disposed of in a dumping site approved by the supervision consultant and the local authority.</p>	All construction sites throughout project Corridor	Engineering cost plus Rs0.5 million toward maintenance cost for soil conservation	Contractor	SC, PIU, RDA
<b>2. Water</b>					
a. Water bodies	<p>Temporary drainage measures such as silt fences, sand bagging and shall be installed prior construction to protect all water bodies from contaminated runoff. Temporary drainage shall discharge to vegetated buffer areas and not directly to streams.</p> <p>Measures will be taken to train the workforce to avoid neglect prevent the temporary or permanent damage to water bodies.</p>	At water bodies or cross drainage	Project cost	Contractor	SC, PIU, RDA
b. Other water sources	<p>Any community water source, such as wells, tube-wells, etc., which must be removed shall be reprovisioned the satisfaction of the local user group prior to the removal and commencement of construction. The alternative sources shall provide at least the same quantity of water as the removed source.</p>	Along the project corridor	Project cost	Contractor	SC, PIU, RDA

Issue/ Component	Remedial Measure	Approximate Location	Mitigation Cost	Institutional Responsibility	
				Implementation	Supervision
c. Drainage and run-off	At cross drainage structures, the earth, stone or any other construction material will be properly disposed of, so as not to block the flow of water.	Throughout project corridor	Project cost	Contractor	SC, PIU, RDA
d. Contamination of water from construction waste.	Construction work close to streams or other water bodies will be avoided, especially during the monsoon period. Waste storage to be located with a vegetation buffer between it and water. All necessary precautions will be taken to construct temporary or permanent devices to prevent water pollution due to increased siltation and turbidity. All necessary measures will be taken to prevent earthworks and stone works from impeding rivers, streams, water canals, or drainage system. Wastes must be collected, stored, and taken to the approved disposal sites.	Throughout project corridor	Project cost	Contractor	SC, PIU, RDA
e. Contamination of water from fuel and lubricants	To avoid contamination from fuel and lubricants, vehicles and powered equipment will be properly maintained and refueled. Oil and grease traps will be provided at fuelling locations, to prevent contamination of water. The slopes of embankments leading to water bodies will be modified and screened so that contaminants do not enter the water body. Side drains provided in the settlement areas will discharge through a silt trap (acting as a primary settling tank). Refueling and lubrication will be conducted using drip trays to prevent soil contamination Waste petroleum products will be collected, stored in drums and recycled wherever possible. If disposal is required it shall be at approved sites as per Sri Lankan hazardous waste management regulations. Waste petroleum products will be collected, stored in drums and recycled wherever possible. If disposal is required it shall be at approved sites as per Sri Lankan hazardous waste management regulations. Water quality will be monitored. Out of the four Rivers only Bewas River is a perennial River and rest all dries up during summer season. However the water quality for such rivers will be monitored during non-summer season.	Throughout project corridor	Project cost  Rs0.072 million has been allocated for water quality monitoring at 4 sampling locations.	Contractor	SC, PIU, RDA

Issue/ Component	Remedial Measure	Approximate Location	Mitigation Cost	Institutional Responsibility	
				Implementation	Supervision
f. Sanitation and waste disposal in construction camps	No construction camp will be located within 500m of the Tabbowa Sanctuary. The construction camps will be located away from the habitation. The sewage system for such camps will be properly designed and built so that no water pollution takes place. If necessary, temporary effluent collection and treatment facilities will be installed in the construction camps. The workplace will have proper medical facilities.	At construction camp locations, wherever located along the project corridor	Project cost for maintenance of hygienic condition at construction camps	Contractor	SC, PIU, RDA
g. Use of water for construction	The contractor will arrange for water required for construction so that nearby communities remain unaffected. Since the project area does have significant perennial surface bodies, water shall be extracted after agreement with the local authority and the local end user groups. No water to be extracted from the tanks and watering holes in the Tabbowa Sanctuary without the written permission of the WCD after liaison with the TS warden. Water wastage will be avoided by training staff in proper water management techniques. Water usage will be recorded and water will not be wasted during the construction.	Throughout project corridor	Engineering cost	Contractor	SC, PIU, RDA
<b>3. Air</b>					
a. Emission from construction vehicles and machinery	All the machinery and plants will be downwind of human settlements. The pollution emission levels of all vehicles, equipment and machinery used for construction will conform to Sri Lanka standards prescribed in Sri Lanka National Environmental Act (1980, Gazette, 30th June 2003). Air pollutant parameters will be monitored regularly during construction, as envisaged in the EMP.  The asphalt plant, crushers, and the batching plants will be at least 1 km in the downwind of the nearest human settlement.	Construction sites	SLRs < 0.1 million for air quality monitoring at four construction sites	Contractor	SC, PIU, RDA

Issue/ Component	Remedial Measure	Approximate Location	Mitigation Cost	Institutional Responsibility	
				Implementation	Supervision
b. Dust control	<p>All precautions will be taken to reduce the level of dust emissions from the hot mix plants, crushers and batching plants.</p> <p>The hot-mix plants, crushers and batching plants will be at least 1 km downwind from the nearest habitation. The hot mix plant will be fitted with dust extraction units.</p> <p>Water will be sprayed in the lime, cement, and earth mixing sites; asphalt mixing site; and temporary service and access roads.</p> <p>After compacting works, water will be sprayed on the earthwork regularly to prevent dust.</p> <p>Hydroseeding of embankments shall take place as soon as possible after works are completed. Delivery vehicles will be covered.</p> <p>Mixing equipment will be well sealed and equipped as per existing standards.</p>	Throughout project corridor	Civil works cost plus Rs1.5 million	Contractor	SC, PIU, RDA
<b>4. Noise Levels</b>					
a. Noise from vehicles, asphalt plant and powered mechanical equipment	<p>The plants and equipment used for construction shall be minimized in duration and intensity to avoid disturbance of wildlife and nuisance to local human settlements.</p> <p>Vehicles and equipment used will be fitted with silencer and maintained to keep the noise at minimum levels.</p> <p>Noise standards for industrial enterprises will be strictly enforced to protect construction workers from severe noise impacts in line with standards prescribed in Sri Lanka National Environmental Act (1980, Gazette, 30th June 2003).</p> <p>Workers will be provided with appropriate ear muffs/plugs.</p> <p>The noise level will be monitored during the construction, as per the EMP.</p> <p>Portable temporary noise barriers will be placed near sensitive receivers in urban locations.</p>	<p>Throughout project corridor</p> <p>Throughout project corridor</p> <p>At hot mix plant, batching plants and construction sites.</p>	<p>SLRs&lt;0.1 million for four construction sites and other specified locations noise monitoring during construction</p> <p>SLRs&lt;0.10 million for temporary noise barriers.</p>	<p>Contractor</p> <p>Contractor</p>	<p>SC, PIU, RDA</p> <p>SC, PIU, RDA</p>
b. Noise from blasting operations	<p>Requirements for blasting will be reviewed at the detailed design stage.</p> <p>If required blasting will be carried out as per Sri Lankan statutory requirements.</p> <p>No blasting will take place within 2km of the TS.</p> <p>People living near blasting sites will be informed of blasting times prior to the blasting.</p> <p>Blasting will not be undertaken at night.</p> <p>Workers at blasting sites will be provided with earplugs.</p>	Quarry sites	Civil works cost	Contractor	SC, PIU, RDA

Issue/ Component	Remedial Measure	Approximate Location	Mitigation Cost	Institutional Responsibility	
				Implementation	Supervision
c. Noise barriers	Solid, movable, continuous temporary barriers will be installed at sensitive locations to comply with statutory noise levels.	Sensitive locations such as educational institutions, hospitals etc.	SLRs 0.3 million for wall per noise barrier	Contractor	SC, PIU, RDA
<b>5. Flora</b>					
a. Loss or damage to vegetation.	Areas cleared of trees will be replanted according to the Forest Ordinance. Keeping in mind the survival rate 5 trees will be planted for each tree to be grown.  Only trees clearly identified and conspicuously marked for felling will be cleared within the ROW.	Throughout project corridor	SLRs<0.5 million for felling of trees plus SLRs.<0.5 million for road side plantation	Contractor	SC, PIU, RDA
b. Compaction of soil	Construction vehicles, machinery, and equipment will move or be stationed in the designated area only, to prevent compaction of vegetation outside ROW.  While operating on temporarily acquired land for traffic detours, storage, material handling, or any other construction-related or incidental activities, trampling of soil and damage to naturally occurring herbs and grasses will be kept to the minimum.	Throughout project corridor  Throughout project corridor	Engineering cost  Civil works cost	Contractor  Contractor	SC, PIU, RDA  SC, PIU, RDA
<b>6. Fauna</b>					
Loss, damage or disruption to fauna	Construction workers will be directed not to disrupt or damage the fauna. State rules for hunting (wildlife protection) will be adhered to and rules for bird catching will be followed. Construction vehicles will ply specified access roads to avoid accidents with wildlife and cattle.	Throughout project corridor	No cost is involved	Contractor	SC, PIU, RDA
<b>7 Safety and Accidental Risks</b>					
a. Accident risks from construction activities	To ensure safe temporary accesses, lighting and safety signal devices will be installed. Traffic rules and regulations will be strictly adhered to. If blasting is required, at blasting sites, the blasting time, signal, and guarding will be regulated. Prior to blasting, the site will be thoroughly inspected. Safety of workers during construction will be protected by providing helmets, masks, safety goggles, etc.	Throughout project corridor	Civil works cost	Contractor	SC, PIU, RDA

Issue/ Component	Remedial Measure	Approximate Location	Mitigation Cost	Institutional Responsibility	
				Implementation	Supervision
	<p>The electrical equipment will be checked regularly.</p> <p>At every work place, a readily available first aid unit including an adequate supply of dressing materials.</p> <p>A mode of transport (vehicle suitable to act as ambulance), nursing staff, and doctor will be available if needed.</p> <p>Training on road safety education will be imparted to drivers of construction vehicles. No drunk driving will be allowed.</p> <p>Adequate signage, barriers and persons with flags to control traffic will be provided during construction.</p> <p>Communications through newspaper/ announcements/ radio/TV etc. about the time frame of the project and the activities causing disruption to road access will be made. Information on the temporary arrangements made to give relief to the public will be included.</p>	Throughout project corridor	Civil works cost	Contractor	SC, PIU, RDA
b. Loss of access and traffic jams	Temporary access will be built at interchanges of the highway and other roads. Since the present road is to be widened primarily on one side, the chances of severe congestion are minimal. However, temporary diversions will be provided wherever necessary, with proper drainage facilities.	Along settlement stretches and at major intersections.	Civil works cost	Contractor	SC, PIU, RDA
c. Health issues	<p>Adequate drainage, sanitation, and waste disposal facilities provided at work places.</p> <p>Proper drainage maintained around the sites to avoid water logging / disease.</p> <p>Adequate sanitation and waste disposal facilities will be provided at construction camps (septic tanks, soakage pits, etc).</p> <p>At every workplace, good and sufficient water supply will be maintained to avoid water-related diseases and to secure the health of workers.</p> <p>Adequate drainage, sanitation, and waste disposal will be provided at workplaces.</p> <p>Preventive medical care will be provided to workers.</p> <p>A health care system will be maintained at construction camps for routine check up of workers and avoidance of communicable disease.</p>	Throughout project corridor construction camps	Civil works cost	Contractor	SC, PIU, RDA

Issue/ Component	Remedial Measure	Approximate Location	Mitigation Cost	Institutional Responsibility	
				Implementation	Supervision
<b>8. Cultural or Archaeological Property</b>					
Damage or loss of religious/cultural property	<p>The contractors shall keep a watching brief for accidentally excavated archaeological or cultural property.</p> <p>If any valuable articles such as fabrics, coins, artifacts, structures, or other archaeological relics are discovered, the excavation will be stopped and the archaeological authority will be informed.</p> <p>Construction camps, blasting sites, and all construction activities away from cultural properties so they are not affected.</p>	Along the project corridor	Provisions made in the resettlement plan)	Contractor and Archaeology Department of Sri Lanka	SC, PIU, RDA
<b>9. Environmental Enhancements</b>					
a. Roadside landscape development	Avenue plantation of shade trees mixed with flowering trees, shrubs, and aromatic plants as per detailed schemes prepared, will be carried out.	Throughout project corridor	SLRs.<0.3m illion for additional tree plantation	Contractor	SC, PIU, RDA
b. Roadside amenities	Restoration and improvement of bus shelters, bus bays, and truck stops as per design will be carried out. Road furniture including footpaths, railings, traffic signs, speed zone signs, etc. will be erected as per design.	Throughout project corridor	Civil works cost	Contractor	SC, PIU, RDA
c. Cultural property	Enhancement of all cultural properties and the access roads will be completed as per design.	Throughout project corridor	Covered under damaged of cultural properties	Contractor	SC, PIU, RDA
<b>C. Operational Stage</b>					
a. Contamination from spills due to traffic and accidents	<p>The accident sites will be cleared immediately.</p> <p>The soiled earth will be scraped up collected and removed to a designated disposal site acceptable to the authorities.</p>	Throughout project corridor	Civil Works cost	Local government bodies including Provincial RDA	RDA
b. Dust Generation	<p>Improvement of road surface should reduce dust.</p> <p>Roadside tree plantations will be maintained.</p> <p>Afforestation will be taken up at new sites near the road.</p>	Throughout project corridor	Covered in civil works and environmental enhancement costs	RDA	RDA

Issue/ Component	Remedial Measure	Approximate Location	Mitigation Cost	Institutional Responsibility	
				Implementation	Supervision
c. Air pollution	Vehicular emissions of critical pollutant parameters (TSP, RTSP, CO, SO <sub>2</sub> , NO <sub>x</sub> and Pb) will be monitored as per the EMP.	Villages to be selected at detailed design. Puttalam km3; Kala Oya km37; Nochchiagama km52; and M. Bualakulama km65	SLRs < 0.1 million for air quality management.	Motor vehicle section of CEA and RDA	RDA
d. Noise pollution	Signs for sensitive zones (hospitals, educational institutions, sanctuaries etc.) will be put up where horns will not be blown and traffic speed needs to be regulated.		SLRs < 0.1 million for signs and noise management.	Motor vehicle section of CEA and RDA	RDA
e. Water	The drainage system will be cleaned periodically. Water quality will be monitored as per the monitoring plan.		SLRs < 0.1 million for monitoring	Local government bodies, RDA	RDA
f. Flora and Fauna (key stone species)	Impacts to TS will be monitored by reference to TS Warden for the first 3 years. The re-plantation scheme, containing key species, will be strictly monitored for the first 3 years. Efforts will be made for planted trees, shrubs, and grasses to be properly maintained. Efforts will be made to educate the villagers on the use of specified areas for cattle grazing.	Throughout project corridor	SLRs.0.19 million	Forest department	Forest Department, RDA
g. Hazardous chemicals	Vehicles delivering hazardous substances will be printed with appropriate signs. Any spillage will be reported to relevant departments will be made and instructions followed in taking up the contingency measures. Efforts will be made to clean spills of oil, toxic chemicals, etc. as early as possible.				
h. Safety measures	Traffic management will be developed, especially for congested locations. Traffic control measures, including calming, speed breakers and speed limits, will be enforced. Further growth of encroachment and squatting within the ROW will be discouraged. No school or hospital will be allowed to be established within 50 m of the highway.	Throughout project corridor		Local government bodies	RDA

Note: Data and proper names are as given in the FS and EIA report. FS = Feasibility Study for the Rehabilitation of Puttalam-Trincomalee Road (Korean Consultants International / Pyeong Hwa Engineering Consulting Co Ltd Jan 2005). Further developments due to RP and other detailed engineering design considerations may change the above assumptions. DFO = Department of Forest, EIA = environmental impact assessment, EMP = environmental management plan, RDA= Road Development Authority, TS = Tabbowa Sanctuary, km = kilometers, m = meters, mm = millimeters, PAP = project affected people, PIU = Project Implementation Unit, RAP = resettlement action plan, ROW = right of way, SC = supervision consultant, CEA = Central Environment Authority, TSP = total suspended particulate matter, PM10 = respirable particulate matter <10u, SO<sub>2</sub> = sulfur dioxide, NO<sub>x</sub> = nitrogen oxides, CO = carbon monoxide, HC = hydrocarbons, Pb = lead