

**ROAD DEVELOPMENT AUTHORITY
MINISTRY OF PORTS AND HIGHWAYS
THE DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA**

**Preparatory Survey on
Traffic Improvement Project
around New Kelani Bridge**

**FINAL REPORT
VOLUME 3:
Environmental Impact Assessment**

DECEMBER 2013

JAPAN INTERNATIONAL COOPERATION AGENCY

**ORIENTAL CONSULTANTS CO., LTD.
KATAHIRA & ENGINEERS INTERNATIONAL**

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DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA
MINISTRY OF PORTS AND HIGHWAYS
ROAD DEVELOPMENT AUTHORITY (RDA)



**PROPOSED SECOND NEW KELANI BRIDGE PROJECT
A PROJECT FOR TRAFFIC IMPROVEMENT AROUND EXISTING
NEW KELANI BRIDGE**



**ENVIRONMENTAL IMPACT ASSESSMENT
(Final Report)**

August 2013

Volume I – Main Report

Submitted to;
Central Environmental Authority
Ministry of Environmental and Renewable Energy

Submitted By;
Road Development Authority
Ministry of Ports and Highways

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LIST OF ABBREVIATIONS

ADT	Average Daily Traffic
AP	Affected Persons
AEA	Atomic Energy Authority
CEA	Central Environmental Authority
CEAA	Consulting Engineers and Architects Associated (PVT) LTD
DS	Divisional Secretary
DSD	Divisional Secretariat Division
EA	Environmental Assessment
EIA	Environmental Impact Assessment
EMC	Environmental Management Committee
EMP	Environmental Management Plan
EMoP	Environmental Monitoring Plan
EPL	Environmental Protection License
ESD	Environmental and Social Division, RDA
FGD	Focused Group Discussion
GoSL	Government of Democratic Socialist Republic of Sri Lanka
GN	<i>Grama Niladari</i> (Subordinate of DS)
GND	Grama Niladari Division
GSMB	Geological Survey and Mines Bureau
JICA	Japan International Corporation Agency
LLA	Land Acquisition Act
MOH	Medical Officer of Health
NAITA	National Apprenticeship Industrial Training Authority
NBRO	National Building Research Organization
NHSP	National Highway Sector Project
NWS&DB	National Water Supply and Drainage Board
NHDA	National Housing Development Authority
MOPH	Ministry of Ports and Highways
PIU	Project Implementation Unit
RDA	Road Development Authority
ROW	Right of Way
SC	Supervision Consultant
SD&CC	State Development and Construction Corporation
SLLRDC	Sri Lanka Land Reclamation and Development Corporation
SLT	Sri Lanka Telecom
SHM	Stake Holder Meeting
SPRA	Social Participatory Rapid Appraisal
UDA	Urban Development Authority
WHO	World Health Organization

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EXECUTIVE SUMMARY

With the operation of Colombo – Katunayake Expressway (CKE) it is anticipated that the traffic flow into the Colombo city through the New Kelani bridge will be increased. The present traffic arrangement in and around the New Kelani bridge will not be able to cater to this traffic and in turn it may also affect the life span of the existing bridge. Therefore Road Development Authority (RDA) of



the Ministry of Ports and Highways (MoPH) initiated a study with the assistance from the Government of Japan to improve the traffic condition around the New Kelani Bridge.

Hence as the proposed project, a six lane bridge across the Kelani River adjacent to the existing New Kelani Bridge, and associated ramps structures, will be constructed.

The objective of the project is to increase the transport efficiency in the environs of New Kelani Bridge and to establish the nexus between CKE and the city transport network. The project is named as **The Second New Kelani Bridge Project –A Project for Traffic Improvement around Existing Kelani Bridge.**

The project is located in Colombo and Gampaha districts covering the District Secretaries' (DS) administrative areas of Colombo, Kolonnawa and Kelaniya. Respective GN divisions are Navagampura, Bloemandhal and Grandpass North in Colombo, Wadullawatte Orugodawatte and Sedawatte in Kolonnawa and Peliyagoda and Gangabada East in Kelaniya. Local Government bodies which cover the project area are Colombo Municipal Council, Kolonnawa Urban Council and Peliyagoda Pradeshiya Sabha.

The study is based on desk studies, field studies, stakeholder meetings and household surveys to obtain relevant latest field data and to assess project impacts on the Physical, Physio-chemical, biological and Social environments. The report conforms to the ToR issued by CEA.

Various project alternatives were considered. "No Project Alternative" was compared against possible project alternative. If no auxiliary bridge is constructed across the Kelani River close to the "New Kelani Bridge" as proposed, the existing bridge will not be able to cater to the increased traffic flow in and out of Colombo city, increasing the traffic congestion within the project area. The additional traffic load onto the existing New Kelani Bridge will reduce its life span as a result.

Four layout alternatives have been considered during the feasibility studies. In these alternative layouts location alternative for the placing of the main bridge was also considered and it was concluded that it is best to construct a new bridge parallel to the existing bridge. Various bridge types,

ramp arrangements, interchange arrangements have also been selected as construction alternatives. These alternatives have been evaluated under various aspects. The result of such comparison shows that Alternative-B is determined to be optimal in terms of cost, environmental impact, traffic congestion, construction ease, water quality impacts etc.

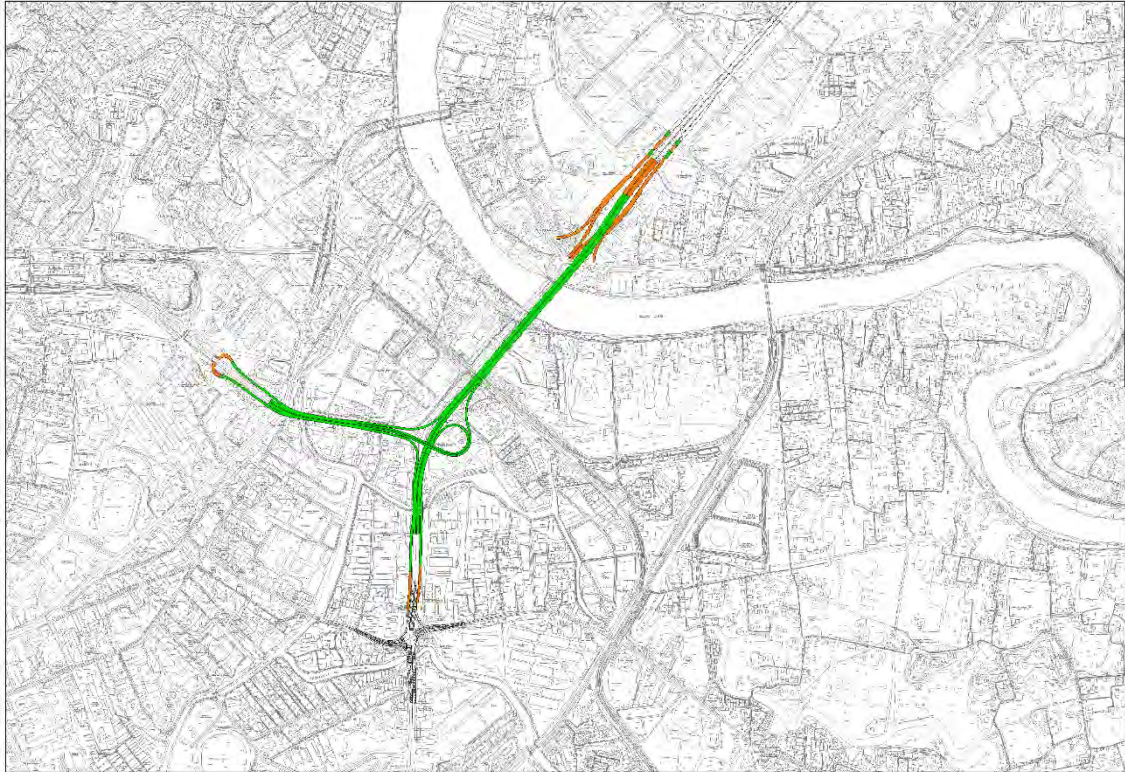


Figure 1-Layout Plan -Route Alternative B

Standard construction techniques in road and bridge construction will be employed in construction and most of the construction work will be machine based. There will also be some manual construction work such as form work, assembling reinforcements, welding, providing finishes, lane marking etc. There will not be any piers for the proposed six lane main bridge across the Kelani River in the waterway.

The project is still in the feasibility level and construction work will go on for a period of 36 months commencing 2017. The total construction cost including land acquisition, taxes and administration costs will be approximately Rs.60.9 billion. Funding will be provided by the Government of Japan under JICA funding.

Topography of the area consists of relatively flat terrain which consists of flood plain areas and slightly elevated areas of high urban character. Main land use types are water bodies, marshy land, parks and urban built up areas.

Average annual rainfall in the project area is 2200 mm. The average temperature in Colombo is 28 °C and the maximum temperature is 31 °C.

Water quality parameters of the project area were measured by National Building Research Organization (NBRO), BOD values ranged from 1 to 2.6 mg/l at 20C⁰, total coliform from 680 to 300 count/1000 ml, dissolved oxygen (DO) from 5.6 to 7.8mg/l etc. There is no major water usage of the project area in the form of either groundwater or surface water because of water quality issues. Baseline air quality noise and vibration in the project area was measured by NBRO. Air quality-CO₂ concentrations from 600-1120ppm, CO values from 2 to 6.7, SO₂ values from 12 to 274 µg/m³, NO₂ values from 16 to 33 µg/m³, SPM from 49 to 168µg/m³ and PM₁₀ from 30 to 68 µg/m³.

High noise levels were recorded in the project area. Movement of vehicles is the main source of noise. Based on the noise levels the Project Area could be classified as a high noise area. The noise level was 70-80dB in the most measured locations. Vibration frequency range is between 0.28Hz to 1.63Hz

Only floods are recorded as natural disasters within the project area (especially within Kelani River and flood bund).According to existing literature, the phenomenon of global warming in the project area and surroundings has been reported; 1-Increased vulnerability to Floods, 2-Sea level rise, 3-Increase in temperature are such parameters.

Biological environment of the area was assessed through a terrestrial and aquatic habitat survey. The floral species observed in residential and commercial area of the project site predominantly include fruits, vegetables, shading and ornamental plant species. The polluted canals are unused by residents and water in these canals is green in color because of blue green algae and other microorganisms.

The social environment consists of households mostly occupied by squatters, business premises and Government buildings. Total population in the affected area is 1915 . Two percent (2%) of the households spend less than Rs.10,000 per month which is an indication of high level of poverty.

The most significant impact from the project is the displacement of people from houses and business premises. Thus 395 of houses, 54 business premises have to be relocated. Total number of affected residential and business infrastructure is 449. Most of the people who live in the affected settlement area work as laborers or porters at Pettah and Colombo Fort area. During the census survey carried out in the project area it was observed that some households are involved in house level business activities such as manufacturing incense sticks and doormats.

Using detours to find access could be considered as a nuisance to the neighborhood during project construction period. According to the results of Socio Economic surveys for Resettlement Action Plan study, approximately 90% of the affected householders stated their willingness to be relocated.

Construction activities such as soil excavation, piling, backfilling and embankment work will require operation of heavy machinery. Movement of dump trucks and trucks loaded with material will also take place. There is a risk of injury to people and workers.

Main Affected Places



Figure 2 Main Affected Places

Government buildings and a few religiously important buildings such as Buddhist temples, Buddha statues and Hindu Kovils are located within the project affected area and include:

1. Atomic Energy Authority- Fully affected
2. Workshop of the Automobile Engineering Training Institute, Sanchi Temple and Amman Kovil (Located adjacent to the New Kelani bridge road) will be partially affected
3. Statue of Mr. SWRD Bandaranayake, a former Prime Minister, two roadside Buddha statues and a small Christian prayer room will be also affected and could be relocated in suitable places

Refer Figure 2 for the locations of the affected places.

The existing high-tension (132kV) power line to Kelanithissa power plant will need to be changed to an underground system which may result in temporary power outages. Other than these major impacts, the construction work will also need to remove electricity power lines, telecommunication lines, and water supply lines located within the project area. Several petroleum pipe lines transporting oil from the harbour cross the project and structures will be designed to avoid them.

The new bridge and the road network are designed to be built at a much higher elevation than the existing road and bridge structure. Such constructions and removal of structures will change the landscape of the project area.

Offsite construction waste disposal will disturb the low land and its drainage pattern if not carried out systematically. Soil also could get contaminated from the substances used for road pavements, spill of paints and such chemicals. As there is no heavy earthwork involved the impact of ground subsidence is not anticipated.

The risk of fire and electrocution should also be considered during a project of this magnitude. Also stagnant water bodies that could be created if precautions are not taken during construction and this may lead to breeding of mosquitoes.

There will not be any significant permanent impact on the drainage pattern of the area as the provided bridge and appurtenant structures are elevated. There will not be any significant impact on flood bunds of Kelani River. The proposed road design does not block any drainage pathways as in most instances the system is elevated

Some impacts on water quality will occur during construction such as the increase of water turbidity, contamination by construction related substances and chemicals. Based on a numerical analysis it was inferred that there is no significant impact of NO₂. SPM due to construction work. The value of the estimated results is close to the measured values. The estimated concentration of NO₂ at the Project site along the road, when the Project is implemented, is decreased compared to when the project is not implemented. Construction, noise will be generated by construction machinery and vehicles. However, significant impacts will not be continuously present even during construction stage as noise generating construction work is intermittent. A reduction of noise levels could be anticipated once the new bridge and new roads are opened for traffic as there will be a distance

based noise decay owing to high vehicular speed. It was predicted that vibration associated with road construction work will impact nearby residents. A reduction of the vibration level was predicted due to implementing the project. Although construction machines and vehicles generate greenhouse gases, quantities of generating gases do not give serious impact. By the implementation of the project, the amount of CO₂ emission will be decreased.

A considerable amount of the project area is covered with man-made habitats. Since the project activities are restricted to the existing ROW and surrounding lands, the project would not lead to loss of habitats.

During the survey of the project affected area any endemic or threatened flora and fauna species were not observed. It will be necessary to cut down trees which interfere with the proposed constructions. Some of the trees including 44 large trees (diameter at breast height more than 30 cm) and 125 medium trees (diameter above breast height between 15cm to 30 cm) may be affected.

The traffic congestion will be reduced once the new bridge and all access roads of the project are operational. This will also help the county's economy as the precious man hours spent on the road will be reduced. However there could be temporary traffic congestion during construction time.

According to recent studies carried out by Department of Archeology on the request of RDA, there are no any archeological sites in the area.

The following main mitigation measures are suggested to mitigate social impacts. Further details are provided in the Resettlement Action Plan (RAP). Compensation payments for land and structures lost (houses or business premises) and providing interim payments for the loss of livelihood, business or employment. Arrangements are being made to resettle affected householders in a housing scheme constructed by UDA in the State Timber Corporation Land at Orugodawatte. Tentatively estimated resettlement cost stands around Five billion Sri Lanka Rupees.

The statues including the Bandaranayake Statue will be relocated to suitable locations based on the desires of the stakeholders while the small Christian prayer room also can be relocated at a suitable location in consultation with its users.

Sanchi temple is only marginally affected and no major rehabilitation is necessary. Amman Kovil will lose 40% of its land area it will be rehabilitated within the current premises.

The Atomic Energy Authority is planned to be shifted to Mahenawatte , Homagama. The Automobile Training Institute is planned to be reconstructed at the Vocational Training Institute premises also in Orugodawatte.

Impacts emerging from noise, vibration, ground subsidence, traffic congestion, water quality, air quality, soil contamination and blocking of drainages/silting will be controlled by compelling the Contractor to adhere to Contract conditions, specifications and the Environmental management Plan supervised by RDA and periodically monitored by CEA.

Adverse effects on Workers' and residents' health and safety, will be mitigated through the Environment management Plan and FIDIC Conditions of Contract under JICA guidelines where Contractor is required to put in place a Safety Plan and appoint a dedicated Safety Officers and provide medical facilities.

Any adverse impacts due to waste disposal of construction camps as well as construction waste will be mitigated by getting the Contractors to adhere to proper waste disposal methods and use of approved sites for disposal. All hazardous chemicals will be required to be handled according to the relevant regulations

Only trees that interfere with construction work will be felled. Trees will not be cut during breeding seasons of birds if they use them as breeding places and if they are forage trees fruiting seasons will be avoided. New trees will be planted in suitable locations in the project area to enhance the bio diversity of the area, especially along the river banks

All mitigation measures will be closely monitored by the project proponent, Road Development Authority, especially through its Environmental and Social Division and the Project Management unit while the activities will also be monitored by relevant statutory institutions such as SLLRDC, Local Authorities, Irrigation Department, Labour Department and Public health Inspectors. Central Environmental Authority will carry out periodic monitoring as well as attending to public complaints, if any.

There will be environmental effects during construction of the project and these can be mitigated through Environmental Management and Monitoring Programmes. Since the project once completed will reduce the traffic congestion, it will result in substantial environmental benefits including reduction of pollution, dust, smoke and reduction of greenhouse gasses. The effects on global warming will be positive through reduced greenhouse gases.

Stakeholders indicate no objection to the proposed project and in fact there is wide spread support for this nationally important project. Majority of households and business owners who will be relocated have no objection for relocation if adequate compensation and alternative accommodation is provided at a close location with better facilities. All government and religious institutions are willing to be relocated or rehabilitated if they are assisted to reestablish and continue their services.

The Project will add a pleasing landscape to this important entry point to the city of Colombo with the unique design of the Extra-dozed bridge architecture inspired by national symbols of Sri Lanka

The alternative B layout is recommended to be proceed to the detailed design and construction stages with mitigation measures identified in this EIA. Implementation of the EMP and EMoP and resettlement of affected parties before commencement of construction is recommended according to the Resettlement Action Plan (RAP).

1 INTRODUCTION

1.1 Background of the project

Main land based transport system of Sri Lanka is the road network. It occupies 98% of goods and 92% of commuter transport. Development of transport infrastructure is a major Government Policy. The existing New Kelani Bridge situated at the Colombo North is a strategic point in the Colombo City transport network. Colombo Katunayaka Expressway (CKE) Project is near completion, which will increase the traffic flow towards Colombo creating additional burden to the economy. Especially it is anticipated that the traffic flow into the Colombo city through CKE will be increased. The present traffic arrangement in and around the New Kelani bridge will not be able to cater to this traffic and in turn it may affect the life span of the existing bridge. Therefore, construction of a new bridge is determined urgent.

Road Development Authority (RDA) of Ministry of Ports and Highways (MOPH) is the premier highway authority in the country and is responsible for the maintenance and development of the National Highway Network, comprising the Trunk (A Class) and Main (B Class) roads and the planning, design and construction of new highways, bridges and expressways to augment the existing network.

Therefore, Road Development Authority (RDA) had initiated a study to improve the traffic around the New Kelani bridge area. A basic level prefeasibility study has been completed by RDA where four route options had been studied. With all the options it was revealed that a new bridge should be constructed across the Kelani River adjacent to the existing New Kelani Bridge (upstream). The project is now officially termed as “Traffic Improvement Project around New Kelani Bridge in the Democratic Socialist Republic of Sri Lanka” (here after referred as to “the project”). The project is intended to augment and increase the capacity of the existing New Kelani Bridge by building an additional bridge with six lane facility parallel to the existing bridge with elevated viaducts and interchanges to connect CKE, Colombo Port and Baseline Road. And it will also facilitate a smooth traffic flow along Baseline Road and New Kelani bridge road towards the Colombo port access road.

The project has now entered its feasibility level study which can be broadly separated into four stages, i.e. (1) Review of present traffic status in and around the New Kelani bridge and the draft plan (prepared during prefeasibility), (2) Developing basic design plans (3) Carrying out environmental and social assessments and (4) Project review and preparation of the final report.

At this stage of the project, RDA through the Government of Sri Lanka (GoSL) has requested financial assistance from the Japan International Cooperation Agency (JICA) to carry out the feasibility and detail design studies and subsequently the construction of the new bridge and associated access roads.

1.2 Objective of the proposed project and justification of the project

There are only limited entry routes to Colombo North namely Victoria Bridge (Japan Friendship Bridge), Mattakkuliya Bridge and New Kelani Bridge. Traffic volumes have increased during the recent times and especially after the completion of CKE there will be additional traffic congestion at existing New Kelani Bridge of which the capacity should be augmented by the proposed project. Colombo Harbour Development Project and Port City Project in the future will further increase the traffic volume in this area.

Colombo north is a very important place in the transport network and there is severe traffic congestion in the environs of New Kelani Bridge exerting a burden on the economy of the country as the road network is used for passenger transport as well as goods transport. As road transport usage amounts to 98% compared to other transport media. Therefore improving the road network is essential in the development of transport infrastructure. Thus the implementation of the proposed project is justified.

The objective of the project is to increase the transport efficiency in the environs of New Kelani Bridge and the solution as the nexus between CKE and the city transport network. As the New Kelani Bridge is now in existence constructing an additional bridge adjacent to the New Kelani Bridge and the construction of approach roads using as far as possible the existing road and roadsides is justified. The main permanent impact from the project is the displacement of communities living near by the project area. The project will also have an impact on buildings of few government institutions also located in the project acquisition boundary. The objective of the project could be illustrated as below.

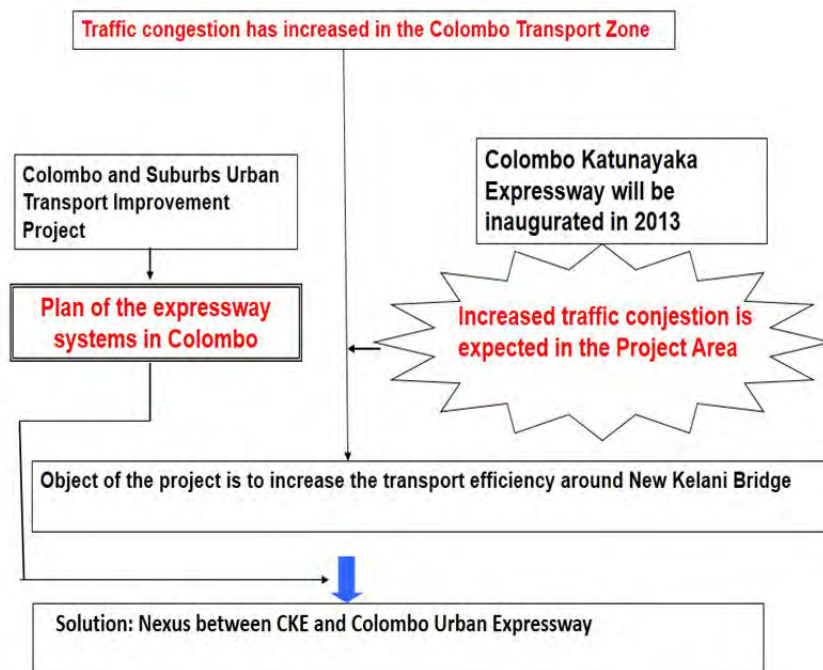


Figure 1-1 Objective of the project

1.3 Project Scope

The scope of work for this project could be summarized as follows;

- (1) Construction of an extra dozed main bridge and elevated roadway across the Kelani River connecting Colombo Katunayaka Expressway to Orugodawatte Junction and Port access Road.
- (2) Junction improvement for Orugodawatte
- (3) Carry out demolition of the affected social and other infrastructure such as households, Government buildings.
- (4) Provide compensation or resettlement sites for the affected stakeholders
- (5) Provide alternative places for Government buildings affected
- (6) Carryout compensatory landscaping for lost trees.

1.4 Objective of the Environmental Impact Assessment (EIA) Report

The main objectives of the EIA study is to describe the project environment, identify and differentiate significant adverse and beneficial impacts of the project, develop feasible mitigation measures to minimize the adverse impacts and to provide guidance to the environmental experts in the detail design team to further strengthen the mitigation measures and incorporate them into respective tender documents. This will enable an effective environmental impact management during the construction period and during the operational stage of the project.

The report will also enable the project proponent (the RDA) to obtain the approval from the Central Environmental Authority (CEA) as well as from JICA for the execution of the project.

This EIA report has been prepared based on the Terms of Reference (TOR) issued by CEA (please refer Annex 1.1).

The EIA Study specifically aims at the following activities:

- ✓ Prepare an EIA report, which should properly address all the items specified in the TOR issued by the CEA and which should be substantially adequate to obtain the environmental approval from the Project Approving Agency (PAA).
- ✓ Assimilate baseline data and information relating to physical, physio-chemical and social environments in and around the project site, and the impact caused by future activities envisaged such as the regular use of the bridge by commuters.
- ✓ Carrying out a noise, vibration, air quality, water quality (both surface water and groundwater)
- ✓ Have a series of dialogue with the line agencies who has jurisdiction regarding the project, local communities/households directly and indirectly affected by the project.
- ✓ Assess the potential impacts that will be generated during the construction as well as operation phases of the project.
- ✓ Formulate necessary counter measures against the potential adverse impacts so as to minimize the possible negative impacts due to project implementation, and ;

- ✓ Prepare an Environmental Management and Plan (EMP) so that the Project Proponent (PP) can prevent negative effects on the environment and take necessary action before the impacts become irreversible.

1.5 Methodologies and technologies adopted in EIA report preparation

1.5.1 General Methodology

The EIA was prepared by a team of consultants. Refer Annex 1.2 for their names, qualifications and tasks undertaken.

The study was based on desk studies as well as field studies to obtain relevant latest field data on the physical, physio-chemical and social environment.

The methodology for this EIA consists of;

- Understanding the nature of the project through the site visits, discussions with RDA, taking part in the introductory meetings with RDA etc.
- Study all documents such as project descriptions prepared by RDA and JICA survey Team,
- Study the conceptual drawings, survey plans etc. related to the proposed project,
- Visit the proposed site at Peliyagoda and its environs where the proposed bridge and the approaches will be establish to assess potential environmental impacts from the proposed works
- Carrying out a social assessment by interviewing the people who live close to the proposed site
- Carry out air quality, water quality (both river water and ground water), noise and vibration measurements at pre-determined strategic locations,
- Carrying out an ecological assessment to assess the baseline ecology and the possible impacts on ecology,
- Proposing mitigation measures to alleviate the possible construction and operational impacts and the social impacts.

The EIA study was carried out for a period of 4 months from March to June 2013.

1.5.2 Methodology for Hydrological Study

Basic hydrological parameters for the area such as rainfall, temperature, humidity etc. were obtained from the Department of Meteorology. Water levels and discharges of Kelani River were obtained from the Department of Irrigation. Simple flood frequency analysis was carried out on the water levels to assess inundation levels.

1.5.3 Methodology for Ecological Study

A habitat survey was carried out to identify the terrestrial and aquatic ecology of the proposed site, to ascertain the habitat types present and the possible impacts on sensitive flora, fauna, and habitats as a result of the proposed project.

Direct observations were made to identify flora, fauna and the existing terrestrial and aquatic habitats (especially in Kelani River) in the vicinity of a proposed development site and the

surrounding area. A line transect survey was carried out 50 m either side of the center line of national roads, beside the municipal and the local road network, around flood bunds, riverine and marshy areas to identified fauna and flora distributed in the area with the habitat information. In addition information was collected from indirect observations and from residences in the project affected area. At the same time data on important religious trees, economically valuable trees, shading species and trees that had been marked on survey map were identified with their names and locations. Several floral species were identified using published descriptions and taxonomic keys (please refer Annex 4.1 for details).

1.5.4 Methodology of the Social Study

The social study was carried out to assess the social impact of the project. The studies were carried out using a social appraisal on a census basis. The said census was carried out using three types of questionnaires;

- (a) Household survey questionnaire
- (b) Questionnaire for business premises
- (c) Questionnaire for common properties

The stakeholders affected by the project were interviewed and their ideas were recorded during the household survey. Socially important places such as government institutions, temples, *kovils* etc. were studied. The socially relevant line agencies such as the Divisional Secretary Office, Pradeesheeya Sabha were consulted and their views were mustered.

Major details of the project were revealed to the stakeholders and their socioeconomic status; their views regarding the project especially the impact on their livelihood were discussed and recorded. Their willingness to obtain compensation or alternative resettlement was discussed.

The diagram which is developed for methodology of finding out socio-economic impacts is given below.

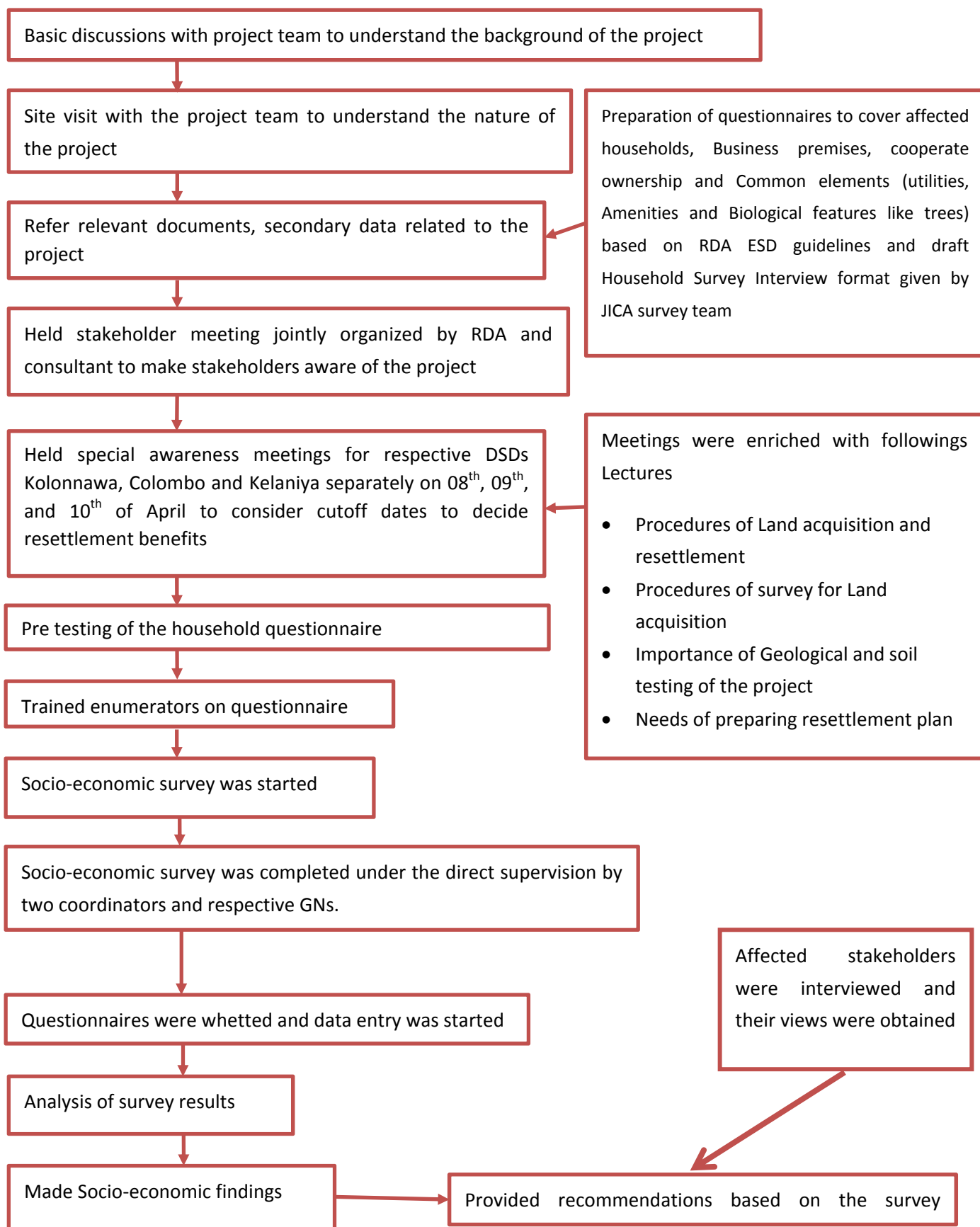


Figure 1-2 Illustrated methodology for the social study

Following key points were considered during the methodology

- (a) Obtaining the fullest support from the stakeholders during the socioeconomic survey and to minimize social conflicts between enumerators and stakeholders. The relevant line agency officers especially Grama Niladharis (GNs) of the affected GN divisions were consulted. During the Focus Group Discussions (FGD's) the Project Team tried to maintain gender balance as much as possible. Key informant interviews were also held to cover special issues such as affected religious places and large scale institutions and business premises.
- (b) Questionnaires were set in the local language (Sinhala) for easy understanding of the enumerators as well as to maintain the transparency between enumerators and affected parties.
- (c) Secondary data on socioeconomic situation of the affected two districts (Colombo and Gampaha) was studied to review the situation of the project area. Throughout the study, secondary data were used as main reference material. They include publications of Dept. of Census and Statistics, Central Banks etc. Publications, administrative records and documents prepared by Divisional Secretariats (Resource Profiles) and line departments were studied.

1.6 Conformity with Government policies and plans

As stated in Section 1.1 development of transport infrastructure is a major Government Policy and there is a marked improvement in the country's transport network by the introduction of expressways, rehabilitating and widening the existing road network etc. The responsibility of the development of the major transport network rests with the Central Government. Plans will be implemented through the Ministry of Transport and the planning activities of the main road network is vested with RDA of ministry of Ports and Highways. Urban Transport System Development Project for Colombo Metropolitan Region and Suburbs under the Ministry of Transport is now underway and this project will fit into that plan.

1.7 Preliminary approvals needed for the project and any conditions laid down by state agencies in granting preliminary clearance for the project

Following approvals will be needed for the project and it is intended to secure all such approvals through this EIA Process.

- (1) Approval by JICA for funding
- (2) Approval from a Divisional Secretary and Local Government Authorities
- (3) Approval from Irrigation Department (As the bridge is across a Provincial River)
- (4) Approval from SLLRDC (for any obstruction to the low lying flood plains in Colombo District)
- (5) Approval from Colombo Municipal Council and Kolonnawa Municipal Council and approval from other local authorities in the project area (for drainage crossings etc.)
- (6) Approval from Coast Conservation Department (CCD) (for any change of the sand bar in the outfall if coffer damming is required for construction of the bridge)
- (7) Approval from CEA (EIA Approval)
- (8) Clearance from Department of Archeology
- (9) UDA approval as it affects town planning

There are no known laid down preconditions from state agencies in granting clearances to the project.

2 POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

2.1 Applicable Environmental Legislation in Sri Lanka

- **National Environmental Act (NEA) No 47 of 1980, and its' amendment Act No. 56 of 1988 and Act No. 53 of 2000**

Under provisions of Part IV C of the NEA No. 47 of 1980 and subsequently stipulated in Gazette (Extra Ordinary) No. 772/22 dated June 24, 1993 the government of Sri Lanka (GoSL) made Environmental Assessment (EA) a legal requirement for a range of development projects. The list of projects requiring an EA in the form of Environmental Impact Assessment (EIA) or Initial Environmental Examination (IEE) is prescribed in the above Gazette notification.

In addition, the Gazette notification includes a list of line ministries and agencies that are designated as Project Approving Agencies (PAA). The PAA's are responsible for the administration of the EIA process under NEA. Further amendments to the NEA stipulated environmental approvals for material extraction, emissions, noise and vibration levels. These regulations will also have a bearing on this development project.

The provisions of the NEA regulations, the construction of national and provincial highways involving a length exceeding 10 km is listed as a prescribed project which requires an Environmental Assessment (EA), but construction of a new bridge or renovation or expansion of an existing bridge has not been listed as a prescribed project.

In addition, other prescribed projects requiring environmental assessments, listed in the same regulations relevant to the proposed project include;

- (i) Reclamation of land, wetland area exceeding 4 hectares;
 - (ii) Conversion of forests covering an area exceeding 1 hectare into non-forest uses;
 - (iii) Involuntary resettlement exceeding 100 families, other than resettlement effected under emergency situations;
 - (iv) Extraction of timber covering land areas exceeding 5 hectares;
 - (v) Clearing of land areas exceeding 50 hectares;
 - (vi) Inland deep mining and mineral extraction involving a depth exceeding 25 meters;
 - (vii) Inland surface mining of cumulative areas exceeding 10 hectares;
 - (viii) Mechanized mining and quarrying operations of aggregate, marble, limestone, silica, quartz, and decorative stone within 1 kilometer of any residential or commercial areas;
- and

All projects and undertakings irrespective of their magnitude, if located partly or wholly within 100 meters from the boundaries of or within any area declared under the National Heritage Wilderness Act; the Forest Ordinance; 60 meters from a river or stream bank and having a width of 25 meters or more at any point of its course; any archeological reserve, ancient or protected monument as defined or declared under the Antiquities Ordinance (Chapter 188); any areas declared under the Botanical Gardens Ordinance; and within 100 meters from the boundaries of or within any areas

declared as a Sanctuary under the Fauna and Flora Protection Ordinance. This project has been listed as a prescribed project under the category of “Involuntary resettlement exceeding 100 families, other than resettlement effected under emergency situations

- **Flood protection Ordinance (chapter 449)**

Under this ordinance the relevant minister is empowered to declare any area in Sri Lanka to be a flood area. And while such order remains in force the area indicated shall form a flood area and be subjected to the provisions of this ordinance.

According to the guidelines of this ordinance the Director of Irrigation Department or any other person designated by the relevant minister shall prepare and carry out a scheme for the efficient protection of such area against floods. The proposed project area is located within the Kelani river flood plain declared under this ordinance.

- **Colombo District (Low Lying Areas) Reclamation and Development Board Act No. 15 of 1968**

The Land Reclamation and Development Corporation (SLLRDC) established under this act have power to declare low lying areas within the Colombo district as flood protection areas. The act was amended by Law No. 27 of 1976, Act No. 52 of 1982 and Act. No. 35 of 2006.

The low lying areas within this stretch of Kelani River are declared as flood protection area by SLLRDC.

- **Crown lands Ordinance (Chapter 454)**

This ordinance could be cited as “An ordinance to make provision for the grant and disposition of crown lands in Ceylon; for the management and control of such lands and the foreshore ; for the regulation of the use of the water of lakes and public streams ; and for other matters incidental to or connected with the matters aforesaid”.

This ordinance empowers the relevant minister to declare reservations for public streams and protect the source, course or bed of any public stream.

- **Mines and Minerals Act No. 32 of 1992**

The Geological Survey and Mines Bureau was established under the Mines and Minerals act to regulate the exploration of mines and minerals, transportation, processing, trading in or export of minerals.

- **Land Acquisition Act No. 9 of 1950, with the latest amendment in 1986 (LAA)**

The Land Acquisition Act clearly outlines the procedures of land acquisition and compensation for public purposes. LAA sets out the procedures for acquiring land and for payment of compensation for acquiring land. It provides compensation at market rates for land, structures and crops.

- **National Policy on Payment of Compensation**

The National Policy on payment of compensation is effective for any acquisition in respect of which a notice under Section 2 of LAA is published after 01.09.2008 and after this date any existing relief schemes for payment of additional compensation will become null and void.

- **National Involuntary Resettlement Policy of 2001 (NIRP)**

To address the current gaps in the LAA in addressing key resettlement issues such as exploring alternative project options that avoid or minimize impacts on people, compensating those who do not have title to, but are currently using and dependent on, land, or implementation of income restoration measures aimed at the social and economic rehabilitation of project Affected Persons (APs), the Government of Sri Lanka adapted the NIRP in the year 2001. NIRP also highlights the need for AP consultation and participation in resettlement processes.

- **Fauna and Flora Protection (Amend) Act (No. 49 of 1993)**

The Fauna and Flora (Protection) Ordinance No. 2 of 1937, as amended by the Fauna and Flora (Amend) Act No. 49 of 1993 and Act No. 22 of 2009 provides regulations for the protection, conservation and preservation of the fauna and flora of Sri Lanka, for the prevention of the commercial exploitation of such fauna and flora; and to provide for matters connected therewith or incidental thereto". Offenses relating to amphibians and fish included in Schedules III and IV of the Act. Part IV (sects. 42 to 48) concerns the protection of flora.

- **Felling of Trees (Control) Act No 9 of 1951**

The Felling of trees Act No 9 of 1951 (as amended 30 of 1953 and 1 of 2000) provides for the prohibition, regulation or Control of the Felling of Trees in the country.

Accordingly, this act orders prohibiting or regulating the felling of trees, steps for identification of trees and penalty for contravention of an order are included as follows.

(1) The Minister may by Order provide for the prohibition, regulation or Control of the felling of trees of such description as may be specified in the Order.

(2) An Order under this section may be made so as to have effect either throughout Sri Lanka or any particular area in Sri Lanka, and may prohibit the doing of anything regulated by the Order except under the authority of a license granted by such officer as may be specified in the Order.

(3) Every Order made by the Minister under this section shall be published in the Gazette and shall come into operation upon the date of such publication or upon such later date as may be specified therein.

- **Other relevant legislation in Sri Lanka**

There are a number of other laws and regulations applicable which are relevant to the project under which certain approvals have to be obtained for project related activities.(see Table 2-1).

Table 2-1 Other relevant legislation in Sri Lanka for approvals

Activity	Time of obtaining approval	Approving Agency	Implementing Agency
Felling of trees and removal of timber	Before construction and during construction	Forest Department	RDA (the contractor should mark the trees to be removed)
Disposal of excavated soil and waste. Disposal of bentonite if used.	After the mobilization of contractor	Local authorities , SLLRDC and CEA (as betonite disposal belongs to the category of “Scheduled Waste disposal)	Contractor through RDA supervision
Operation of asphalt concrete plant, Concrete batch mixing plant, Crusher plant (If operated by contractor or plants from which the contractor obtains material)	After the mobilization of contractor	Central Environmental Authority for the Environmental Protection license (EPL) and trade license from Local Authorities	Contractor through RDA supervision
Establishment of labour camps	Before construction and during construction	Municipal councils, Labour Department (District Factory Inspection Engineer), CEA for EPL	Contractor through RDA supervision
Environmental safeguards, compliance of material extraction locations , burrow pits, quarries etc. which contractor is going to operate or from which contractor is going to purchase material	Before construction and during construction	Local Authorities (Trade licenses), GSMB , CEA (EPL s)	Contractor/Respective site operators through RDA supervision

2.2 The EIA Process

According to GoSL procedure, all development activities require environmental clearance. The main purpose of an EIA is to ensure that development options under consideration are environmentally acceptable and sustainable. Such activity will help both developer and governing authorities to recognize environmental consequences and to avoid or develop suitable mitigation measures early in the project design stage.

According to the NEA the environmental clearance should be obtained through the Central Environmental Authority or other relevant Project Approving Authority (PAA) as stipulated in the NEA.

The EIA process begins when the Preliminary Information (through a duly filled Basic Environmental Information Questionnaire (BIQ)) is submitted by the Project Proponent (PP) to CEA or respective PAA. This questionnaire requires information from the PP to enable the CEA or PAA to determine the level of environmental analysis required prior to providing approval for the project. Upon reviewing the questionnaire (Scoping), the CEA or PAA determines whether the project requires an Initial Environmental Examination (IEE), or an Environmental Impact Assessment (EIA), or whether no further environmental analysis is required, depending on the nature of the potential impacts.

If the project is considered as “Prescribed” the CEA or PAA will prepare a Terms of Reference (TOR) for the EIA or IEE. Based on this TOR the PP will develop a report and submit to CEA or relevant PAA. This report will initially be checked for its consistency/ adequacy with regard to the information required in the TOR. If the information is deemed adequate the report will be evaluated by a Technical Evaluation Committee (TEC) comprising set of professionals/ officials with adequate knowledge in each field of requirement in the TOR.

If the TEC agrees that the report is adequate an environmental clearance will be given with a set of conditions which the PP should adhere.

In case of an EIA the report is opened to the public for a 30 working day period for comments and questions. These comments and questions should be addressed by the project proponent before the final conditional clearance is given. The EIA procedure is illustrated in Figure 2.1.

2.3 Environmental Institutional Framework

The overall implementing responsibility of the project lies with the GoSL and Ministry of Ports and Highways MoPH is the line ministry for the matters pertaining to the highway sector. RDA being the executive agency for road development, has administrative responsibility for implementation of the project under general supervision of the MoPH.

Due to their importance, priority, magnitude of investment and external collaboration etc. the MoPH has established Project Management Units (PMU) for execution of special projects. PMUs have to accomplish a time-bound program through a planned set of interventions agreed upon by concerned authorities. PMUs work under the general supervision of RDA, but have direct linkages and access to MoPH to expedite their work. Thus, PMU is the focal institution responsible for environmental safeguards at project operational level. PMUs have been strengthened with a certain degree of financial autonomy and administrative flexibility subject to the guidance and supervision of the MoPH and directives of the General Treasury.

Environmental and Social Development Division (ESD Division) of RDA will assist the PMU in monitoring the level of environmental compliance by the contractor during the construction works and during operation of the bridge.

As the CEA has been designated as the PAA for this development project, it will monitor the environmental compliances and issues during the construction stage. As the external monitoring agency the CEA will use the “Environmental Management Action Plan” as the primary tool in measuring the level of environmental compliance.

An Environmental Grievance Redress Mechanism will be established at Grama Niladari Level to address any public grievances related to environmental aspects. Any complaint or issue will be recorded by the Grama Niladari and forwarded to the PMU for necessary actions. A three member team comprising of members from the PMU, Engineer and Contractor will visit the relevant site with the Grama Niladari and take action to resolve the issue. If a suitable agreement cannot be made such issues will be referred to ESD division and other relevant divisions of RDA to develop a suitable measure.

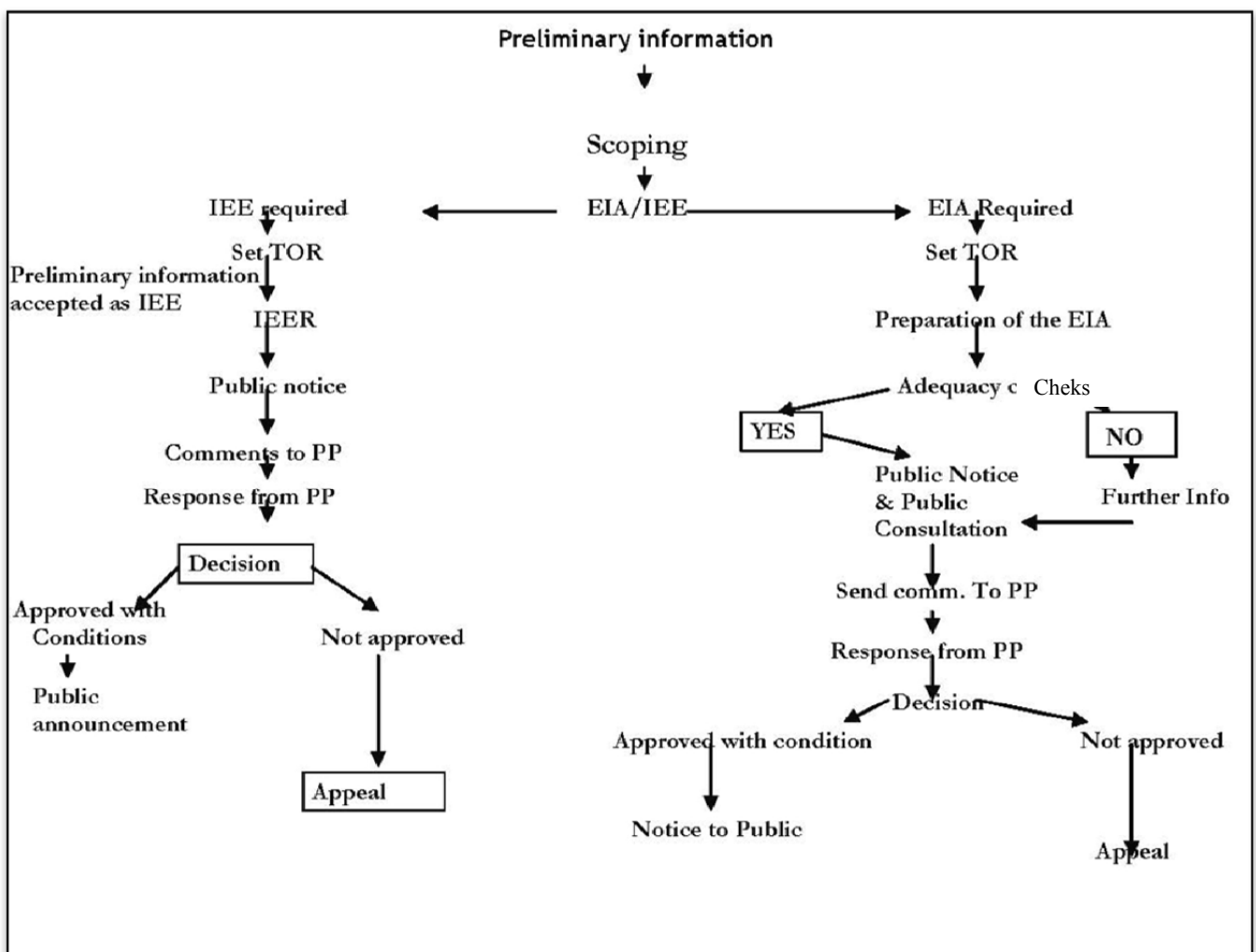


Figure 2-1 EIA Process in Sri Lanka

RELEVANT STANDARDS

- Sri Lanka and International standard for environment

Air quality standards

Sri Lanka standards

The standards for the air quality in Sri Lanka shall be determined in accordance with standards stipulated under the Extraordinary Gazette, No. 1562/22, August 15, 2008 by the Ministry of Environment and natural Resources of Sri Lanka.

Table 2-2 Permissible Ambient Air Quality Standards

Pollutant	* Average Time	Maximum Permissible Level		+ Method of measurement
		$\mu\text{g}/\text{m}^3$	ppm	
1. Particulate Matter- Aerodynamic diameter is less than $10\mu\text{m}$ in size (PM_{10})	Annual	50	-	Hi-volume sampling and Gravimetric or Beta Attenuation
	24hrs.	100	-	
2. Particulate Matter- Aerodynamic diameter is less than $2.5\mu\text{m}$ in size ($\text{PM}_{2.5}$)	Annual	25	-	Hi-volume sampling and Gravimetric or Beta Attenuation
	24hrs.	50	-	
3. Nitrogen Dioxide (NO_2)	24hrs.	100	0.05	Colorimetric using saltzman method or equivalent gas phase chemiluminescence
	8hrs.	150	0.08	
	1hr.	250	0.13	
4. Sulphur Dioxide (SO_2)	24hrs.	80	0.03	Pararosaniline method or equivalent pulse fluorescent
	8hrs.	120	0.05	
	1hr.	200	0.08	
5. Ozone (O_3)	1hr.	200	0.10	Chemiluminescence method or equivalent ultraviolet photometric
6. Carbon Monoxide (CO)	8hrs.	10,000	9.00	Non-Dispersive Infrared Spectroscopy
	1hr.	30,000	26.00	
	Any time	58,000	50.00	

* Minimum number of observations required to determine the average over the specified period-

03 hour average – 03 consecutive hourly average.

08 hour average – 08 hourly average.

24 hour average – 18 hourly average.

yearly average – 09 monthly averages with at least 02 monthly average each quarter.

International standards

Table 2-3 WHO Ambient Air Quality Standards

	Average Period	Guideline Value in $\mu\text{g}/\text{m}^3$
SO ₂	24-hour	20
	10 minutes	500
NO ₂	1-year	40
	1-hour	200
PM ₁₀	1-year	20
	24-hour	50
PM _{2.5}	1-year	10
	24-hour	25

Water quality standards

Sri Lanka Standards

The standards for the water quality in Sri Lanka shall be determined in accordance with the Proposed Ambient Water Quality Standards for inland water Sri Lanka, Central Environmental Authority, 2001.

Table 2-4 Proposed Ambient Water Quality Standards for Inland water Sri Lanka

Parameter	Unit, type of limit	CLASS 1 Waters	CLASS 11 Waters (Sensitive)				Class 111 Waters (General)
		Drinking water with simple treatment 2	Bathing 3	Fish and aquatic life 4	Drinking water, conventional treatment 5	Irrigation and agriculture 6	Minimum quality other uses 7
General							
1. Colour (after simple filtration)	Pt mg/l, max	20	-	-	100	-	-
2. Total dissolved solids (TDS)	mg/l, max	-	-	-	-	500	-
3. Conductivity	dS/m, max	-	-	-	-	0.7	-
4. Odour	-	unobj	unobj	-	unobj	-	-
5. Taste	-	unobj	-	-	unobj	-	-
6. Turbidity	NTU, max	5	-	-	-	-	-
7. Sodium absorption ratio (SAR)	-	-	-	-	-	6-15	-
8. Residual sodium Carbonate (RSC)	meq/l, max	-	-	-	-	1.25	-
9. Total hardness	As CaCO ₃ mg/l	250 des. 600 max	-	-	-	-	-
10. pH	-	6.0-8.5	6.0-9.0	6.0-8.5	6.0-9.0	6.0-8.5	5.5-9.0
11. Dissolved Oxygen at 25°C	mg/l, min	6	5	3	4	3	3
12. BOD (5 days at 20°C or 3 days at 30°C)	mg/l, max	3	4	4	5	5	5
Nutrients							
13. COD	mg/l, max	15	20	15	30	-	40
14. Nitrates (NO ₃ -N)	mg/l, max	5	5	5	5	5	5
15. Total ammonia (NH ₃ -N) - pH < 7.5	mg/l, max	-	-	0.94	-	-	9.1
pH= 8.0	-	-	-	0.59	-	-	4.9
pH= 8.5	-	-	-	0.22	-	-	1.6
16. Total phosphate (PO ₄ -P)	mg/l, max	0.7	0.7	0.4	0.7	0.7	0.7
Other Substances							
17. Chlorides (Cl)	mg/l, max	200	-	-	200	100	-
18. Cyanides (CN)	mg/l, max	0.005	0.005	0.005	0.005	0.005	0.005
19. Fluorides (F)	mg/l, max	1.5	-	-	1.5	-	-
20. Sulphates (SO ₄)	mg/l, max	250	-	-	250	1000	-
Metals							
21. Total cadmium (Cd)	µg/l, max	5	-	H <50 60-120 120-180 >180 Cd 0.2 0.8 1.3 1.6	5	-	5
22. Total chromium (Cr)	µg/l, max	50	-	2	50	-	50
23. Total copper (Cu)	µg/l, max	-	-	H <60 60-120 120-180 >180 Cu 2 2 3 4	-	-	100

24. Iron (Fe)	µg/l, max	300 des, 1000 max	-	300	200	-	-
25. Lead (Pb)	µg/l, max	50	-	H Pb <60 60-120 120-180 >180 1 2 4 7	50	-	50
26. Manganese (Mn)	µg/l, max	1000	1000	1000	1000	1000	1000
27. Mercury (Hg)	µg/l, max	1	1	0.1	1	1	2
28. Nickel (Ni)	µg/l, max	100	100	H Ni <60 60-120 120-180 >180 25 65 110 150	100	100	100
29. Selenium (Se)	µg/l, max	10	10	1	10	-	-
30. Zinc (Zn)	µg/l, max	1000	1000	30	1000	1000	1000
31. Boron (B)	µg/l, max	-	-	-	-	500	-
32. Total arsenic (As)	µg/l, max	10	50	50	10	50	50
33. Aluminium (Al)	µg/l, max	200	-	-	200	50	-
Organic Micro Pollutants							
34. Phenol index	µg/l, max	2	5	1	5	5	5
35. Oil and grease	µg/l, max	100	200	10	100	-	300
36. Anionic surfactants (detergent) as MBAS	µg/l, max	200	300	1000	200	1000	1000
37. Total pesticides	µg/l, max	10	30	30	30	50	50
Micro Organisms							
38. Total coliform	MPN/100 ml, (*P=95%)	5000	1000	20,000	5000	1000	-
39. Faecal coliform	MPN/100 ml, (*P=95%)	250 des, 600 max	50	-	-	-	-
40. Parasite cysts and ova	Not given	-	-	-	-	-	-

Source: Central Environmental Authority (2001)

Abbreviations : n = Natural or baseline values; H = Hardness in terms of CaCO₃ in mg/l; des = Desirable highest level; max = Maximum permissible substances;

MBAS = Methylene blue active substances; *P=95% = 95% of the samples give a value that is equal to or less than the indicated limit; Mean – during longer period; Min. daily = average of daily waters; prevention of eutrophication, excessive weed growth, may require lower, site specific, for stagnant waters

International standards

Table 2-5 EHS, IFC Water quality standards

Pollutant	General EHS guideline of IFC (Indicative Values for Treated Sanitary Sewage Discharges a)
pH	6-9
BOD	30
COD	125
SS	150
n-hexane (mineral oil))	-
n-hexane (animal and vegetable fats)	10
Residual chlorine	-
Phenols	-
Copper	-
Zinc	-
Dissolved iron	-
Dissolved manganese	-
Chromium	-
Cadmium	-
Total cyanogen	-
Total coliform bacteria	400MPN ⁶ /100ml
Nitrogen	10 MPN ⁶ /100ml
Phosphorus	2 MPN ⁶ /100ml

Source ; Environmental Health & Safety (EHS) Guidelines, International Finance Corporation (IFC),2007

Noise standards

Sri Lanka standards

The standards for the noise level in Sri Lanka shall be determined in accordance with regulations made by the Ministry of Transport, Environment and Women's Affairs under section 23P,23Q and 23R of the National Environmental Act, No.47, 1980 read with section 32 of that Act. .

Table 2-6 Permissible Noise Levels in accordance with Noise Control Regulations

Area	L _{Aeq} T, dB(A)	
	Day Time	Night Time
Low Noise (Pradeshiya Sabha area)	55	45
Medium Noise (Municipal Council/Urban Council area)	63*	50
High Noise (EPZZ of BOI & Industrial Estates approved under part IVC of the NEA)	70	60
Silent Zone (100 m from the boundary of a courthouse, hospital, public library, school, zoo, sacred areas and areas set apart for recreation or environmental purposes)	50	45

* Provided that the noise level should not exceed 60 dB (A) inside existing houses, during day time.

Maximum permissible Noise levels at Boundaries of the land in which the source of noise is located in L_{Aeq} T for construction activities.

Construction Activities

L_{Aeq} T, dB (A)

Day Time

Night time

75

50

The following noise levels will be allowed where the background noise level exceed or is marginal to the given levels in the above table.

(a) For low noise areas in which the background noise level exceeds or is marginal to the given level

Measured Background Noise level + 3dB (A)

(b) For medium noise areas in which the background noise level exceeds or is marginal to the given level

Measured Background Noise level + 3dB (A)

(c) For silent zone in which the background noise level exceeds or is marginal to the given level

Measured Background Noise Level + 3dB (A)

(d) For high noise areas in which the background noise level exceeds or is marginal to the given level

(i) For day time

Measured Background Noise level + 5dB (A)

(ii) For night time

Measured Background Noise level + 3dB (A)

International standards

Table 2-7 Noise Level Guidelines- EHS IFC

Noise Level Guidelines- EHS IFC		
	One Hour L _{Aeq} (dBA)	
	Day time 07.00-22.00	Nighttime 22.00-7.00
Residential; institutional; educational	55	45
Industrial; commercial	70	70

Source ; Environmental Health & Safety (EHS) Guidelines, International Finance Corporation (IFC),

Vibration standards

Sri Lanka standards

The standards for the vibration level in Sri Lanka shall be determined in accordance with the Maximum Permissible interim Vibration levels stipulated by the Central Environmental Authority of Sri Lanka for different type of structures. .

Table 2-8 Maximum Permissible Vibration Values

Structure Type	Type of Vibration	Frequency of Vibration (Hz)	Vibration in ppv (mm/sec)
Type 1 structures – Multi story buildings of reinforced concrete or structural steel, with filling panels of block work, brick work or precast units not designed to resist earthquakes	Continuous	0 - 10	5.0
		10 - 50	7.5
		Over 50	15.0
	Intermittent	0 - 10	10.0
		10 - 50	15.0
		Over 50	30.0
Type 2 structures – Two-storey domestic houses and buildings constructed of made of reinforced block work, precast units, and reinforced floor & roof construction, or wholly of reinforced concepts or similar, not designed to resist earthquakes.	Continuous	0 - 10	2.0
		10 - 50	4.0
		Over 50	8.0
	Intermittent	0 - 10	4.0
		10 - 50	8.0
		Over 50	16.0
Type 3 structures – Single and two storey houses and buildings made of lighter construction, using lightweight materials such as bricks, cement blocks etc, not designed to resist earthquakes.	Continuous	0 - 10	1.0
		10 - 50	2.0
		Over 50	4.0
	Intermittent	0 - 10	2.0
		10 - 50	4.0
		Over 50	8.0
Type 4 structures – Structures that, because of their sensitivity to vibration, do not correspond to those listed above 1,2 & 3, & declared as archeologically preserved structures by the Department of Archaeology	Continuous	0 - 10	0.25
		10 - 50	0.5
		Over 50	1.0
	Intermittent	0 - 10	0.5
		10 - 50	1.0
		Over 50	2.0

3 DESCRIPTION OF THE PROPOSED PROJECT AND REASONABLE ALTERNATIVES

3.1 Evaluation of Alternatives

3.1.1 Layout Alternatives

Four layout alternatives have been considered during the feasibility studies and these alternatives are given below.

1. Alternative A- Adjacent to the existing railway
2. Alternative B- Adjacent to New Kelani Bridge
3. Alternative C- Above the existing canal trace
4. Alternative D – Above the existing road trails

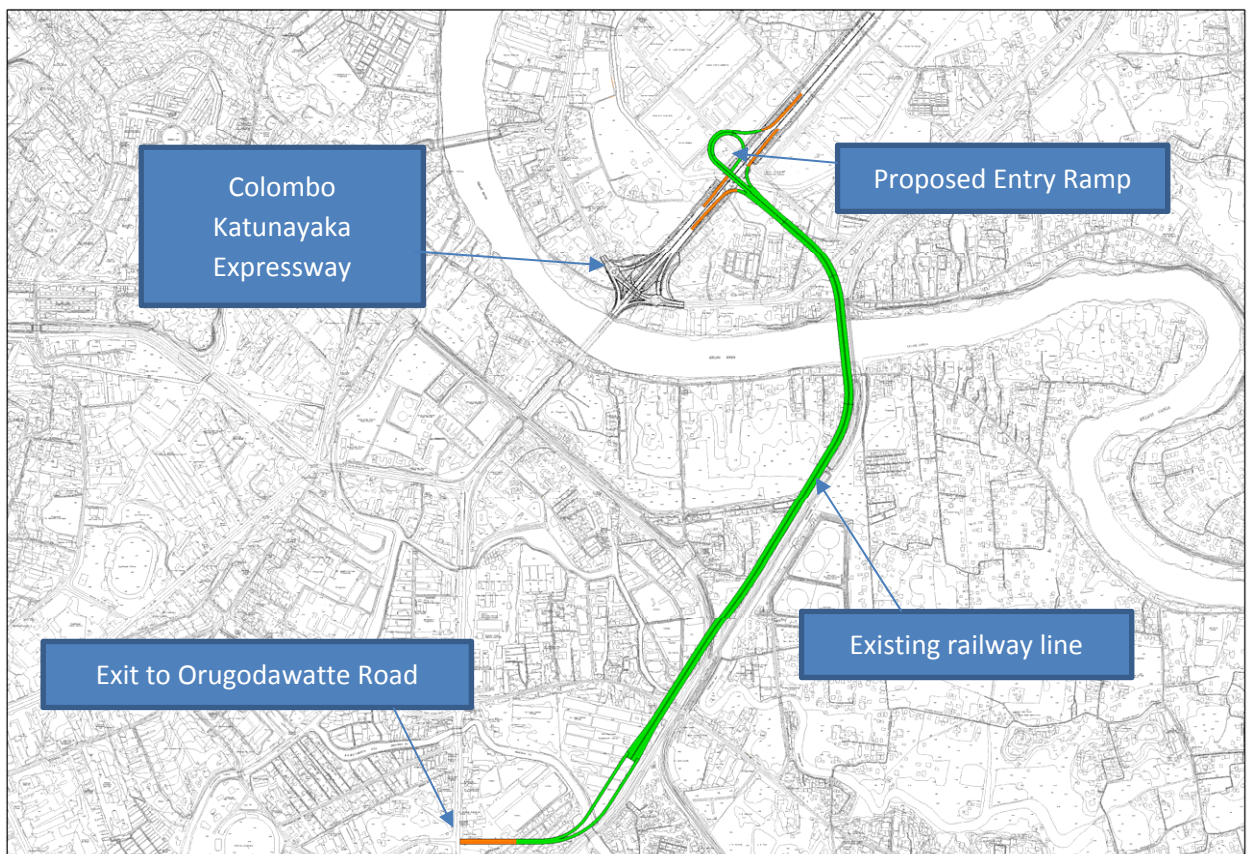


Figure 3-1 Alternative A: Adjacent to the existing railway

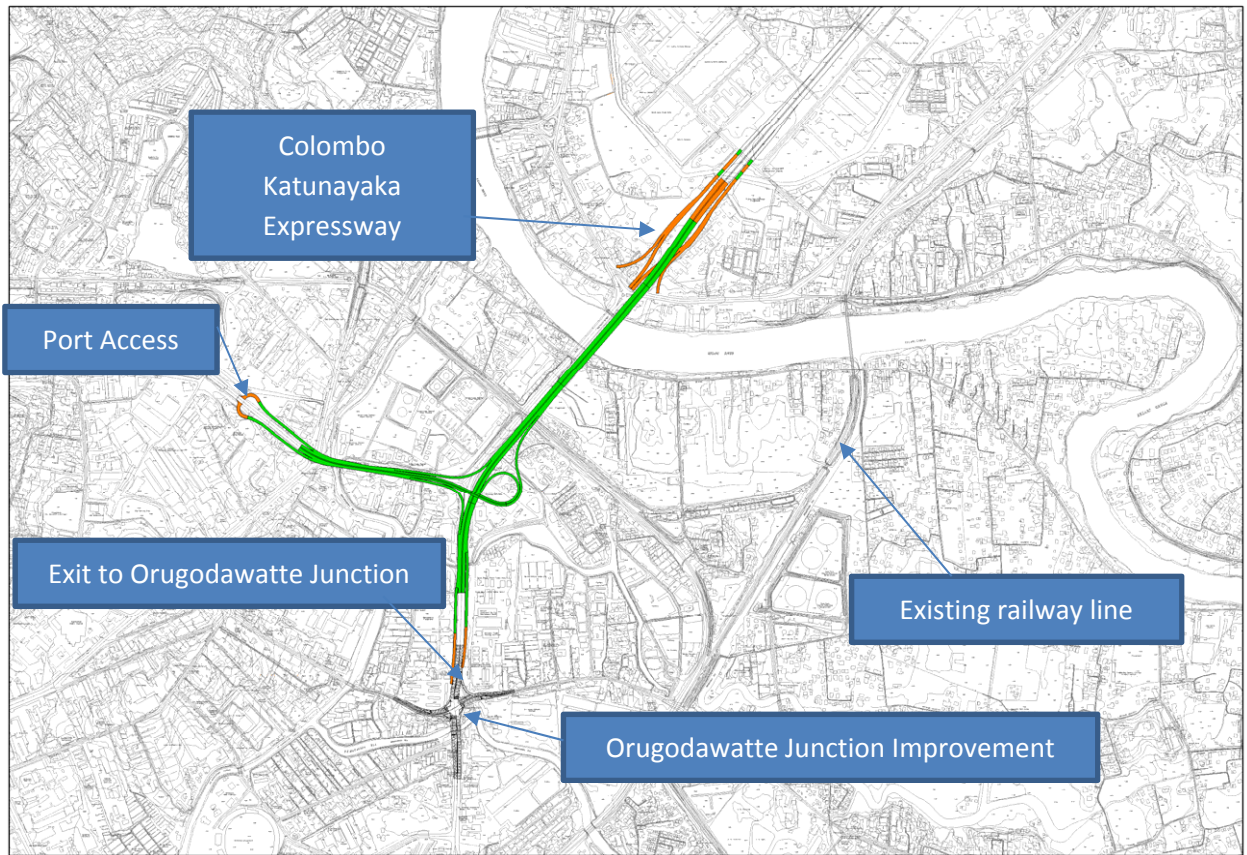


Figure 3-2 Alternative B: Adjacent to New Kalani Bridge

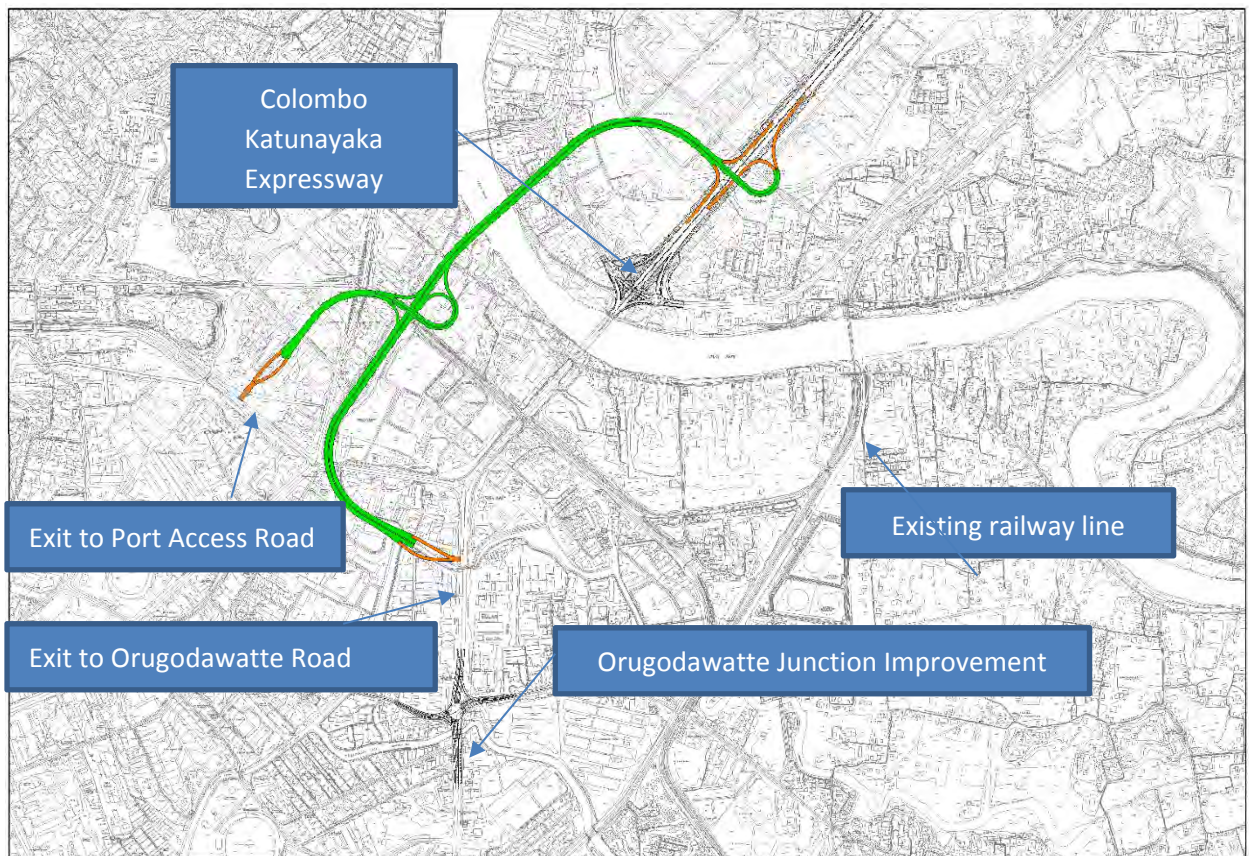


Figure 3-3 Alternative C: Above the existing canal trace

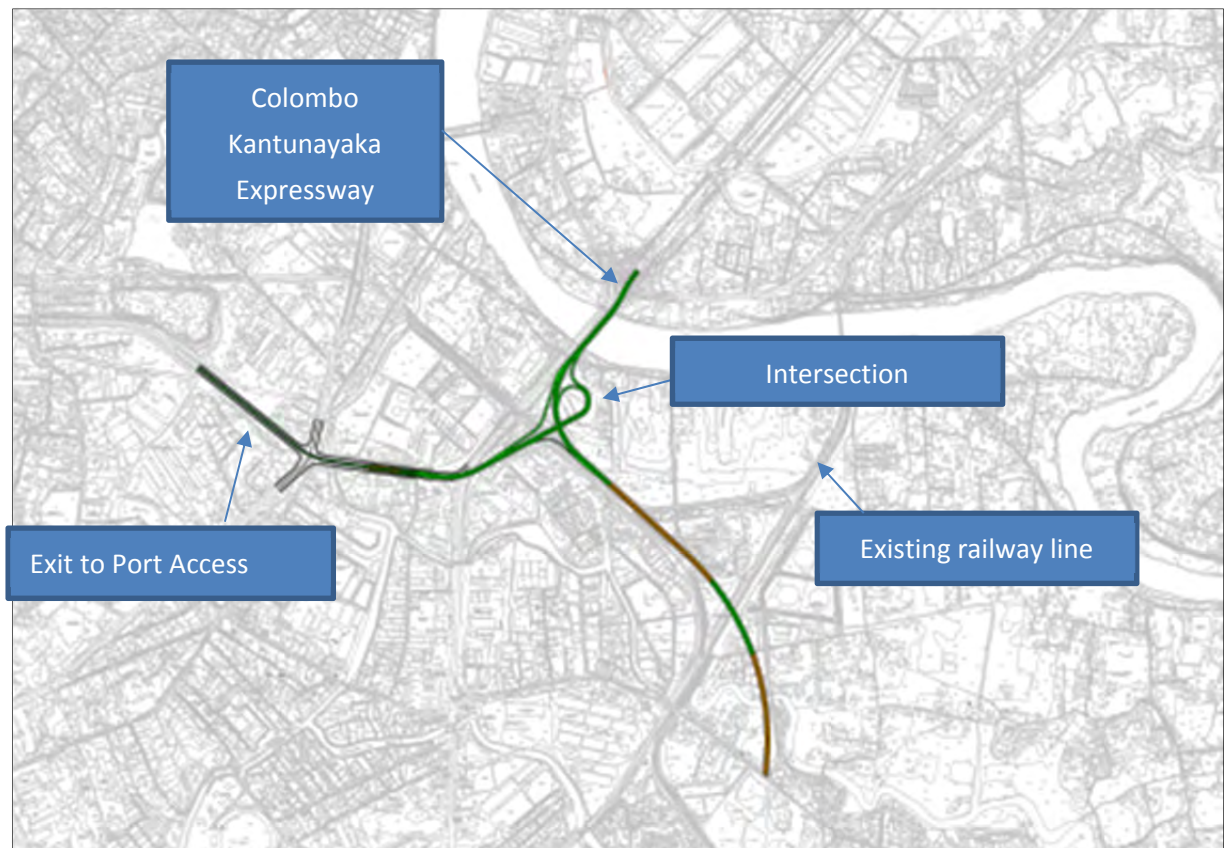


Figure 3-4 Alternative D: Above the existing road

Thought of alternative route candidates

Route A: The Expressway is constructed along the existing railway land in order to minimize the number of affected households.

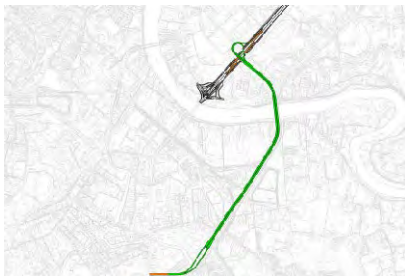



Route B: The Expressway is constructed along and above the Baseline Road in order to lead the vehicles using the Baseline Road to the Expressway, and to reduce traffic congestion in the Baseline Road.

Route C: The Expressway is constructed above the existing canal in order to minimize the number of affected households.

Route D: End point of the Expressway is connected to the Avissawella Road so that the vehicles using the Avissawella Road can access to the Expressway directly without passing Orugodawatta Intersection.

Further details of alternatives is presented in Annex 3.1.

Table 3-1 Comparison of Alternatives

	Alternative A		Alternative B		Alternative C		Alternative D	
Summary	<ul style="list-style-type: none"> • Main line: along the existing railway • Junction: Main line - CKE • On/off ramp: from/to Baseline Road 		<ul style="list-style-type: none"> • Main line: along and above the existing road • Port access: above the existing road • Junction: Main line - Port Access Road • On/off ramp: from/to Baseline Road from/to port area 		<ul style="list-style-type: none"> • Main line: above the existing canal • Port access: in the commercial area • Junction: Main line - CKE • On/off ramp: Main line - Port Access Road from/to Baseline Road from/to port area 		<ul style="list-style-type: none"> • Main line: along the existing road and in new area • Port access: above the existing road • Junction: Main line - Port Access Road • On/off ramp: from/to Avissawella Road from/to port area 	
Plan View								
Length	<ul style="list-style-type: none"> • Main line: 2.2 km 		<ul style="list-style-type: none"> • Main line: 1.6 km. • New Port Access Road: 0.7 km 		<ul style="list-style-type: none"> • Main line: 2.3 km. • New Port Access Road: 0.5 km 		<ul style="list-style-type: none"> • Main line: 2.0 km. • New Port Access Road: 1.4 km 	
Future Urban Expressway Network Plan	<ul style="list-style-type: none"> • The Project (first step of the urban expressway) is connected to CKE by a junction (not directly). • Port Access Road as a part of urban expressway is not provided. • Future extension to the south can be made but the distance would be longer (higher cost and increased land acquisition). 		<ul style="list-style-type: none"> • The Project (first step of the urban expressway) is connected directly to CKE. • Port Access Road as a part of urban expressway is provided. • Future extension to the south will be easily made. 		<ul style="list-style-type: none"> • The Project (first step of the urban expressway) is connected to CKE by a junction (not directly). • Port Access Road as a part of urban expressway is provided. • Future extension to the south can be made but the distance would be longer (higher cost and increased land acquisition). 		<ul style="list-style-type: none"> • The Project (first step of the urban expressway) is connected directly to CKE. • Port Access Road as a part of urban expressway is provided. • Future extension to the south can be made but the distance would be longer (higher cost and increased land acquisition). 	
Traffic Congestion on Existing Traffic	<ul style="list-style-type: none"> • Reduction of traffic congestion in Baseline Road is expected since the vehicles running Baseline Road can easily access to the Project Road. • Reduction of traffic congestion in A01 (existing New Kelani Bridge and Roundabout at the end of CKE) is expected since most vehicles from/to CKE use the Project Road. • Reduction of traffic congestion in A03 road is limited in the project area, since the new road is far from A03 road. 		<ul style="list-style-type: none"> • Reduction of traffic congestion in Baseline Road is expected since the vehicles running Baseline Road can easily access to the Project Road. • Reduction of traffic congestion in A01 (existing New Kelani Bridge and Roundabout at the end of CKE) is expected since most vehicles from/to CKE use the Project Road. 		<ul style="list-style-type: none"> • Reduction of traffic congestion in Baseline Road is expected since the vehicles running Baseline Road can easily access to the Project Road. • Reduction of traffic congestion in A01 (existing New Kelani Bridge and Roundabout at the end of CKE) is expected since most vehicles from/to CKE use the Project Road. 		<ul style="list-style-type: none"> • Reduction of traffic congestion in Baseline Road is expected since vehicles moving towards the east side could use Project Road instead of Baseline Road. • Reduction of traffic congestion in A01 (existing New Kelani Bridge and Roundabout at the end of CKE) can be expected but is limited since only those moving to the east side would use Project Road. • Traffic congestion in Avissawella 	

	Alternative A		Alternative B		Alternative C		Alternative D	
							Road will worsen.	
Construction Period	• 36 months	Fair	• 36 months	Fair	• 36 months	Fair	• 36 months	Fair
Constructability	• Traffic control is not required in Baseline Road during construction.	Good	• Traffic control is required in Baseline Road during construction.	Poor	• Traffic control is not required in Baseline Road during construction. • Construct of the viaduct in the existing canal is required.	Fair	• Traffic control is not required in Baseline Road during construction.	Good
Environmental Impacts	• Impact on noise and air quality will be increased along the Project Road since the Project Road will be newly constructed in residential and commercial area.	Poor	• There is a possibility that impact on noise and air quality will be increased along the Project Road, although the Project Road will be constructed along and above the existing road	Fair	• Impact on water quality of the existing canal will be created during construction. • Impact on noise and air quality will be increased along the Project Road since the Project Road will be newly constructed in residential and commercial area.	Poor	• Impact on noise and air quality will be increased along the Project Road since the Project Road will be newly constructed in residential and commercial area.	Poor
Social Impacts	• 355 structures including 12 large scale structures are affected. • Relocation of Automobile Engineering Training Institute is not required.	Fair	• 325 structures including NAITA Main workshop, Atomic Energy Authority, Amman Kovil are affected. Altogether 4 large buildings. • Relocation of the above large buildings is required.	Fair	• 404 structures including 9 large scale structures are affected. • Relocation of Automobile Engineering Training Institute is not required.	Fair	• 394 structures including 3 large scale structures are affected. • Relocation of Automobile Engineering Training Institute is not required.	Fair
Evaluation			Recommended					

Note: Number of structures for Alternative B based on recent social surveys is 449. Affected number of structures in the table is based on satellite imagery. In Alternative B higher number of households are indicated from survey because multiple houses exist inside visibly single housing units which cannot be identified by satellite pictures. Also the current survey figures indicates the actual ground situation.

REASONS FOR SELECTING ALTERNATIVE B

Technical Reasons

1. Urban expressway connecting Colombo northern and southern areas is provided.
2. The Project Road (first step of the urban expressway) is connected directly to CKE.
3. Port access as a part of urban expressway is provided.
4. Reduction of traffic congestion in the project area such as A1, A3 and Baseline Roads is expected.

Social and Environmental Reasons

5. Optimum number (comparably second highest) of large buildings have to be removed.
6. Least number of settlements to be removed (According to the results of satellite imagery analysis)
7. Minimum water quality impacts, as roads are not built directly over canals
8. Alternative B uses existing road trace as far as possible thus minimizing the impacts on residential houses.

Social Impact Minimisation through Alternatives

Various route alternatives were identified in terms of social impact (i.e. displacement of social infrastructure) which has been represented in the figure below. It is seen that Alternative-B has minimum impact as it mostly follows the existing road traces.

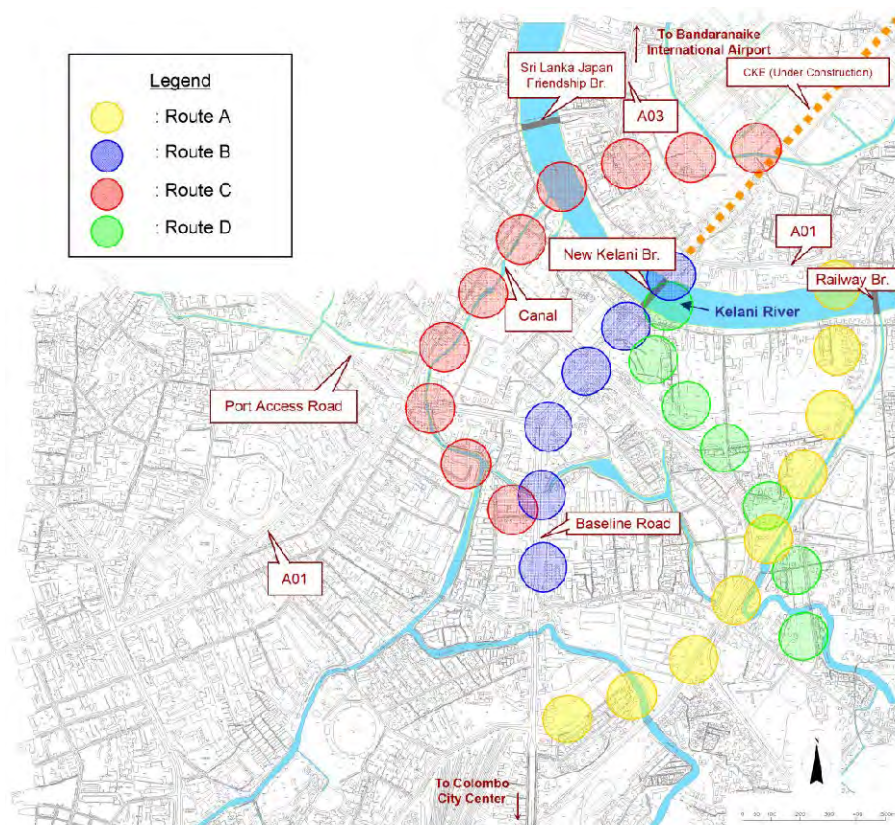


Figure 3-5 Route Alternatives in Social Perspective

The effect of not implementing the project

Three bridges across the Kelani River have been always congested, especially in morning and evening peak hours, due to a high concentration of vehicles on the bridges.

Traffic volume of the Baseline Road near Orugdawatta Intersection is 95,801 veh/day (89,833 pcu/day) in 2012. The traffic capacity on the Baseline Road, which has 6-lane carriageway, is not enough even in the present condition.

In addition, it is forecasted that traffic volume on the Kelani Bridge will increase and the Bridge will become a traffic bottleneck in this area, since some projects such as Colombo - Katunayake Expressway (CKE) (completed in 2013), Outer Circular Highway (OCH) (will be completed in 2015) and the expansion of the Colombo Port, phase one scheduled to open in August 2013.

CKE is connected to the existing New Kelani Bridge, and ramps are connected to two adjacent roundabouts. Traffic congestion in this area will be worsened since a large number of vehicles using CKE, existing New Kelani Bridge, A01 Road and A03 Road will concentrate in this small area.

Therefore, if this project is not implemented, the negative effect on the economy as well as the environment (for example, increase of CO₂ emission) will occur in this area.

3.1.2 Construction Alternatives

Various bridge types, ramp arrangements, interchange arrangements, have been selected as construction alternatives and summary of details are given below;

For bridge types following criteria have been considered.

Impact on the river flow:

As the main bridge will be located downstream of the flood plains, it is important not to disturb the river flow, in order to avoid any risk of flooding. The span arrangement of the main bridge will thus have to be adjusted in order to minimize the number of piers located in the river bed. It was noted that by adopting a design which does not make a pier in the Kelani River from environmental considerations, it is not causing harmful interference to the flow of the river

Impact on the existing bridge:

The main bridge will be located 10m upstream of the existing crossing. However there is no impact on the existing bridge since the piers will not be constructed in the river in this project.

Environmental considerations in structural design:

In order not to affect the flow of the river, the designers do not want to build a pier in Kelani River. Regarding the interchange and ramps, the designs were done to avoid the existing structure as much as possible

Constructability of the bridge foundation:

Construction of the bridge foundation in the river bed will be a challenging task as the rock layer on which the substructure can be founded is located 30 meters deep from the actual ground level of the existing bridge according to literature. Therefore the bridge type, without piers in the river was selected considering constructability.

Location of piers on the CKE side:

The current roundabout located near the northern abutment of the New Kelani Bridge is highly congested, as it gathers the traffic coming or going to the Northern part of the country. Therefore construction of piers in the intersection is avoided.

Construction period:

The CKE will start operating before the end of the year 2013, and it will bring additional traffic into an area where road congestion is already a major issue. It is thus essential to select a type of bridge which can be built quickly, so as to minimize the period during which the traffic congestion generated by the new CKE will impact the area. Reducing the construction period is thus one of the main criteria to ensure a successful project implementation. Therefore steel box Girder Bridge was selected in order to shorten the construction period especially above the existing road.

Aesthetics:

The main bridge will cross the Kelani River just after the New Kelani Bridge Interchange, which will connect the International Airport to the Central Area of Colombo, becoming a new landmark of the city. As it will be one of the first major edifices that tourists will see when arriving at Colombo, it will have to symbolize the fast growing development of the country and its beauty. Emphasis should thus be put on the aesthetic aspects of the main bridge. Therefore an extra-doed bridge which has a symbolic tower and cable arrangement was selected.

3.2 Description of the proposed project - Selected Site**3.2.1 Project Location,**

Project Location is presented in Figure 3.5 below. Area bounded by the GN divisions affected by the project was considered as the project area and the project influential area was considered as the respective DS divisions as outlined in Table 3.2 below.

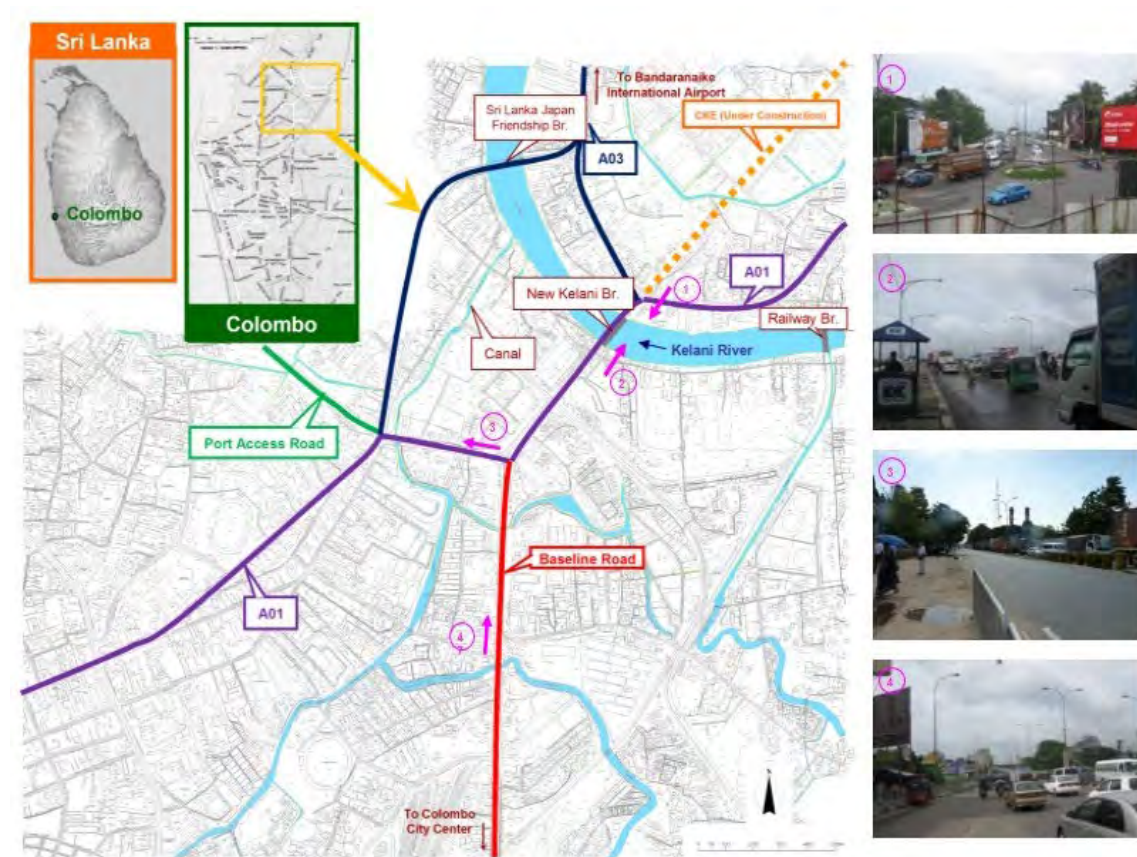


Figure 3-6 Project Location Map

3.2.2 Administrative Divisions

Table 3-2 Project affected administrative divisions

District	DS DIVISION/MC or PS	GN Division
Colombo	Colombo- Colombo MC	Navagampura Grandpass North Bloemendhel
Colombo	Kolonnawa- Kolonnawa UC	Wadullawatte Orugodawatte Sedawatte
Gampaha	Kelaniya- Peliyagoda UC	Peliyagoda Gangabada East

MC= Municipal Council PS= Pradesheya Sabha DS= Divisional Secretariat GN= Grama Niladhari

3.2.3 Bridge Aesthetics

To gain an iconic value to the proposed new bridge across Kelani river facets of national heritage represented by national symbols and other portrayals such as the Kandyan Dancer, Traditional mask of devil (*Gara Yakka*) , national flag, the symbol of the republic, national bird (jungle fowl) and the national flower (*Nil mahanel*) have been made use of.

Portrays of the proposed new bridge along with the national symbols present on the next page.



Figure 3-7 Portrait of the proposed bridge- closer view



Figure 3-8 Portrait of the proposed bridge- distant view Along with the existing bridge



Figure 3-9 Facets of National Heritage and Symbols Used in the Aesthetic Design of the Bridge

3.3 Location map/s of appropriate scale indicating the road trace and surrounding land use.

Location map showing surrounding land use map of the project area is given in Figure 3.9 below.

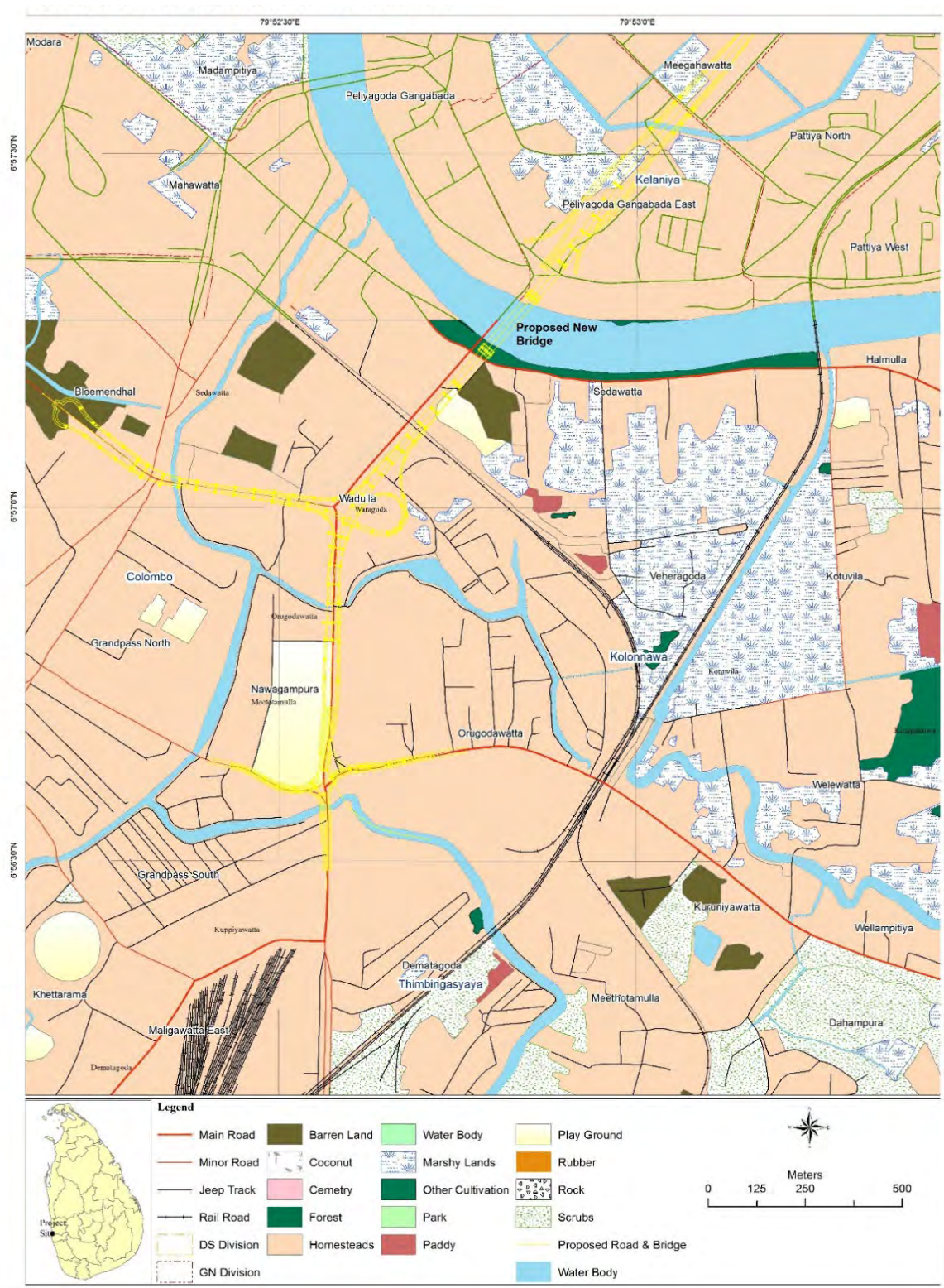


Figure 3-10 Land Use Map of the Project Area with Project Location

Source: Department of Survey

3.4 The layout plan of the project at appropriate scale.

Layout Plan for the project area (for the Selected Alternative) is presented in Figure 3.10 below.

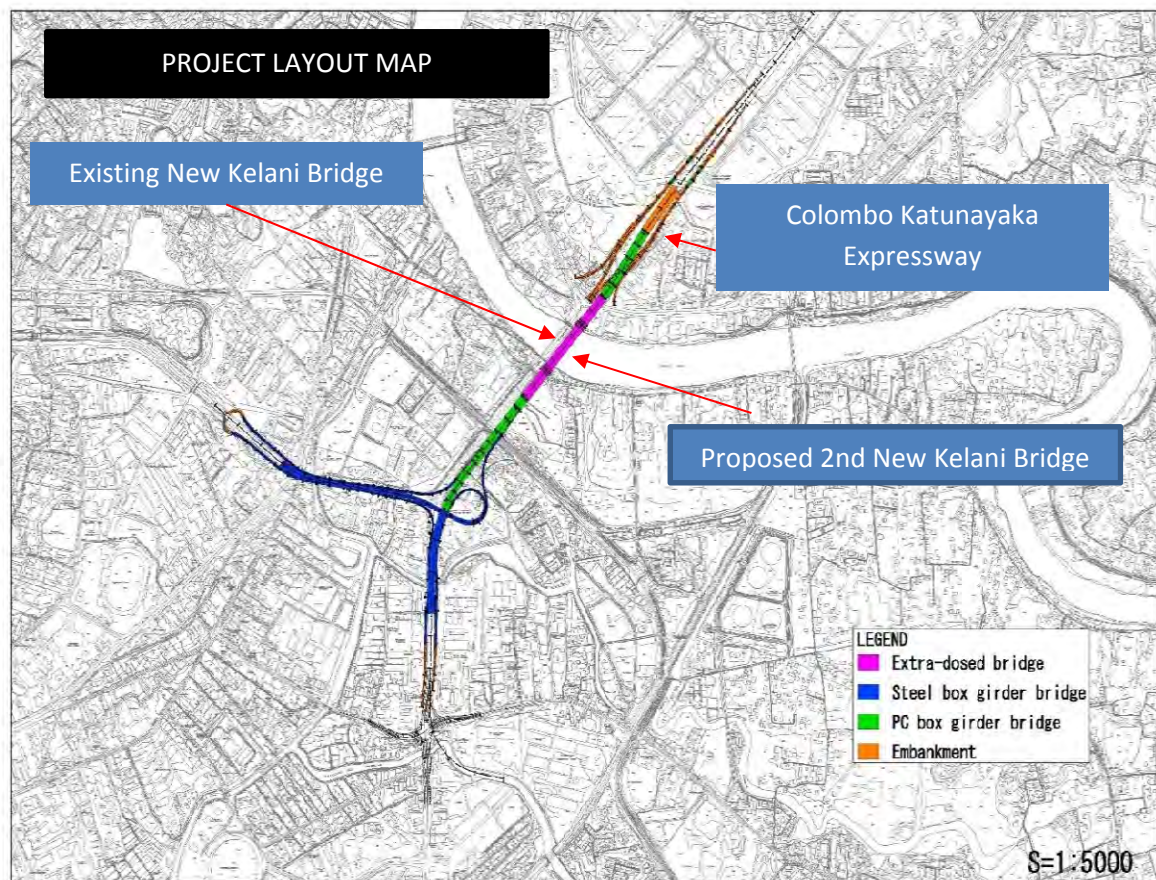


Figure 3-11 Layout Plan for the Project Area

Detailed layout drawings are presented in Annex 3.2.

3.5 Design Details of all Bridge Components Including Design Details of the Bridge, length of traces etc.

Design details of the project components are as follows;

3.5.1 Bridge type:

Overall, each section of the project can be categorized in the following four types of sections as given in figure 3.11.

- Main bridge (the 2nd New Kelani Bridge)
- Approach bridges (Separated section)
- Approach bridges (Overlapped section)
- Ramps

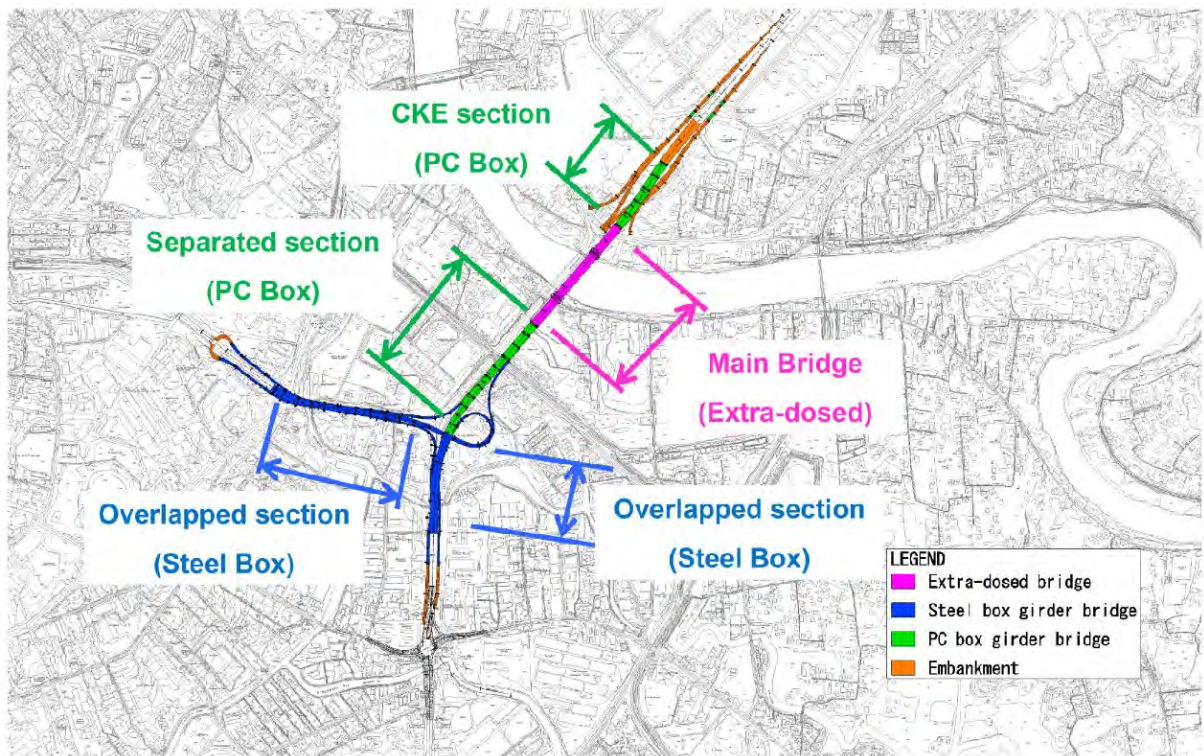


Figure 3-12 Bridge sections of proposed project

- **Main bridge**

The main bridge will be an extra-dosed bridge which crosses Kelani River just downstream of the New Kelani Bridge Interchange, relieving the existing New Kelani Bridge of its increasing traffic. As the CKE will be a six-lane expressway, the carriageway of the Main Bridge will be of six (6) lanes.

The main bridge will be with a single span which has been set at 185m in order to cross the Kelani River without having piers in the river. In order to balance the moments in the different spans during the operation of the bridge, and to ensure positive support reactions on the end piers, the side spans were set at 115m (62% of the main span). The width of the main bridge will be 30.4 m which include six lanes with a total width of 26.5 m and 1m center median (please refer Annex 3.1 for design details and the comparison of different design types for the main bridge).



Figure 3-13 Main bridge across Kelani River (Extra dosed type bridge)

The separated section consists of approach bridges located on both sides of the main bridge, which will be built next to the existing road, without overlapping it. The carriageway of those approach bridges will have six traffic lines, as the separated sections will be built as an extension to the main bridge.

At this stage of the study Precast Box Girder bridges are suggested as the most suitable option for the approach bridges in the separated section. The width of the approach bridges will be 28.4 m and the span length will be 40~50 m (please refer Annex 3.1 for design details and the comparison of different design types for the approach bridges).



Figure 3-14 Images of Precast Box Girder bridges

- **Approach bridges (Viaducts, Overlapped section)**

The overlapped section consists of the approach bridge located between the Kelanitissa Ramps and Orugodawatta Interchange, and the approach bridge located between the Kelanitissa Ramps and the Ingurukade Interchange. Both approach bridges will be built over the existing roads. The width of the bridges will be 21.4 m which includes 19.5 m for four traffic lanes. Bridges of the overlapped sections will be constructed as Steel Box Girder bridges with a span of 40~50 m (please refer Annex 3.1 for design details and the comparison of different design types for the approach bridges).

- **Ramp Bridges**

Ramps Bridges will be used at every interchange of the Project to connect the new infrastructure to the existing road network. A Half Clover Type will be used for the Ingurukade Interchange, a Trumpet A Type for Kelanitissa ramps and side ramps for the New Kelani Bridge interchange. The ramp bridges have been designed with steep longitudinal slope, sharp curves, so as to reduce the land acquisition required for their implementation. Their alignment has been adjusted so that their piers avoid the existing roads and their construction does not impact the traffic on the existing roads.

In this feasibility study it is recommended to construct the ramps with Steel Box Girder. The ramp bridges will have a width of 6.9 m with two traffic lanes and a span of 30~60 m (please refer Annex 3.1 for design details and the comparison of different design types for the ramp bridges).

At this level of the study it has been recommended that all approach roads are placed as viaducts, thus no embankments are required in the project. The only filled sections will be the entry and exit ramps of the approach bridges which merges the elevated bridge sections and ground level roads (existing roads).

- **Drainage provisions**

Storm water drainage provisions will be kept in all bridges and the runoff will be discharged into the Kelani River through roadside drainage structures.

3.6 Methodology of construction

3.6.1 Whether cofferdam is envisaged, sources and quantities of raw material required and locations and quantities of disposal of waste.

Whether Cofferdamming is Envisaged

Major coffer dams may not be necessary as there are no piers in the river sections except for the end piers. Some coffer dams may be necessary for the end piers. The need will depend on the contractors' method of construction.

Sources and Quantities of Raw Materials Used

All construction materials will be procured as a commercial product basically, and it is not intended to operate quarries, borrow pits or metal crushers directly under the project. However all materials will be obtained from approved sites where EPL and other certificates are available.

Approximate Quantities of Construction Materials

Various road construction materials will be required for the construction, and out of those which are important in an environmental point of view are the materials which will be obtained from natural sources. These materials are rubble (9" for foundation), sand and metal (1" and 3/4") for aggregates and following approximate quantities of each material will be needed for construction work and they have to be sourced from the approved sources (e.g. quarries/borrow pits with EPL, sea sand from SLLRDC sand stockpiles etc.) "

Rubble (9") = 1,650 m³

Metal (3/4") = 71,000 m³

Sand = 47,000 m³

Cement = 38,600 MT

Earth work = 91,000m³

These amounts were estimated from the bill of quantities provided for project components taking into account rubble and cast in situ concrete components. Soil quantities for coffer damming cannot be estimated at this stage.

Method of Construction

Standard construction techniques in road construction will be employed in construction and most of the construction work will be machinery based. Some water based equipment such as pontoon mounted equipment may be used to work in Kelani River. There will also be a little amount of manual constructions such as providing finishes, lane marking etc.

3.6.2 Details of Construction Space

Construction space will be required along the project road. 10 m or 5 m from the project road edge will be leased during construction. This space is involved in the Resettlement Action Plan (RAP) as a project affected area. In addition, two construction yards will be secured at existing open areas. Demarcation of ROW and Construction Space are presented in Annex 3.3

3.6.3 Other facilities and services to be provided

This is an urban transport improvement project within Colombo city by using the existing road network to cause traffic flow improvement. The roadway and bridge access facilities and related services will be provided within the project scope.

There were some requests from stakeholders of the project area that a pedestrian crossing is very important to cross the existing bridge to reach Orugodawatte. This request was made during the stakeholder meeting held on 26 March 2013. The necessity of having a pedestrian crossing was noted by RDA and it will be included in the designs.

3.7 Requirement and availability of workforce (during construction) labor camps etc.

Construction work will be awarded to a recognized major construction contractor who will recruit a necessary labor force based on the stages of the project. It is not intended to construct temporary labor camps on site as space is limited. Laborers will be brought to site in shifts and there will not be any resident laborers in labor camps at the site. However a limited number of personnel will remain at the site to maintain the site offices and security of construction material and equipment.

The tentative project implementation schedule is presented below.

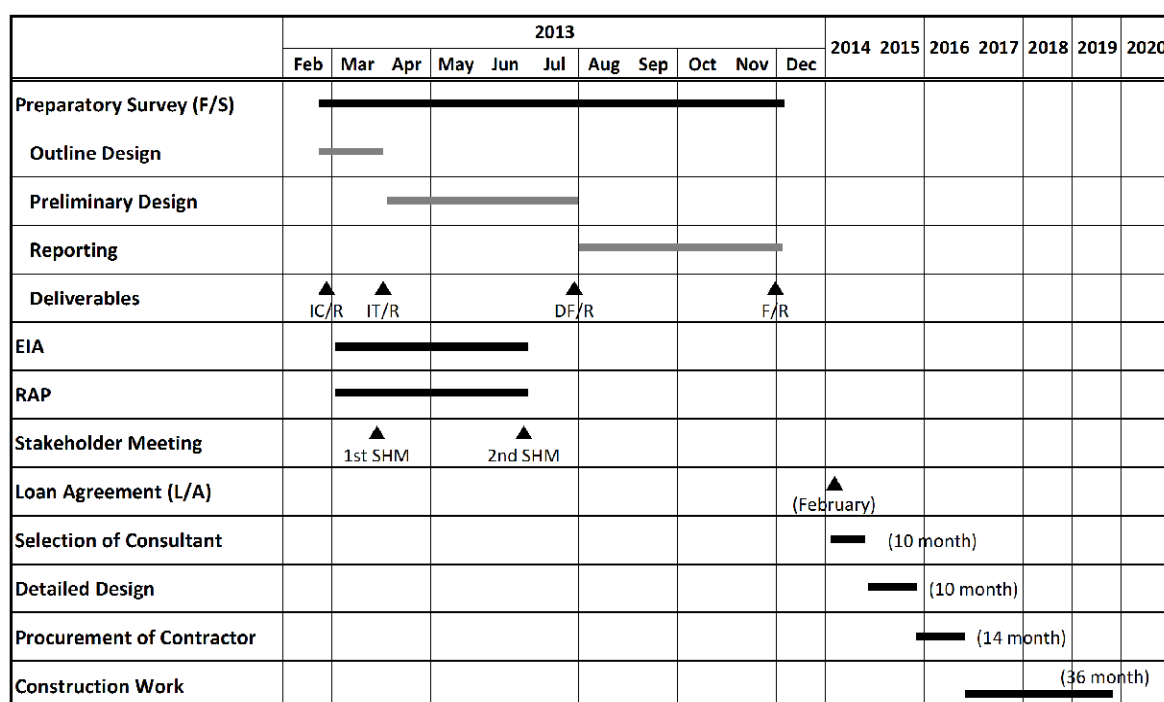


Figure 3-15 Tentative project implementation schedule

3.8 Methodology of operation of the project components, any maintenance requirements during the operational phase and methodologies to be used

Once the main bridge, the approach bridges and ramp bridges are commissioned they will require periodic routine maintenance. Such maintenance work will include cleaning of the road lanes, hydraulic structures, the roadside drains. These works will be handled by RDA through the hierarchical administrative system of Provincial Director, Chief Engineer, Executive Engineer, etc. Funding for such activities will be allocated from the operating budget for RDA. There is no significant impact to the physical environment or to the social environment from such regular maintenance activities.

The latest technology in bridge construction will be used for the project with the aim of minimum maintenance throughout the life span of the bridges. A provision of “Defect Liability Period” will be kept after commissioning the main bridge and other approach bridges where the contractor will be held responsible for carrying out repairs for any defects observed in the bridges. After this period RDA will take over the maintenance.

3.9 Project construction cost

The project construction cost will be approximately Rs. 60.9 billion. As stated in the introduction chapter the GoSL has requested financial assistance from the Government of Japan under JICA funding. Tentative project costs extracted from the JICA Preliminary Design Study are given below.

Table 3-3 Tentative project construction cost (based on preliminary designs)

Item	Description	Amount (LKR.)
1	Civil Works	34,769,000,000
2	Dispute Board	64,000,000
3	Price Escalation	1,968,000,000
4	Physical Contingency	3,680,000,000
5	Consulting services	5,237,000,000
6	Land Acquisition	5,108,000,000
7	Administration Cost	4,066,000,000
8	VAT	5,486,000,000
9	Import Tax	0
10	Interest during construction	154,000,000
11	Commitment Charge	367,000,000
	Total	60,900,000,000

4 DESCRIPTION OF THE EXISTING ENVIRONMENT

This chapter discusses the existing physical, biological and social environments around the project area. The information presented are based on the field observations and available literature. Baseline standards of ambient air quality, noise levels, vibration levels, and surface and ground water qualities were established by measuring levels of such selected environmental parameters.

4.1 Physical environment:

4.1.1 Topography including existing ground levels with respect to MSL along the trace,

Topography of the area consists of relatively flat terrain which consists of flood plain areas, slightly elevated areas of congested urban character. Existing approximate ground levels in the project area are as follows;

Built up areas	-	+2.2m MSL to 3.9m MSL
Marshes	-	+1.1m MSL or less
Flood Plains (Partially built up)	-	+1.4m MSL to 1.7m MSL

4.1.2 Geology and soil,

The main geological strata type is undifferentiated Proterozoic gneiss: poorly exposed under the thick residual soil, alluvium and paddy clay which belongs to "*Vijayan* complex". The geology map is presented in Figure 4.1

Geology Map of New Highway Bridge Over Kelani River

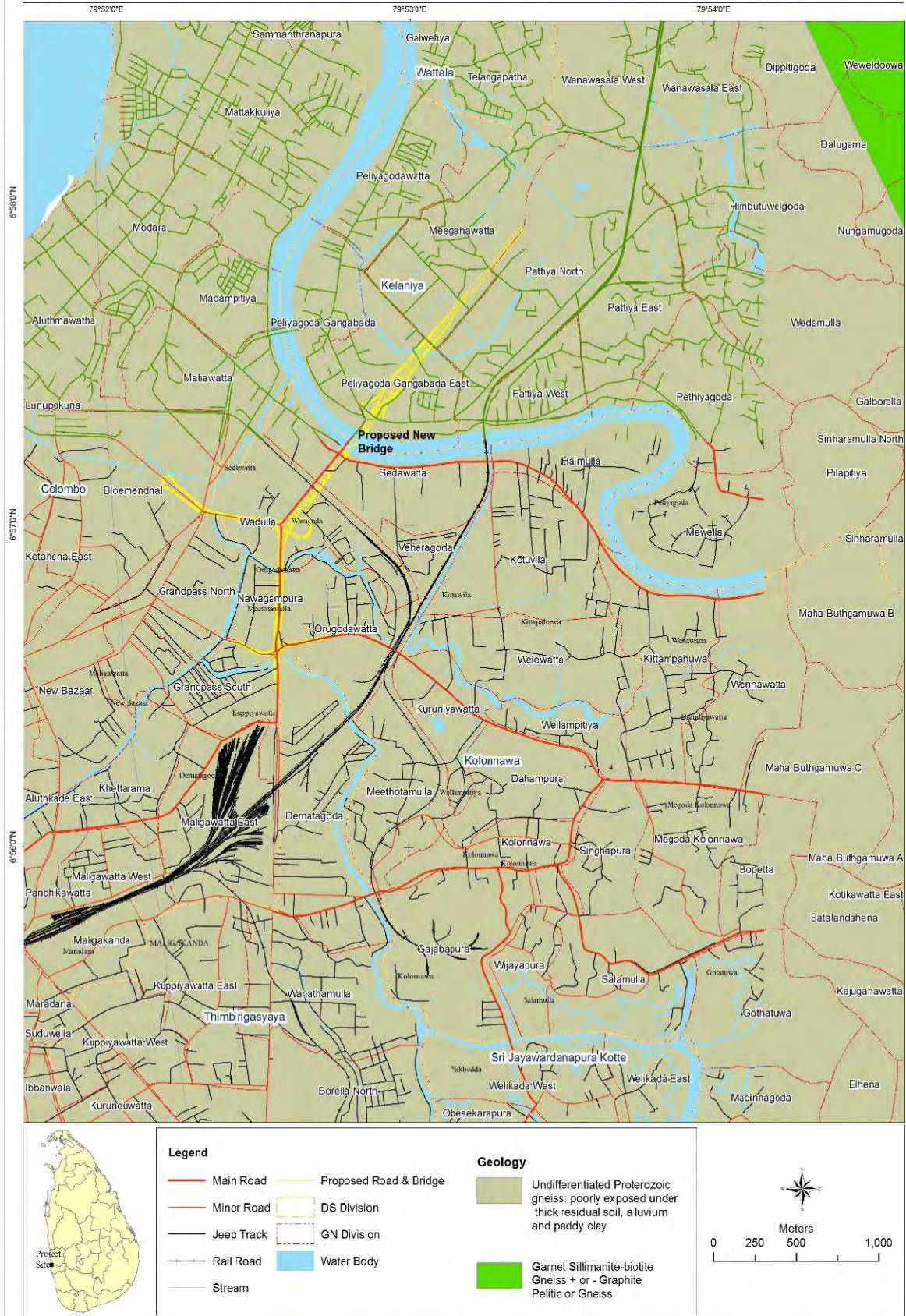


Figure 4-1 Geology Map of the Project Area (Source: Geology of Sri Lanka, P.G. Coorey)

Soil

The predominant soil types in the area are alluvial soils in variable drainage and texture in flat terrain and Red Yellow Podzolic soils with soft and hard Laterite in rolling and undulating terrain.

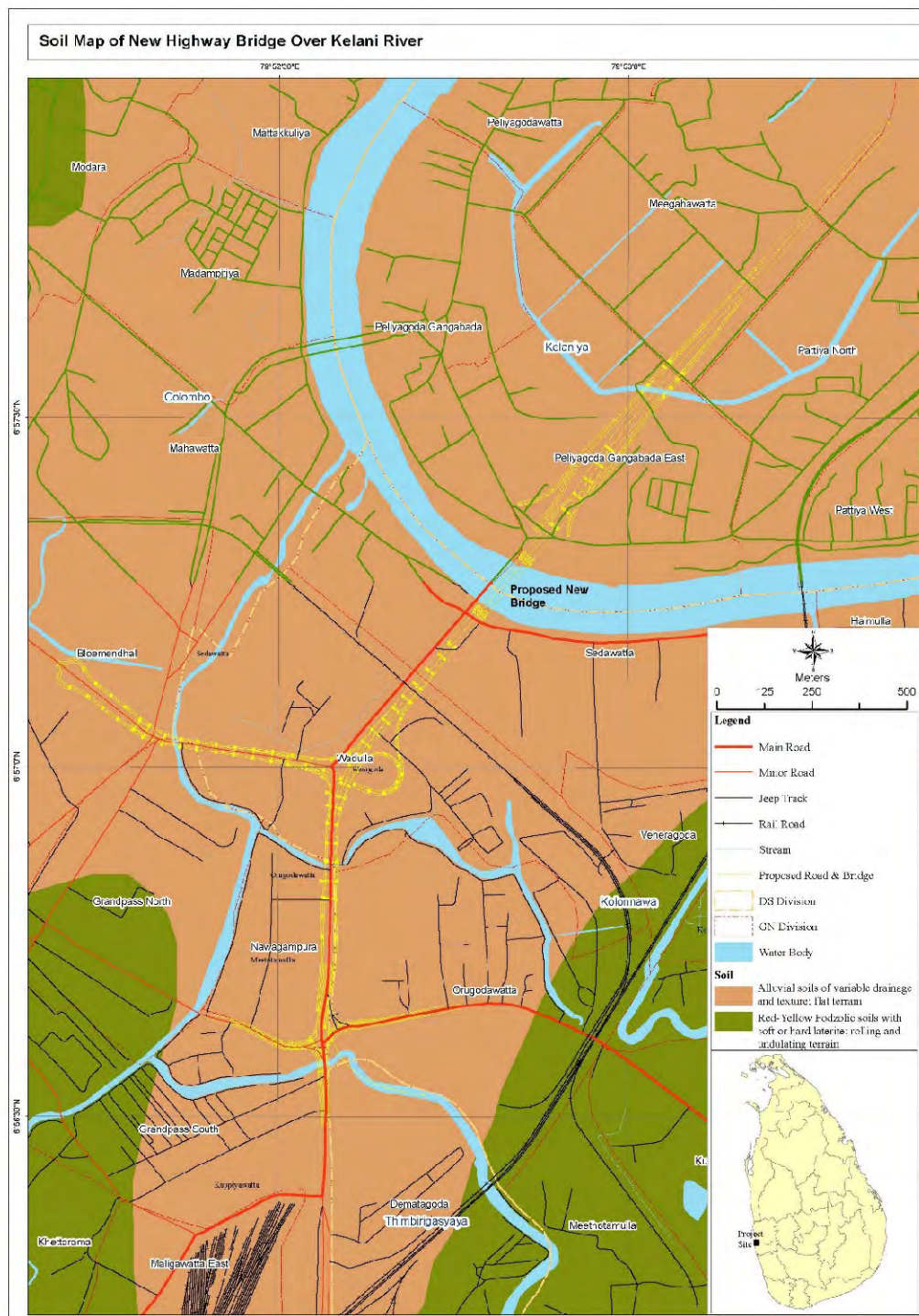
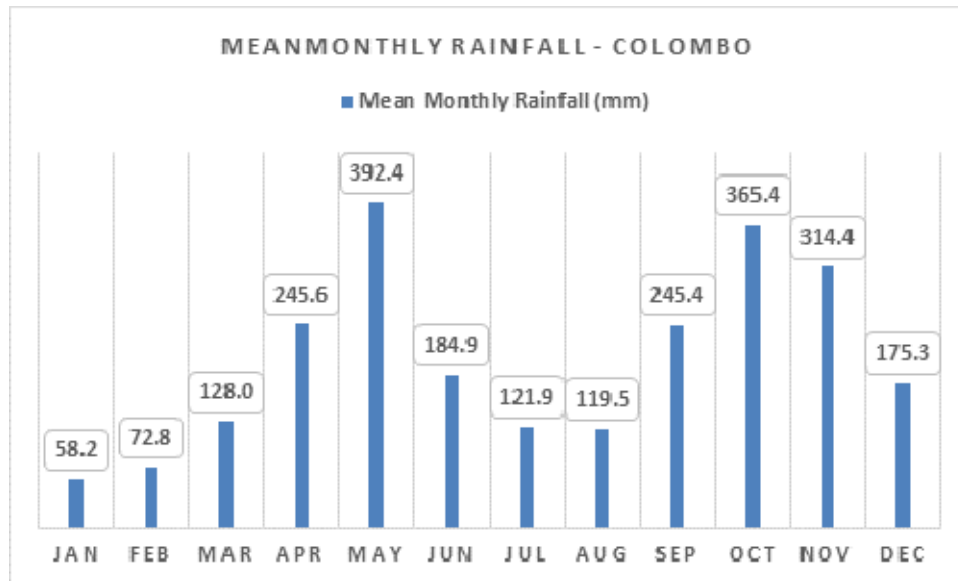


Figure 4-2 Soil Map of the Project Area (Source: Panabokke C- Soils of Sri Lanka)

4.1.3 Climate and meteorology etc.

4.1.3.1 Rainfall

Rainfall in Colombo conforms to a Bi-Model pattern where monsoon seasons take place in two phases, as May to August and October to January. In May, Colombo experiences its highest level of precipitation. Rainfall during this period is highest in May and June and begins to get lower in the middle months of July and August. In Colombo, dry season is a hot and humid lasting from December to March. The lowest rainfall level is observed during January. Long term average rainfall for Colombo along with average rainfall days are given in Figure 4.3 below.



Source: Department of Meteorology

Figure 4-3 Average Rainfall Data Colombo

4.1.3.2 Temperature

Colombo weather is fairly temperate throughout the year. However, from December to March the weather remains fairly dry. The average temperature in Colombo is 28 °C and the maximum temperature is 31 °C. The temperature during night time drops down to an average of 22 °C between November and March, where the average temperature remains to be at 27 °C. The highest temperatures seemed to have occurred in February and March when it rises up to 36°C, still the average temperature remains at about 28 °C, which is also equal to the average temperature all through the year. While the daytime temperature usually settles at 28 °C to 29 °C, the average daily minimum only falls to 25 °C to 26 °C. There is very little range in temperature both during the day and through the whole year. There is high humidity year round, and rainfall fluctuates depending on whether the season is wet or dry. Average high and low temperature values are portrayed in Figure 4.4 below.

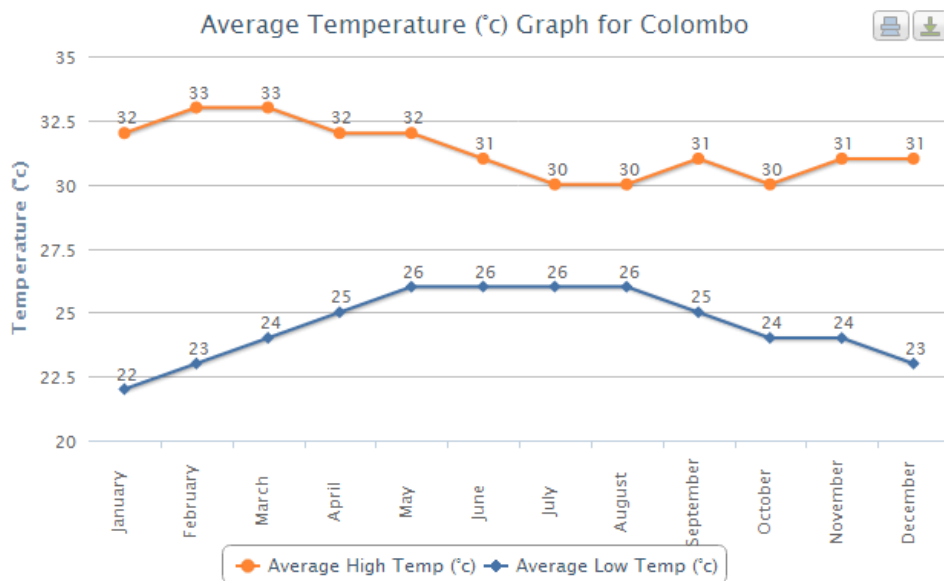


Figure 4-4 Average High and Low Temperature

4.1.3.3 Relative Humidity

Long term relative humidity values for Colombo is illustrated in Figure 4.5 below.

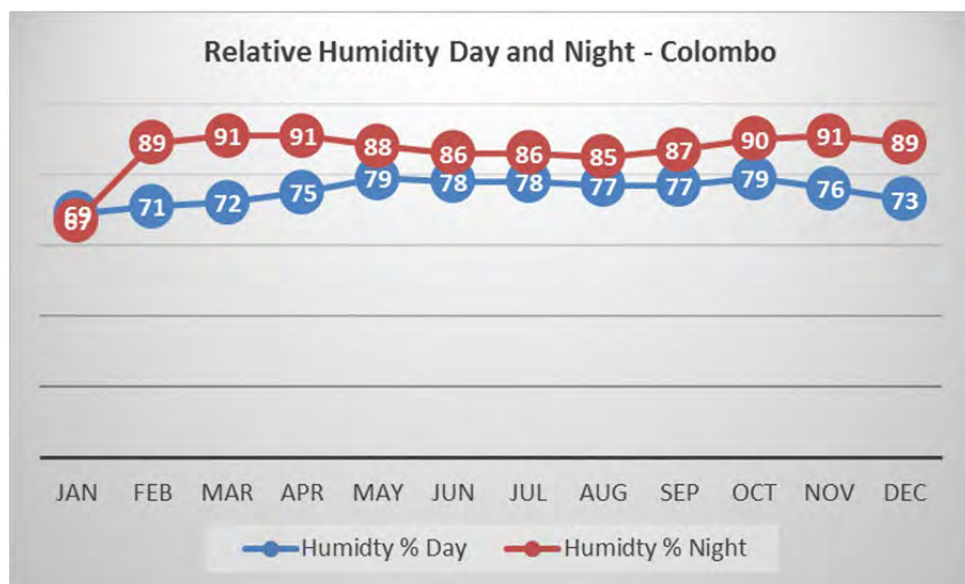


Figure 4-5 Day and Night Relative Humidity in Colombo

Source: *Climate of Sri Lanka – Chandrapala L –Unpublished*

4.1.3.4 Potential Evaporation

Long term mean potential evaporation for Colombo is given in Figure 4.6 below.

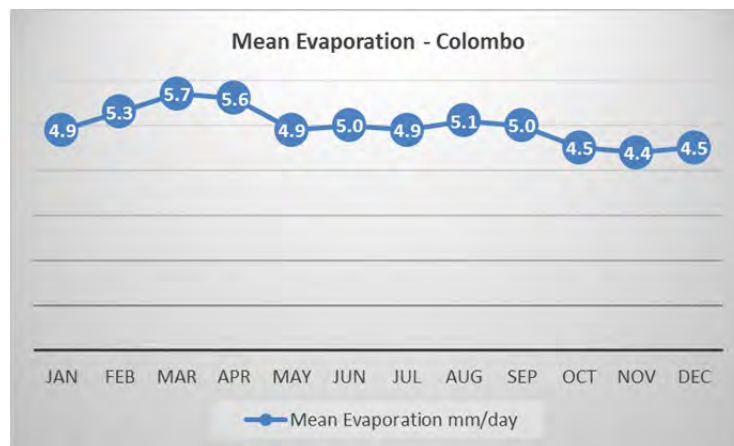


Figure 4-6 Mean Evaporation - Colombo

Source: *Climate of Sri Lanka – Chandrapala L –Unpublished*

4.1.3.5 Wind

Wind roses for the Colombo meteorological station is presented in Figure 4.7 below.

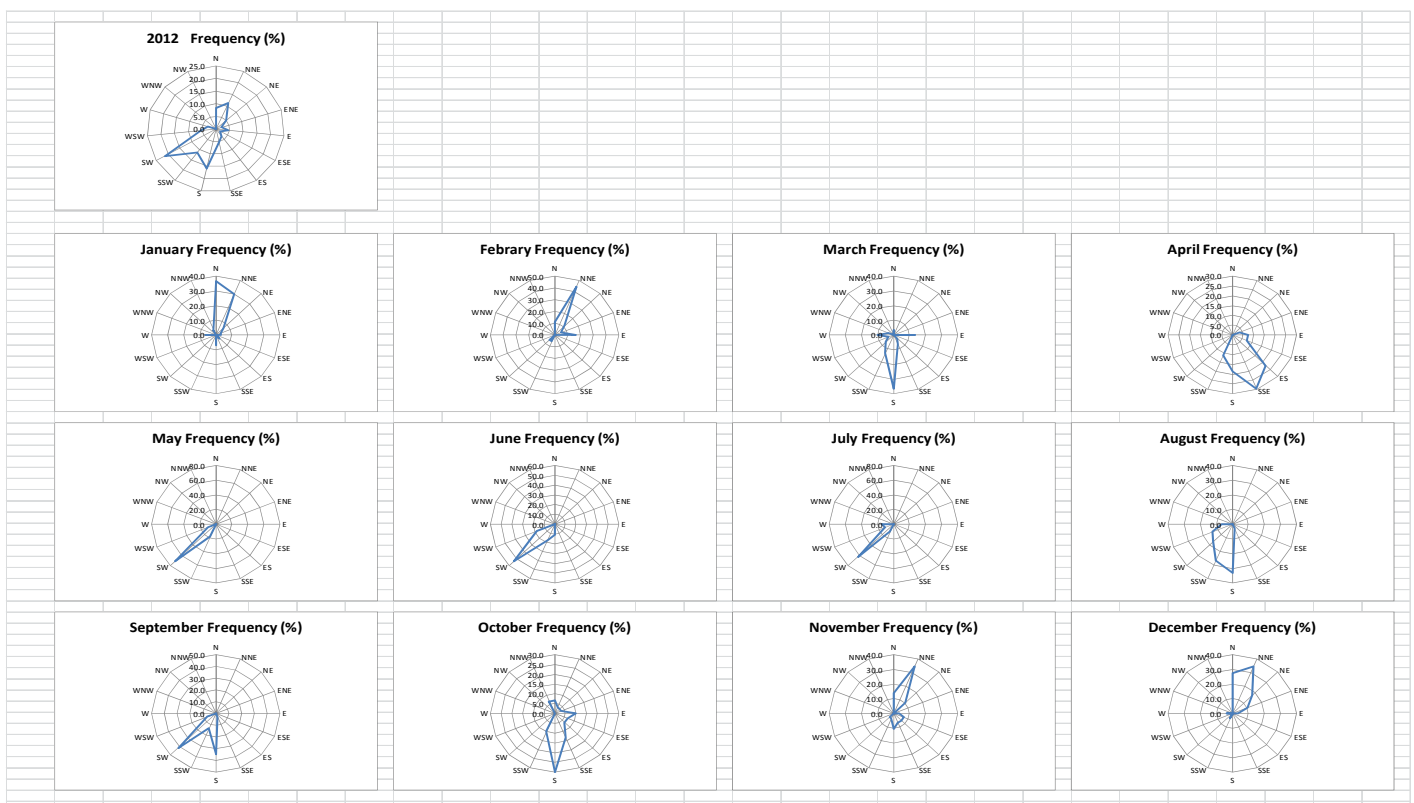


Figure 4-7 Wind roses for Colombo (2012)

4.1.4 Surface and groundwater hydrology and drainage

4.1.4.1 Drainage pattern across the proposed trace

The proposed bridge and the attendant road access improvement take place in the flood plain of the Kelani River and the surrounding high ground area. The drainage pattern of the project area is directed towards the Kelani River and then to sea through the Kelani River outfall. The drainage pattern of the project area is depicted in Figure 4.8 below.

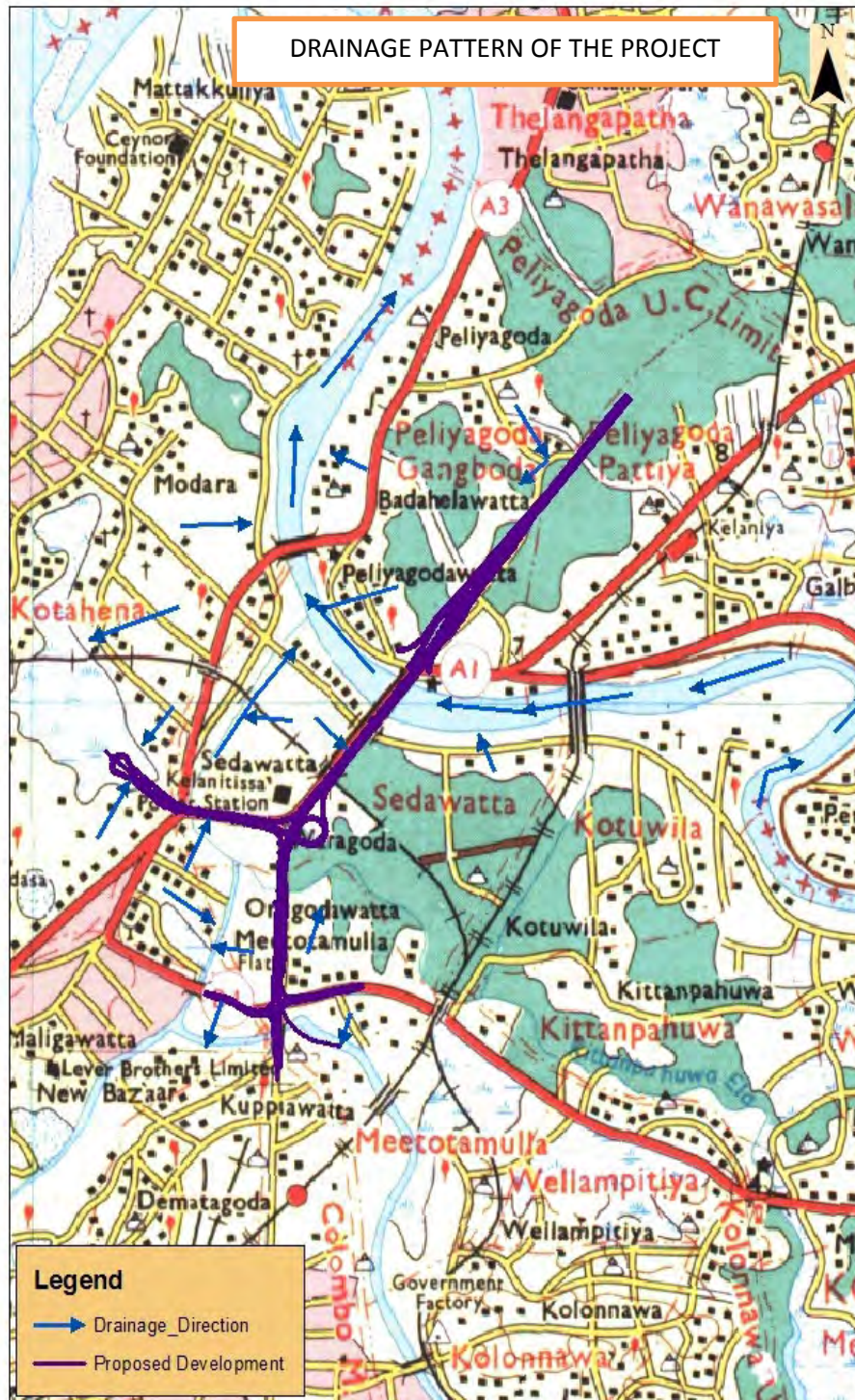


Figure 4-8 Drainage Pattern of the Project Area

Source: Survey Department Topography Maps and Google Earth Maps

4.1.4.2 River Condition and Cross Section of Bridge Site

River condition and cross section of the bridge on the site is presented below.

Table 4-1 River conditions at proposed bridge site

Item	Detail	Remarks
Location	Within 10m upstream of existing Kelani Bridge	
River Cross Section	See figure	
Main River Width	145m	
Minimum Riverbed Elevation	Between -5.0 to -6.0 MSL	
Average Velocity	-0.3 to 1.5 m/s	Tidal Fluctuations
Average Water Level Variations	-0.2 to 0.5 m MSL	Tidal Fluctuations
Flood Level (1989 Flood)	2.79 m MSL	Source: Irrigation Department; Data at Nagalagam Gauging Station (500m downstream of proposed bridge)
Riverbed Soil Condition	Main River – Sand, Clay, Silt Floodplain – Peat, Clay, Silt, Sand	

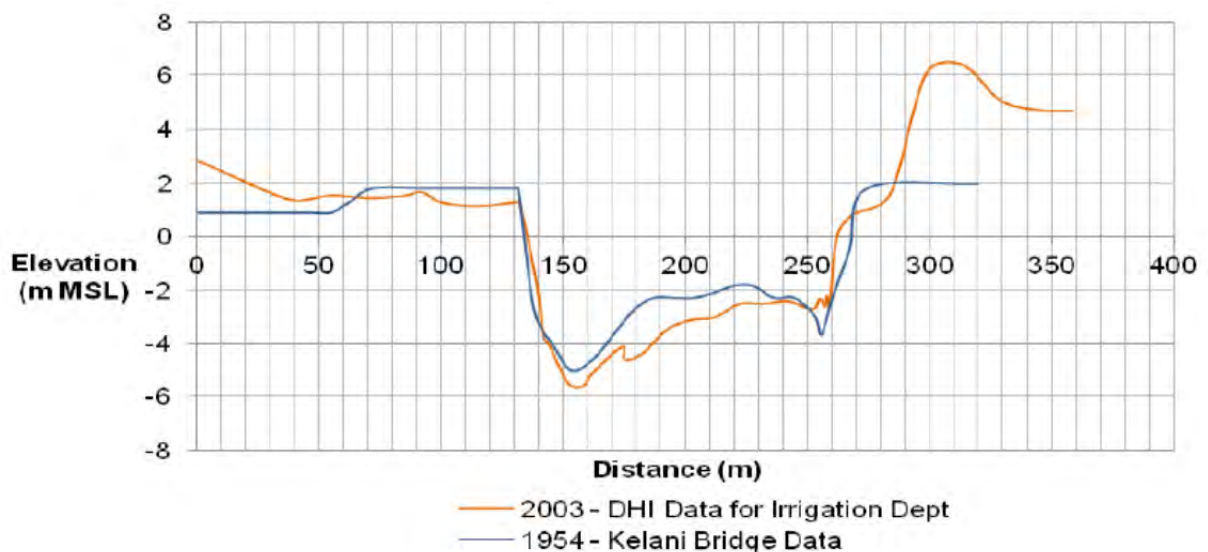


Figure 4-9 River cross section at existing Kelani bridge

4.1.4.3 Flood peak values, inundation levels and retention areas and inundation periods

Flood peak values for different return period for Kelani River has been computed in “Comprehensive Study on Disaster Management in Sri Lanka JICA and Oriental Consultants- March 2009”. The relevant values are given in Table 4.2 below. The most relevant station to the present project is Nagalagam Street where 50 year flood peak amounts to 5349m³/sec.

Table 4-2 Flood Peak Values for Kelani River

Return Period (Year)	Peak Discharge (m ³ /s)			
	Glencourse	Hanwella	Kaduwela	Nagalagam
2	1,438	1,566	1,613	1,665
5	2,292	2,569	2,673	2,788
10	2,860	3,247	3,415	3,601
20	3,401	3,886	4,104	4,346
30	3,714	4,263	4,513	4,790
50	4,105	4,735	5,026	5,349

Note: Analysis was based on no river overflow and also no storage in flood basin

Source: Comprehensive Study on Disaster Management in Sri Lanka JICA and Oriental Consultants- March 2009

Flood peak value at Nagalagam Street (see figure 4.11 for location) for year 2005 extreme flood event has been estimated as 2000m³/sec in the study Event Based Flood Modeling in Lower Kelani Basin -M. M. G. T. De Silva¹, S. B. Weerakoon*, Srikantha Herath, U. R. Ratnayake- SAITEM RSEA 2012 of which the flood hydrograph is given below in Figure 4.10.

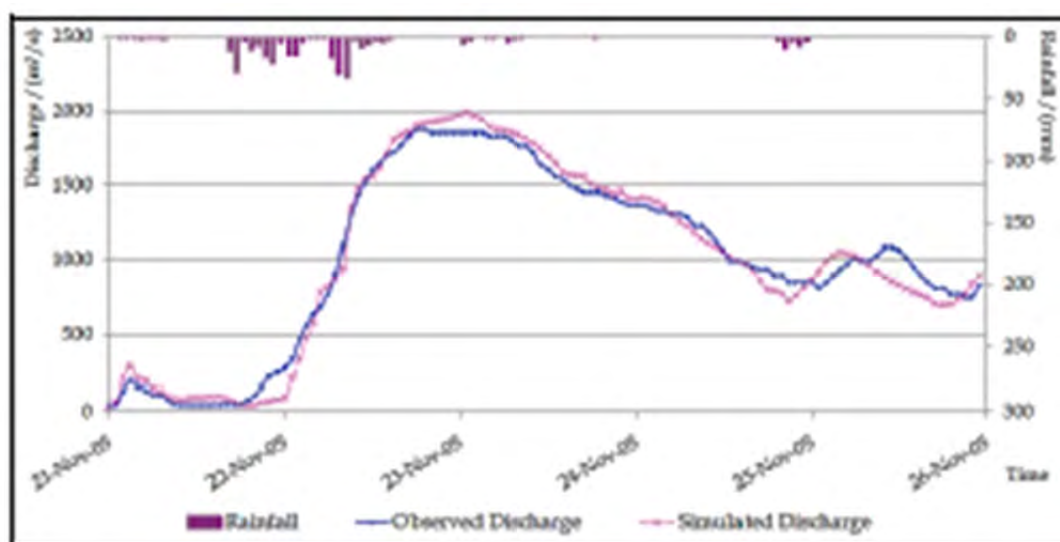


Figure 4-10 Flood Hydrograph for Nagalagam Street for 2005 Extreme Flood

Source: Event Based Flood Modelling in Lower Kelani Basin -M. M. G. T. De Silva¹, S. B. Weerakoon*, Srikantha Herath, U. R. Ratnayake- SAITEM RSEA 2012

Predicted flood levels for different return periods were obtained from the stations Nagalagam Street and Kelanimulla between which the proposed new bridge will be constructed. Using water level data available at the Irrigation Department Hydrology Division, flood frequency analysis was carried out. Please refer figure 4.11 for flood level information at above measuring stations and figure 4.12 for the locations of above measuring stations.

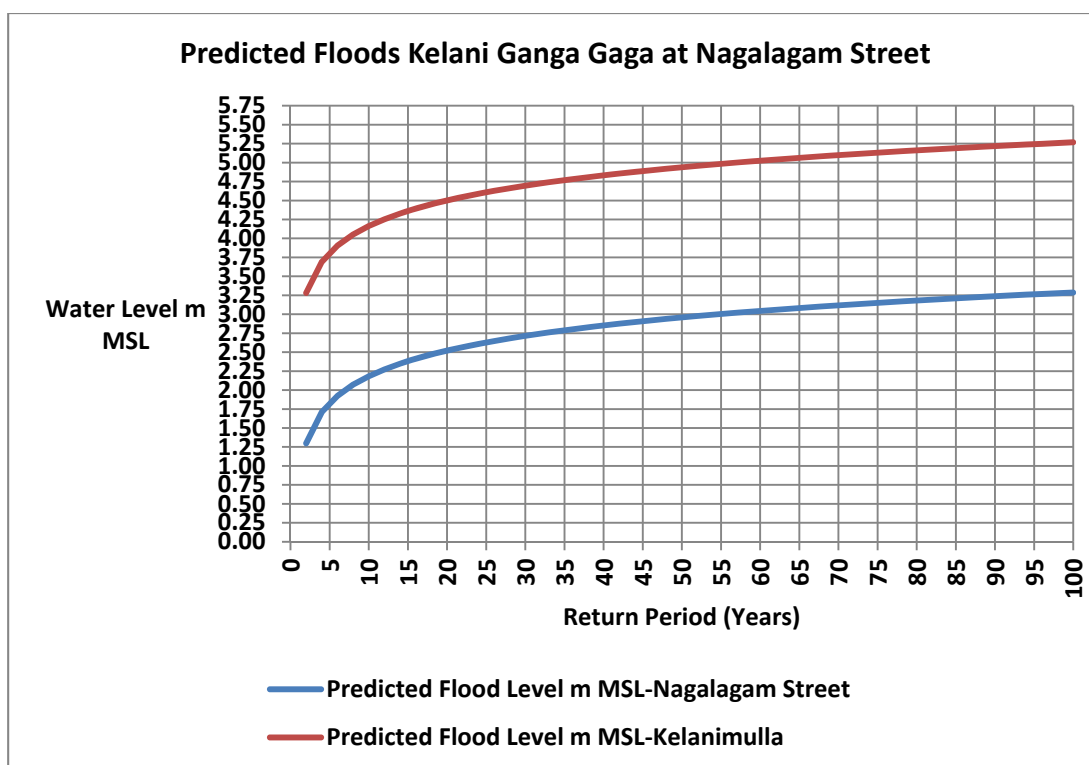


Figure 4-11 Flood Levels of Kelani River

Source: Base Data - Department of Irrigation

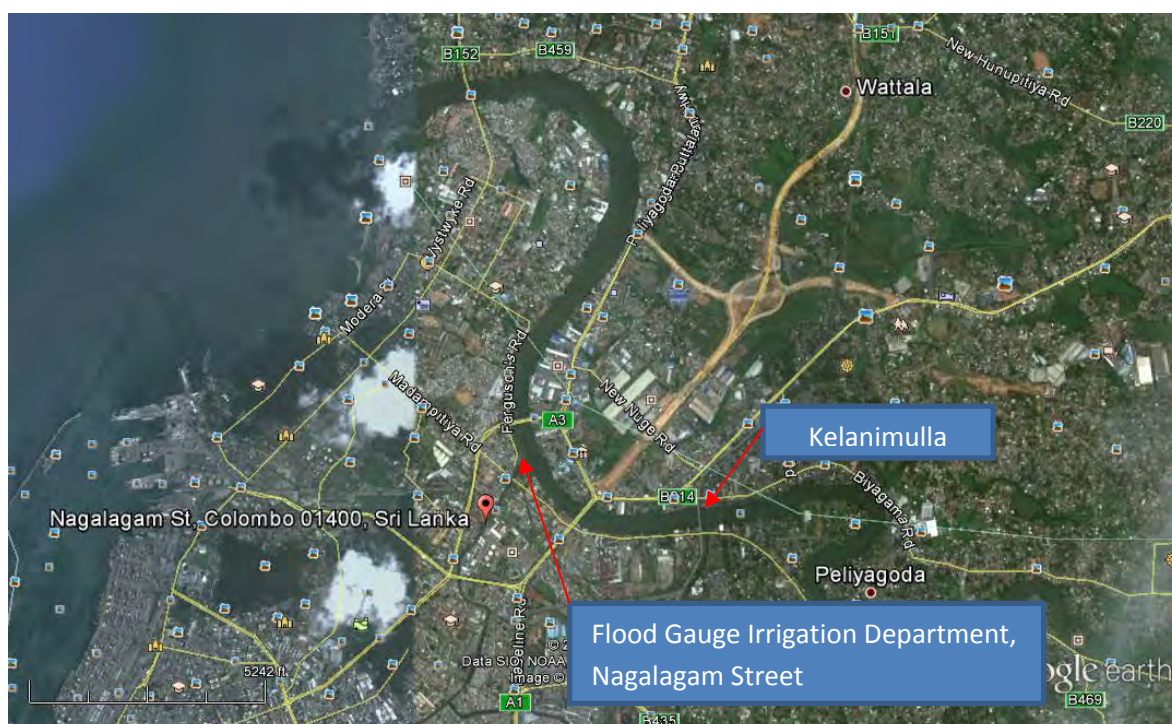


Figure 4-12 Location of Nagalagam Street and Kelanimulla flood level measuring stations

4.1.4.4 List of existing irrigation or drainage flood protection schemes encountered

There are several Irrigation and Flood Protection Schemes situated upstream of Kelani River, and one section of the flood band could be observed parallel to the railway line. Colombo South flood bund is one of the main flood protection structure in the project area.

4.1.4.5 Retention areas, marshlands or any other water bodies encountered

The main retention area is the flood plain of the Kelani River between North and South Kelani Flood Protection bonds. This area is called the unprotected area because it is a flood prone area. The main water body found in the area is the Kelani River and apart from this there are few drainage canals which are connected to Kelani River.

4.1.4.6 Drainage capacity of existing waterways and flood ways across the proposed trace

The main waterway in the project area is Kelani River and there are few small drainage canals which are generally stagnant and they have only a small flood detention capacity because of siltation, non-maintenance, minor widths and very low slope where water is almost stagnant. Drainage capacity of Kelani River is presented in table 4.3 below.

Table 4-3 Drainage Capacity Kelani River

Waterway Name	Drainage Capacity in Discharge Terms	Return Period	Source
Kelani River at Nagalagam Street	1665	2	Comprehensive Study on Disaster Management in Sri Lanka JICA and Oriental Consultants- March 2009
	2788	5	
	3601	10	
	4346	20	
	4790	30	
	5349	50	

4.1.4.7 The present flood detention capacity of the lowlands on both sides of the trace

Kelani river flood plains have a very large flood detention capacity. The road segment across this area is planned to allow flood passage by the construction of bridge piers and it does not cause any significant reduction of the flood detention capacity.

4.1.4.8 Bottom Sediment

Bottom sediment data for Kelani River or canals are not readily available. However there is a borehole investigation report carried out for the proposed bridge site and soil data are available for two bore holes taken close to the left and right banks of the river. These bore hole data indicate silty clay, black peat with partially decomposed vegetation, organic silt and fine to medium silty sand. Although the conditions of bottom sediments are such close to the bank, it is likely that the bottom sediment to be silty sand in the mid-range of the river because of water flow velocity.

4.2 Water Quality and Water Usage

4.2.1 Water quality

The water quality of the project area was measured at several locations to obtain a baseline dataset for the project and this measurement was carried out by the National Building Research Organization (NBRO). Summary results of water quality measurements carried out are given in Table 4.4 below. Locations are given in Figure 4.13. (Measurement location of the surface water is near the upstream and downstream of the project site, measurement of groundwater is near the project site's well). The surface water quality was carried out twice and the measurement interval was about two weeks. .

Water Quality Sampling Locations of New Highway Bridge Over Kelani River



Figure 4-13 Water Quality Measurement Locations
(WQ1-D, WQ2-U: surface water, WQ3, WQ4 and WQ5: ground water)

Table 4-4 Parameter and locations of water quality measurement

Water quality survey	Parameters	Locations
Surface water	pH, Temperature, Turbidity, DO, BOD, SS,	Upstream and downstream from the New Kelani Bridge
Ground water	pH, Temperature, BOD, Total Coliform, Conductivity	Project site and 100m either side of the project side

Surface Water

Kelani River, Sebastian canal and Dematagoda canal and their branch canals are the major surface water bodies located in the project area. Bathing and washing areas could be observed within 50 m upstream and downstream from the existing bridge (New Kelani bridge) Devotees of the Hindu Kovil near Paliyagoda junction uses water from Kelani river to sprinkle water over the sacred Bo tree within the Kovil premises.

During field investigations it was observed that many drainage lines (bringing domestic waste water and storm water) are opened to branch canals of Sebastian and Dematagoda canals. Hence it could be concluded that the water in these canals is already contaminated and polluted. The analysis result is shown in Table 4.5

Table 4-5 Result surface water quality analysis

N o.	Parameter	Unit	Standard Criteria		Result			
			Class II Bathing, Drinking	Class II Fish and aquatic life	April 4, 2013		April 19, 2013	
					WQ1-D	WQ2-U	WQ1-D	WQ2-U
1.	Temperature	°C	Natural	Natural	28.0	27.5	28.8	29.0
2.	Turbidity	NTU	-	-	9.8	8.6	1.2	2.2
3.	TSS	mg/l	-	-	3.5	7.1	2.2	1.3
4.	Conductivity	Ds/m	-	-	2.1	1.4	1.2	2.2
4.	pH	-	6.0 - 9.0	6.0 - 8.5	7.8	7.7	6.5	6.3
5.	DO	mg/l	4	3	7.8	7.0	6.0	5.4
6.	BOD	mg/l	4	4	2.6	2.8	2.2	1.3
7.	Coliform Total	MPN/100mg	1000	20000	NM	NM	NM	NM

Standard Criteria; "Proposed Ambient Water quality Standards for Inland water Sri Lanka," Central Environmental Authority, 2001

Ground water quality

The groundwater in the project area appears to contain high concentrations of Sulfur and Iron. This situation has prompted people not to use groundwater for drinking and other domestic needs.

The analysis result is shown in Table 4.6

Table 4-6- Result of ground water quality analysis

N o.	Parameter	Unit	Standard Criteria		Result April 4, 2013		
			Class II Bathing, Drinking	Class II Fish and aquatic life	WQ3	WQ4	WQ5
1	Temperature	°C	Natural	Natural	26.5	26.0	28.7
2	Conductivity	dS/m, max	-	-	0.24	0.43	0.81
3.	pH	-	6.0- 9.0	6.0 - 8.5	7.7	8.4	7.4
4.	BOD	mg/l	4	4	2.3	2.0	<1.0
5.	Coliform Total	MPN/100mg	1000	20000	3000	4100	680

Standard Criteria; "Proposed Ambient Water quality Standards for Inland water Sri Lanka," CEA,2001

The full report on water quality is included in volume II B of this report.

4.2.2 Water Usage

There is no major water usage of the project area either groundwater or surface water because of water quality issues. Regarding surface water, the upstream and downstream of the new Kelani Bridge, residents in the vicinity use the river for washing and bathing. However, that use is limited owing to the deterioration of water quality in the dry season from January to April. The Ambatale water supply intake is the only major water use node which is closest to the project area but this intake is located in Kelani River well away from the project area (approx. 9km upstream).

4.3 Existing land use

Main land use types are water bodies, marshy lands, parks and urban built up areas. The east side of Baseline Road, mainly makeshift housing built on encroached land exist. Relatively large buildings such as a factory and the power plant are lined up in the west side. Other major developments on the east side are the Automobile Training Institute and the Atomic Energy Authority. A housing project constructed by UDA is in progress near the port access road. In the north side of the New Kelani Bridge Road, Kelanitissa power plant is located. The building density on the south flank of Port Access Road is high. There is no agricultural land around the project area. Existing land use details are presented in Figure 3.9.

4.4 Ambient air quality and noise and Vibration

4.4.1 Air Quality

The monitoring day was a sunny day with fair scattered wind. The prevailing wind direction and speeds are given in table 4.7. The measurement locations were selected under the following conditions: 1- Sensitive areas (ex. residential area, temple, kovil, etc) along the Baseline road and the Port access road (5 points; L_{eq} 3 to 7)), and 2- Other places for judging the project effectiveness (3 points; L_{eq} 1,2 and 8). Refer Figure 4.14 below.

Air Quality Sampling Locations of New Highway Bridge Over Kelani River



Figure 4-14 Locations for Air quality Monitoring

Table 4-7 Wind speed and direction during the sampling time

Time	05 April 2013		06 April 2013		22 April 2013		23 April 2013	
	Wind Direction	Wind Speed (km/hr)	Wind Direction	Wind Speed (km/hr)	Wind Direction	Wind Speed (km/hr)	Wind Direction	Wind Speed (km/hr)
02:30	Calm	0	Calm	0	Calm	0	Calm	0
05:30	Calm	0	S	3.8	Calm	0	E	3.0
08:30	SSE	1.8	SW	2.0	SE	4.6	NE	4.2
11:30	W	6.4	WNW	10.6	S	8.4	SW	4.4
14:30	SW	6.0	W	10.6	SW	10.6	W	5.2
17:30	W	5.0	W	10.8	SW	8.2	NW	4.2
20:30	W	5.6	SW	4	Calm	0	NE	3.6
23:30	Calm	0	SW	2.8	Calm	0	Calm	0

Table 4-8 Measurement Locations

Location	Description	Coordinates
Leq1	At the roadside of Kandy Road, in front of Sri Bhoopala Vinayaker Kovil, Peliyagoda	06° 57' 20.01" N 079° 53' 03.61" E
Leq2	At the roadside of Negambo Road, Peliyagoda, in front of the Sir Lanka Cement Corporation Outlet	06° 57' 24.89" N 079° 52' 57.38" E
Leq3	At the roadside of Sedawatha Road, Wellampitiya, close to the Jayantha saw mills	06° 57' 15.78" N 079° 52' 51.59" E
Leq4	At the Premises of Minimuthu Suppliers, No 43/1, Sedawatha Road, Wellampitiya	06° 57' 13.21" N 079° 52' 56.50" E
Leq5	At the premises of Sanchi Viharaya, New Kanani Bridge Road, Wellampitiya.	06° 57' 00.96" N 079° 52' 39.74" E
Leq6	At the roadside, close to the premises of Mr. H.A Piyasena, No.31/10, Orugodawatta, Wellampitiya.	06° 56' 53.90" N 079° 52' 44.60" E
Leq7	At the premises of Mr.M.J.M. Badurdeen, No 12, Baseline Road, Orugodawatha	06° 56' 41.17" N 079° 52' 42.77" E
Leq8	At the premises of Sri Somaloka Viharaya, No. 150, Stace Road, Colombo 14	06° 58' 36.66" N 079° 52' 38.95" E

Table 4-9 Concentration of each parameter at measurement location

Location	Sampling Date	Date of Analysis	Time average	Concentration					
				SO ₂ (µg/ m ³)	NO ₂ (µg/ m ³)	CO (ppm)	CO ₂ (ppm)	SPM (µg/ m ³)	PM ₁₀ (µg/ m ³)
Permissible Air Quality Standards, Sri Lanka				80 (24hrs)	100 (24hrs)	9.00 (8hrs)	-	-	100 (24hrs)
WHO ambient Air Quality Standards				20 (24hrs)	200 (one hr)	-	-	-	50 (24hrs)
Leq1	22.04.2013	22.04.13	8 hrs	-	-	6.7	1120	-	-
		23.04.13	24 hrs	24	28	4	670	-	-
		26.04.13	24 hrs	-	-	-	-	72	43
Leq2	05.04.2013	06.04.13	8 hrs	-	-	6.7	1080	-	-
		06.04.13	24 hrs	-	25	4	650	-	-
		10.04.13	24 hrs	-	-	-	-	157	68
Leq3	05.04.2013	06.04.13	8 hrs	-	-	5	960	-	-
		06.04.13	24 hrs	19	33	3	580	-	-
		10.04.13	24 hrs	-	-	-	-	168	67
Leq4	05.04.2013	06.04.13	8 hrs	-	-	3.3	970	-	-
		06.04.13	24 hrs	12	18	2	580	-	-
		10.04.13	24 hrs	-	-	-	-	91	55
Leq5	22.04.2013	22.04.13	8 hrs	-	-	6.7	1030	-	-
		23.04.13	24 hrs	31	33	4	620	-	-
		26.04.13	24 hrs	-	-	-	-	66	39
Leq6	05.04.2013	06.04.13	8 hrs	-	-	3.3	990	-	-
		06.04.13	24 hrs	13	17	2	600	-	-
		10.04.13	24 hrs	-	-	-	-	117	44
Leq7	22.04.2013	22.04.13	8 hrs	-	-	5	940	-	-
		23.04.13	24 hrs	17	16	3	560	-	-
		26.04.13	24 hrs	-	-	-	-	52	31
Leq8	22.04.2013	22.04.13	8 hrs	-	-	5	920	-	-
		23.04.13	24 hrs	18	22	3	540	-	-
		26.04.13	24 hrs	-	-	-	-	49	30

Measured existing ambient air quality levels with respect to SO₂, NO₂, CO and PM₁₀ were below the Ambient Air Quality Standards stipulated by the Ministry on Environment and Natural Resources of Sri Lanka. Also measured existing ambient air quality levels with respect to SPM was within the Ambient Air Quality Standards stipulated under the Extraordinary Gazette, No.850/4, December 20, 1994, by the central Environmental Authority of Sri Lanka. These results of existing ambient air quality are described in the NBRO report in Volume IIB.

4.4.2 Noise

High noise levels were recorded in the project area. Movement of vehicles is the main source of noise. Based on the noise levels the project area could be classified as a high noise area.

Measurement of noise level was conducted at 10 locations. The measurement was done on April 5-6, 2013 during 4 times (morning, afternoon, late afternoon and nighttime) per day. Measured locations of noise levels can be seen in Table 4-10 and in Figure 4.15.

It should be noted that Environmental Standards pertaining to Permissible Noise Levels of the High Zone are prescribed in the Regulations (Regulations made by the Ministry of Transport, Environment and Women's Affairs section 23P, 23Q and 23R of the National Environmental Act). This standard is described in the NBRO report in volume II B.

The measurement locations were selected under the following conditions; 1- Sensitive area (ex. residential area, temple, kovil, etc.) along the Baseline road and the Port access road (7 points: N3 to N9), and 2-Other places or judging project effectiveness (3 points; N1, 2 and 10).



Figure 4-15 Locations for Noise Measurement

Table 4-10 Noise level measurement locations.

Location	Descriptions	Coordinates
N1	At the roadside of Kandy Road, Close to the Keleniya CTB Deport, Peliyagoda	06° 57' 20.01" N 079° 53' 06.60" E
N2	At the roadside of Nigambo Road, Peliyagoda, in front of the Sir Lanka Cement Corperation Outlet	06° 57' 24.89" N 079° 52' 57.38" E
N3	At the roadside of Sedawatha Road, close to the Jayantha saw mills, Wellampitiya,	06° 57' 15.74" N 079° 52' 51.48" E
N4	At the roadside of Sedawatha Road, close to the Minimuthu Suppliers, No 43/1, Seedawatha Road, Wellampitiya	06° 57' 13.14" N 079° 52' 56.60" E
N5	At the Nawaloka Ground, Wellampitiya, Close to the residential houses	06° 57' 08.05" N 079° 52' 51.46" E
N6*	At the roadside, New Kalani bridge road, Wellampitiya, Close to the Nawaloka Ground	06° 57' 09.46" N 079° 52' 49.87" E
N7	At the roadside of the New Kanani Bridge Road, Close to the Sanchi Viharaya, Wadullawatte.	06° 57' 01.14" N 079° 52' 40.02" E
N8	At the roadside, close to the premises of Mr. H.A Piyasena, No.31/10, Orugodawatta, Wellampitiya.	06° 56' 53.90" N 079° 52' 44.60" E
N9	At the premises of Mr.M.J.M. Badurdeen, No 12, Baseline Road, Orugodawatha	06° 56' 41.17" N 079° 52' 42.77" E
N10	At the premises of Sri Somaloka Viharaya, No. 150, States Road, Colombo 14	06° 58' 36.66" N 079° 52' 38.35" E

Noise measurement except in locations N3, N5 and N8, have exceeded the environmental standards already. Measurement locations N3 (approx. 40m from road edge), N5 (approx. 65m from road edge) and N8 (approximately 40m from road edge) were set allowing a stated distances from the road edge

Table 4-11 Wind speed and direction during the measurement time.

Time	05 April 2013		06 April 2013	
	Wind Direction	Wind Speed (km/hr)	Wind Direction	Wind Speed (km/hr)
02:30	Calm	0	Calm	0
05:30	Calm	0	S	3.8
08:30	SSE	1.8	SW	2.0
11:30	W	6.4	WNW	10.6
14:30	SW	6.0	W	10.6
17:30	W	5.0	W	10.8
20:30	W	5.6	SW	4
23:30	Calm	0	SW	2.8

Table 4-12 Noise Levels at each measurement location on 5th – 6th April 2013

Location	Measuring Date	Morning			Afternoon			Evening			Night		
		Leq	L ₅₀	L ₉₀	Leq	L ₅₀	L ₉₀	Leq	L ₅₀	L ₉₀	Leq	L ₅₀	L ₉₀
Permissible Noise level, Sri lanka (L _{Aeq}) High zone		70			70			70			60		
EHS Noise level guidelines (L _{Aeq}) Industrial, Commercial		70			70			70			70		
N1	6/04/2013	80	76	73	81	76	74	79	75	73	72	68	62
N2	6/04/2013	78	74	69	75	71	67	77	74	70	74	71	72
N3	6/04/2013	69	63	58	64	59	54	61	57	52	53	47	45
N4	6/04/2013	78	71	68	64	57	52	63	56	51	58	53	49
N5	6/04/2013	68	65	62	66	62	60	67	64	61	66	59	54
N6	5/4/2013	79	74	71	78	74	70	80	72	67	75	71	65
N7	5/4/2013	80	75	71	77	74	70	78	70	67	75	71	65
N8	5/4/2013	66	64	61	65	61	58	64	61	58	59	58	57
N9	5/4/2013	71	69	66	70	68	66	73	71	69	71	69	62
N10	5/4/2013	69	66	63	70	67	65	72	67	68	64	59	53

4.4.3 Vibration

Measurement of vibration level was conducted at 6 locations. The locations of vibration measurement were been selected in places such as in the vicinity of existing bridge piers, at Sanchi temple and amman Kovil. (Located in the vicinity of observation location V5)

The measurement was done on April 5, 2013 during 4 times (Morning, Afternoon, Evening and Night time) per day. The vibration levels at each measurement location can be seen in Table 4-14 and Figure 4-16.

Measured vibration levels at the locations were well within the intermittent vibration levels stipulated for “type 3 structures” in the Interim Vibration Standard stipulated by the Central Environmental Authority of Sri Lanka. This Interim Vibration standard is described in the NBRO report in volume II B.

The measurement location is presented below. The measurement locations were selected under the following conditions; 1- Sensitive area (ex. Temple, Kovil, V1, 5 and 6) along the Baseline road and the Port access road.

Vibration Sampling Locations of New Highway Bridge Over Kelani River



Figure 4-16 Locations for Vibration Measurement

Table 4-13 Vibration levels measurement location

Location	Descriptions	Coordinates
V1	On the basement of the North-western corner of the building of sri Bhoopala Vinaayaker Kovil, Peliyagoda	06° 57' 19.19" N 079° 53' 03.38" E
V2	On the basement of a building close to the Sri Lanka Cement Cooperation Outlet, Nigambo road, Peliyagoda	06° 57' 25.18" N 079° 52' 79.36" E
V3	At the ground of about 0.2m to the concrete basement of the Kelani Bridge, Sedawatha road, Wellampitiya	06° 57' 14.07" N 079° 52' 53.86" E
V4	On the basement of a building,at about 50m from the concrete basement of the Kelani Bridge, Sedawatha Road, Wellampitiya	06° 57' 13.54" N 079° 52' 54.62" E
V5	On the basement of the building of Sanchi Viharaya, New Kelani Bridge road. Wadullawatte	06° 57' 00.78" N 079° 52' 39.83" E
V6	On the basement of the premises of Mr. M.J.M.Badurdeen, No 12, Baseline road, Orugodawatha	06° 56' 41.32" N 079° 52' 43.10" E

Table 4-14 Vibration levels at each measuring location on 5th April 2013

Location	Run Time (min)	Morning		Afternoon		Evening		Night	
		Frequency Range (Hz)	Vibration in ppv (mm/sec)	Frequency Range (Hz)	Vibration in ppv (mm/sec)	Frequency Range (Hz)	Vibration in ppv (mm/sec)	Frequency Range (Hz)	Vibration in ppv (mm/sec)
Interim Standard for Vibration Levels by the CEA (Type 3 structures, intermittent type)		0-10 10-50 over 50	2.0 4.0 8.0	0-10 10-50 over 50	2.0 4.0 8.0	0-10 10-50 over 50	2.0 4.0 8.0	0-10 10-50 over 50	2.0 4.0 8.0
V1	15	0-10	0.27	0-10	0.23	10-50	0.28	0-10	0.38
V2	15	>50	0.56	>50	0.46	0-10	0.31	>50	0.33
V3	15	10-50	0.60	10-50	0.52	0-10	1.01	10-50	0.78
V4	15	0-10	1.63	0-10	0.63	>50	0.32	>50	0.55
V5	15	10-50	0.58	10-50	0.48	>50	0.72	10-50	0.52
V6	15	>50	0.65	>50	0.56	10-50	0.69	10-50	0.49

Note:	Hz= Frequency range, ppv= Peak Particulate velocity levels (mm/sec)		
	taken at 09.00 represent 06.00-11.00 - Morning		
	taken at 13.00 represent 11.00-15.00 - Afternoon		
	taken at 18.00 represent 17.00-21.00 - Evening		
	taken at 23.30 represent 22.00-24.00 - Night		

Measured vibration levels at all six (6) locations were well within the intermittent vibration levels stipulated for “type 3 structures” in the interim Vibration Standards stipulated by the Central Environmental Authority of Sri Lanka. Records on natural disasters occurred

4.5 Flood Propagation

Out of disasters such as Tsunami, cyclones and earth slips flood is the only phenomenon which has occurred in the project area in a disaster level. Below given is the flood levels at Nagalagam Street which is downstream of the project area along with the Major and Minor flood level the Irrigation Department standard flood classification for the water level gauge at Nagalagam Street. Refer Figure 4.17 for details.

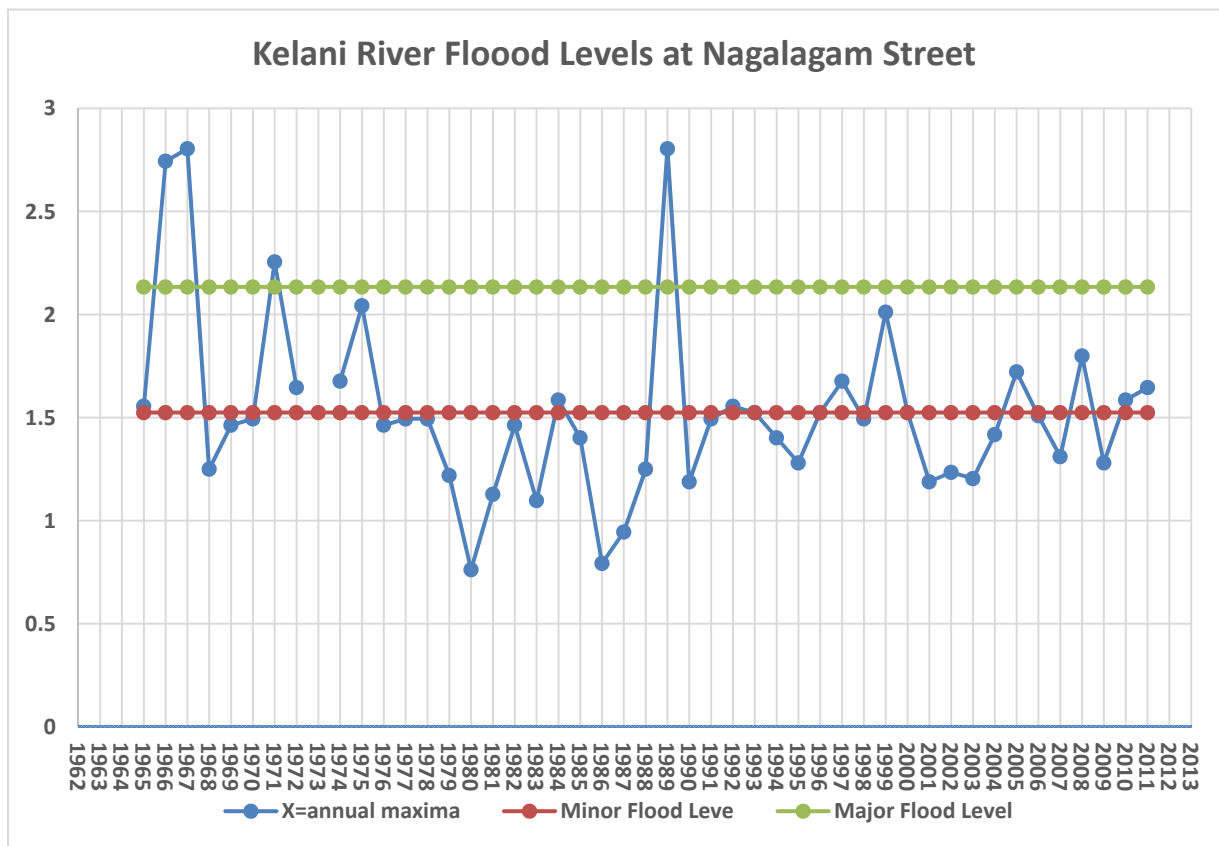


Figure 4-17 Flood Levels at Nagalagam Street

Source: Department of Irrigation

It is seen from the graph above that floods in year 1966, 1967 and 1989 are of disastrous proportions. Propagation of the Tsunami has not exerted any impact on the project area according to the analysis carried out by the Disaster Management Center (DMC). There is flooding in the unprotected area between flood bunds and there is no possibility of flooding in the rest of the area by the floods of lower return periods (i.e. 25 years).

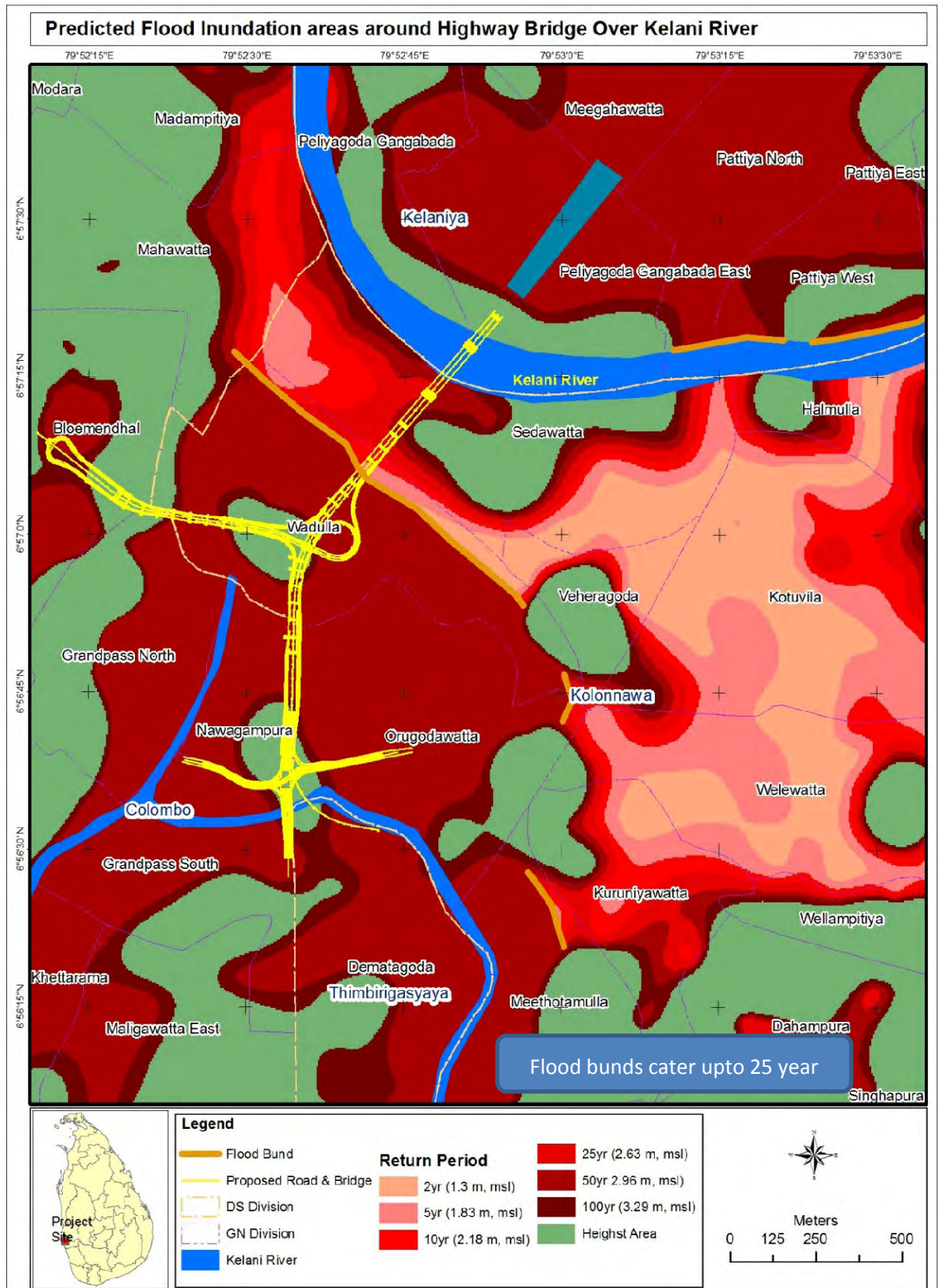


Figure 4-18 Flood Propagation Map

Source- Irrigation Department flood Levels

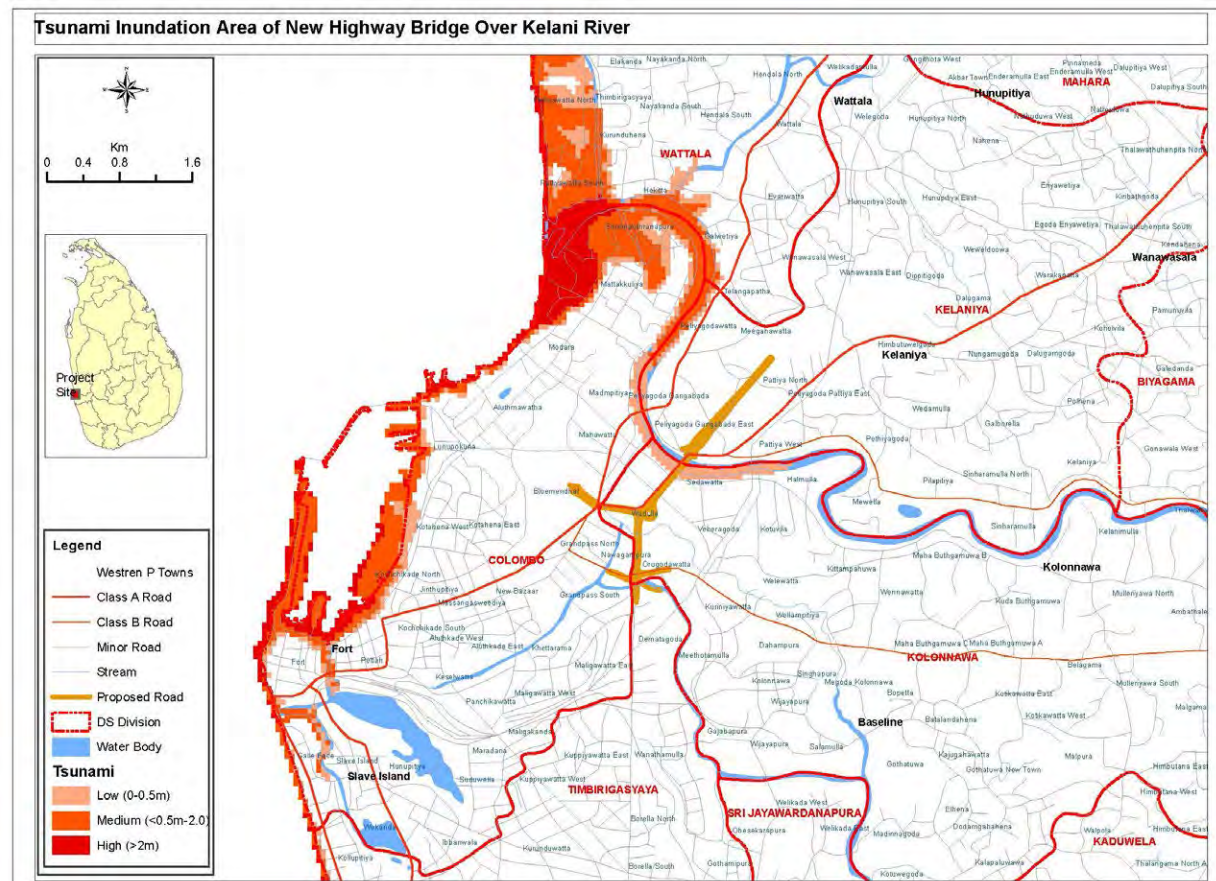


Figure 4-19 Tsunami Propagation Map

Source: Disaster Management Center

4.6 Global Warming

According to the National Climate Change, Adaptation Strategy for Sri Lanka, 2011 to 2016-November 2010¹, Sri Lanka is a negligible contributor to global warming. However, the nation is highly vulnerable to the potential impacts of climate change which include:

- Increases in frequency and intensity of disasters e.g. droughts, floods and landslides;
- Variability and unpredictability of rainfall patterns;
- Increase in temperature; and
- Sea level rise, among others.

Climate change vulnerabilities potentially affect many sectors in the economy, including the transportation sector, and threatens to compromise the investments which are currently being deployed for example for road rehabilitation works. The publication entitled “*Sector Vulnerability Profile – Urban Development Human Settlement and Economic Infrastructure – Supplementary Document to Climate Change Adaptation Sri Lanka*”¹ outlines the impacts on climate change on various sectors in the form of maps and data tables.

¹ Climate Change Secretariat, Ministry of Environment Sri Lanka

The main vulnerability indicators relevant to the project are:

1. Increased vulnerability to floods
2. Sea level rise
3. Increase in temperature

4.6.1 Increased Vulnerability to Floods

4.6.1.1 Increased Rainfall Intensity

Recent studies by Sri Lanka Land Reclamation and Development Corporation (SLLRDC) has shown that rainfall intensities for Colombo have increased for short duration rains.

4.6.1.2 Flooding

As it was observed that the short duration rains have increased it could be predicted that flood levels also could increase in future.

4.6.2 Rise in Sea Level

Quantification of the Sea Level rise is still non-conclusive and widely varying assessments exist though the occurrence of the sea water level rise is now established globally as a fact. One conservative assessment estimates the sea level rise to be 0.5m over a period of 100 years. Figure

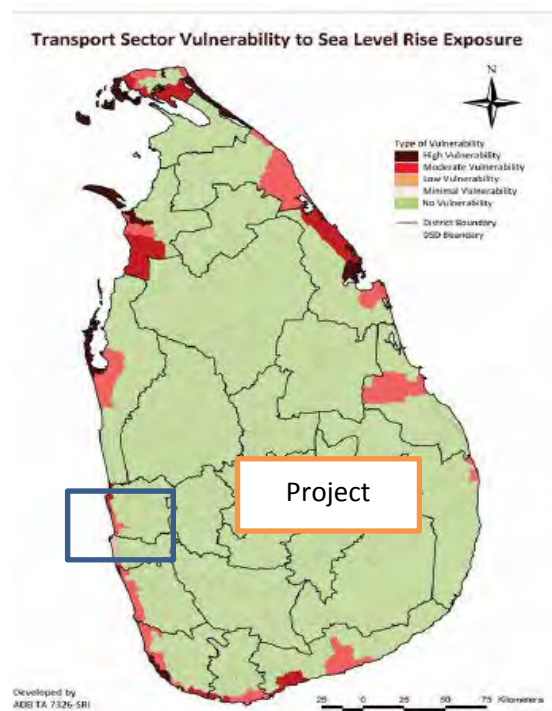


Figure 4-20 Transport sector vulnerability to sea level rise exposure

4.6.3 Drought Exposure

4.6.3.1 Increase in Temperature

According to Chandrapala and Fernando there is an ascending temperature trend in most of the climatic stations in Sri Lanka, as detailed in the adjoining table below. The closest meteorological station to the project is Colombo which has recorded an increase of 0.0164 °C per year.

Table 4-15 Trends of air temperature (1961 ~ 1990)

Climate change in Sri Lanka		
Trends of air temperature (1961-1990)		
LOCATION	SLOPE – °C/year	r ²
Ratnapura	0.0175	0.88
Badulla	0.0217	0.85
Kandy	0.0185	0.72
Nuwara Eliya	0.0146	0.56
Colombo	0.0164	0.67
Hambantota	0.0104	0.81
Anuradhapura	0.0364	0.79
Kurunegala	0.0173	0.42
Jaffna	0.0180	0.61

Chandrapala & Fernando, 1995

4.7 Biological Environment

Biological environment of the area was assessed through a habitat survey as indicated below; In addition, the project area and its vicinity is progressing in urbanization. Protected areas such as national parks is not identified in the project area.

4.7.1 Habitat survey:

Both terrestrial and aquatic habitats are distributed in the proposed project area. Of these two main terrestrial habitat types and two aquatic habitats were encountered during the field survey.

1. Terrestrial habitats

- Mixed residential and commercial area
- Road reservations

2. Aquatic habitats

- Kelani river and riverine vegetation
- Canals and associated marshy areas

4.7.1.1 Terrestrial Habitats

- **Mixed Residential and Commercial area**

The project area mainly consists of small, medium and large scale industries, saw mills, garages, container yards, religious places and residences. Large numbers of low income families live within small land plots and are mainly scattered around Kelani Bridge. In addition groceries, business premises and workshops, medium to large scale luxury houses are also located in the area. In several locations bare land plots, playgrounds and small home gardens can be observed.

In the project area, large extents of low-lying area have been reclaimed from time to time for development purposes such as housing, public utilities, industries and warehousing. Some lands which could not be reclaimed for the above purposes were utilized for the disposal of solid waste.

The floral species recorded from residential and commercial area of the project site predominantly include fruits, vegetables, shading and ornamental species. Species such as Jack (*Artocarpus heterophyllus*), bread fruit (*Artocarpus incisos*) and Coconut (*Cocos nucifera*) are the economically important trees which can be mainly seen in home gardens of the project affected area.

- **Road reservations**

A considerable amount of shading, economically important trees and fruit species are located within the existing Right Of Way (ROW) of the proposed development area. *Mangifera indica* (Mango), *Terminalia catappa* (Kottamba), *Filicium decipiens* (Pihimbiya), *Terminalia arjuna*- (Kumbuk), *Pettophorum pterocarpum*- (Kaha Mara) etc. had been grown as roadside vegetation during different time periods.

As roadside vegetation *Ficus benghalensis* (Nuga), *Ficus religiosa* (Bo), *Albizia odoratissima* (Suriyamara), *Albiziasaman* (Para mara), *Terminalia catappa* (Kottamba), *Polyalthia longifolia* (Villo), *Spathodia campanulata* and *Alstonia scholaris* (Rukattana) are commonly observed by the sides of national roads. Other than that, weedy shrub and herb species were found in some road reservations. Most of these are large trees and have been grown for shading purposes. Compared to the road reservations of Baseline Road and adjoining lands, local road network's reservations occupy only a minimum number of trees that belongs to different species.

4.7.1.2 Aquatic Habitats

- **Kelani River and Riverine Vegetation**

A large amount of aquatic plants were not observed in water logged areas of the Kelani River close to the Kelani Bridge. However, a large number of riverine vegetation could be observed. Since most of the residences and other built up structures are located adjacent to the river bank, riverine species along the river bank is minimal. Both common home garden species as well as riverine species such as *Alstonia scholaris* (Rukattana), *Terminalia arjuna*, (Kumbuk), *Albizia odoratissima* (Suriyamara), *Ficus religiosa* (Bo), *Artocarpus heterophyllus* (Jack), *Dichrostachys cinerea* (Andara) etc. can be seen beside the river banks of up and down stream.

- **Canals and associated marshy areas**

Canals and drainage systems which run from surrounding areas of the project site directly connect with upstream and downstream areas of the Kelani Bridge. Recent city beautification measures jointly carried out by UDA, Ministry of Defense and Urban Development and Colombo Municipal Council (CMC) have implemented solid waste management and clearing of reservation areas free from weeds etc. to enhance the aesthetic value of the area.

However, water in these canals and drainage systems is polluted, hence it is not used for day to day activities of stakeholders. The water in these canals is green in color with blue green alga and other microorganisms being present. Earlier, a considerable amount of land area around proposed site was marshy lands, but they have been gradually reclaimed for various purposes such as infrastructure development projects, industries, roads, playgrounds, container yards, residences and commercial activities etc. A marshland situated in the vicinity of the project site has been converted to a huge garbage dumping site. This site is known as the Blumendal garbage site adjacent to the Port Access Road which is currently being managed by the Colombo Municipal Council.

4.7.2 Flora, Fauna and Biodiversity

Throughout the study a total of 87 aquatic and terrestrial fauna species was recorded in the project area. Most of the floral species observed in the project area are typical home garden species and shading trees which are distributed in many parts of the surrounding habitats (List Annex 4.1. Terrestrial and aquatic flora found in the proposed project area). During the study a total of 78 species of animals were recorded including 2 species of Dragon flies, 11 species of butterflies, 7 species of fish, 2 species of amphibians, 6 species of reptiles, 36 species of birds and 14 species of mammals (Annex 4.1 Terrestrial Flora found in the Proposed Project Area).

4.7.3 Rare, endangered and endemic species in the project area and its vicinity

During the survey of the project affected area any endemic or threatened floral and fauna species were not observed.

4.7.4 Proposed lands for material storage yards and other activities.

Altogether 3 sites have been identified for the material storage yards, labour camps and other construction related activities within the proposed project area. These include ;

- A. Nawaloka ground
- B. Ground located on the right side of Colombo-Katunayaka expressway (~0.700 km post)
- C. Open area located opposite to the Nawaloka ground

Out of these three, two sites (Site A and B), are being frequently used by the surrounding communities as playgrounds and other social functions. There are no trees located within site A, but few (less than 10) trees are located in the periphery of site B. Site C is currently being used as a

container yard by a private company, but no trees are found within this site. Proposed locations A and B are presented in figure 4.21. These proposals are only tentative.

These lands are owned by the government.

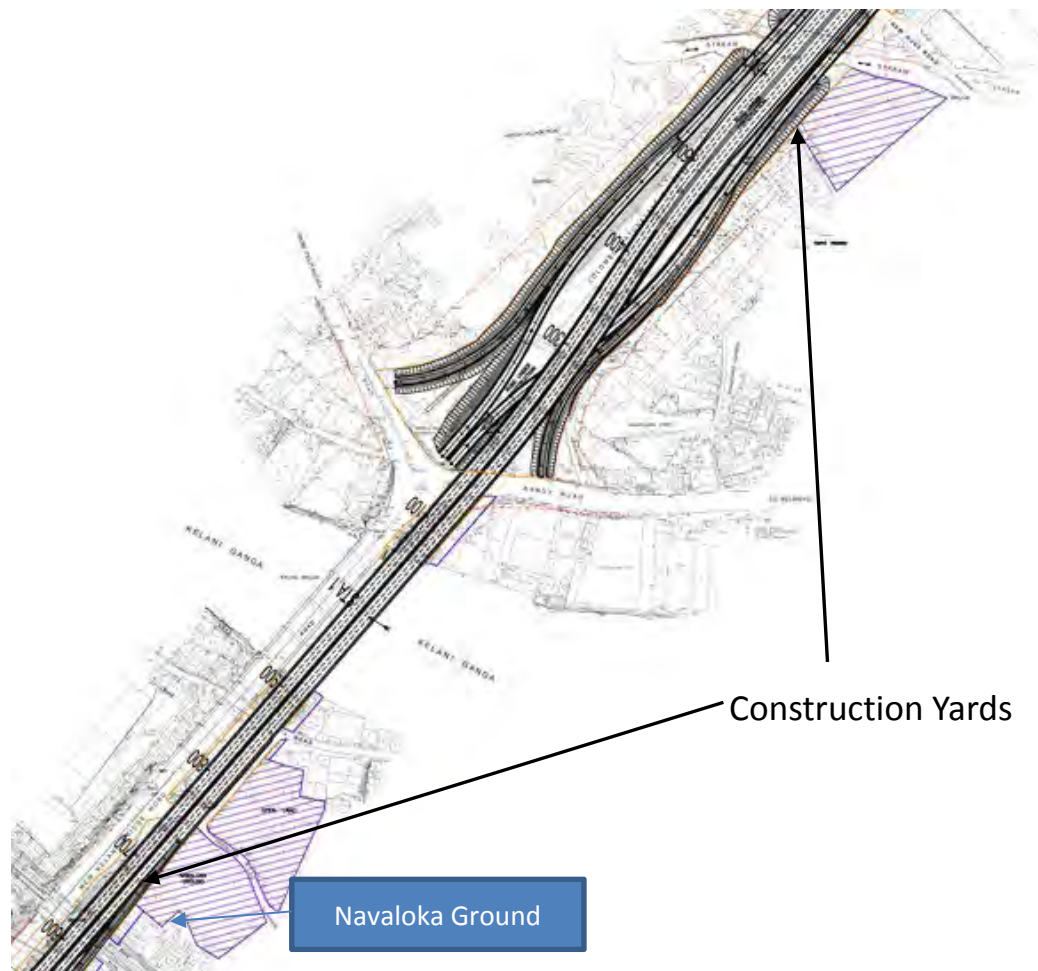


Figure 4-21 Proposed locations for yards

4.8 Socio-cultural Environment

The project area belongs to Colombo and Gampaha districts. In the year 2011 the total population of Sri Lanka is 20,263,723. Out of it 4,604,450 live in Colombo and Gampaha Districts. It is nearly 23% of the total population. The highest amounts of the migrated population also have been recorded in Colombo and Gampaha districts. Percentage of migrated population to total migrated population of Sri Lanka is 16.2 percent for Colombo district and 15.4 percent in Gampaha District. Balance 68.4 percent is shared by other 23 districts. The main reason for migration is employment, marriage, education etc. in Colombo and Gampaha districts.

Apart from the above two categories of the population, large number of commuter population from Northern districts of Colombo daily commute to Colombo district via Gampaha district through the existing New Kelani Bridge.

Project Impact Area and Surroundings

The boundaries of the seven GN divisions affected (i.e. Bioemendal, Grandpass (North), Nawagampura in Colombo DS division, Seedawatta, Wadullawatta, Orugodawatta in Kolonnawa DS division and Peliyagoda Gangabada (East) in Kelaniya DS division) were considered as the project surrounding for the social study. Residential and commercial population within the project boundary area is presented below;

Table 4-16 No. of affected households and population

DS Division	GN Division	Residential Population		Commercial/ Business population	
		Male	Female	Male	Female
Colombo	Grandpass North	0	0	15	2
	Bloemendhol	74	63	60	14
	Nawagampura	44	33	15	6
Kolonnawa	Orugodawatta	22	24	0	0
	Sedawatta	223	252	26	7
	Wadullawatta	468	512	22	5
Kelaniya	Peliyagoda Gangabada East	17	11	0	0
Total		848(48.6%)	895(51.4%)	138(80%)	34(20%)

Other socio-economic status of the project affected area is summarized in sections below.

4.8.1 Existing houses, commercial and government buildings within the direct impact areas and the surroundings

The direct impact area was considered as the area impacted by Right of Way (ROW) and service corridor which is required at some places (please refer Annex 4.2 for these areas).

Surrounding Area

Existing social infrastructure in the surrounding area is presented in the table below.

Table 4-17 Existing houses, commercial and government buildings within the surrounding area

DS division	GN division	No. of houses*	No. of commercial units**	Government Buildings***
Colombo	1 Bloemendhal	3,205	N/A	1.Bloemendhal primary school 2. Bloemendhal Tamil school 3.Cooperative building, Bloemendhal
	2 Grandpass (North)	1,670	N/A	1.Cooperative building, Kosgashandiya 2.Post Office
	3 Nawagampura	1,446	N/A	1.Public hall 2.NHDA housing scheme 3 Ceylon Transport Board premises
	4. Grandpass (South)	3,529		1.Vijayaba Vidyalaya – (School) 2.St. Joseph girls’ School 3.St. Joseph’s Boy’s School 4.Cooperative building, Bodirajaramaya 5. Post Office 6. Rajasingha Maha Vidyalaya – (School)
Kolonnawa	1 Seedawatta	1,572	N/A	1. Siddhartha Central College, Sedawatta 2. Clinic – Sedawatta 3. Dispensary – Sedawatta 4. Indigenous medical center 5. Post office 6. RDA building 7. Cooperative building
	2 Wadullawatta	1,759	N/A	1.GN’s office 2.Automobile Engineering Training Institute 3.Atomic Energy Authority 4.Kelanitissa power station 5.Housing scheme 6.CTB depot 7.Vocational training center
	3 Orugodawatta	1,205	N/A	1.Clinic – Orugodawatta 2. Indigenous medical center 3. Post office 4. Flour stores 5.Sri Lanka ports building
Kelaniya	1 Peliyagoda – Gangabada East	466	N/A	1.H.K. Darmadasa school 2. Police station 3.Local Authority building 4. UDA Industrial Zone 5.Govrnmrnt building 6.SDandCC building

Source: * Department of Census and Statistics 2012 ***Resource profile 2012 Kolonnawa, 2011 Colombo and 2013 Kelaniya

Note: **No of commercial units for respective GN divisions are not available (N/A) in relevant resource profiles or any other published documents.

Direct Impact Area

Houses and commercial/government buildings in the direct impact area are given in the table below.

Table 4-18 Existing houses and, commercial buildings within the direct impact area

DS division	GN division	No. of houses	No. of commercial units
Colombo	1. Bloemendhal	33	11
	2. Grandpass (North)	0	5
	3. Nawagampura	14	12
Kolonnawa	1. Sedawatta	93	14
	2. Wadullawatta	240	12
	3. Orugodawatta	9	0
Kelaniya	1. Peliyagoda – Gangabada East	6	0
	Total	395	54

Source: Socioeconomic study April/May 2013

The above table shows that, the affected total physical entities are 449 units and the majority affected are housing units and the number is 395 (88%). Affected number of commercial units is only 54 (12%).

4.8.2 Socio Economic status of population

Social Status

From the household survey data the summary of the social status is highlighted in Table 4.19 given below.

Table 4-19 Summary of Social Status of the Residential Population

No.	Social parameters	Surrounding Area (A)		Direct Impact area (Socioeconomic field survey April/May 2013) (B)		Percentage of B/A	Reference for Detailed Breakdown
		No	%	No	%		
01	Gender Composition (Census 2012)						Table 4.22 (a), 4.22 (b) in the Annex 4.3
	Male	25,857	50%	848	49%	(3.3%)	
	Female	25,845	50%	895	51%	(3.5%)	
	Total	51,702	100	1,743	100	(3.4%)	
02	Ethnic Composition #						Table 4.22(C), 4.22(d) in the Annex 4.3
	Sinhala	21,633	33%	680	39%	3.2%	
	Tamil	26,838	41%	887	51%	3.3%	
	Moor	15,918	24%	168	10%	1.1%	
	Others	1,341	2%	8	0.4%	0.5%	
	Total	65, 730	100	1,743	100		
03	Religious Composition #						Table 4.22(e), 4.22(f) in the Annex 4.3
	Buddhist	19,041	28	631	36%	3.3%	
	Christians	11,768	18	278	16%	2.4%	
	Islam	16,363	24	170	10%	1%	
	Hindu	18,521	28	664	38%	3.6%	
	Others	1,227	2	-			
	Total	66,920	100	1,743	100		
04	Age Composition Census and Statistic 2012)						Table 4.22(g), 4.22(H) in the Annex 4.3
	0 – 5 Years	N/A	N/A	185	11%		
	6 -17 Years	13,547	26	381	22%	2.8%	
	18 – 60 years	33,414	65	1,068	61%	3.2%	
	61 years and over	4,741	9	109	6%	2.2%	
	Total	51,702	100	1,743	100		

Source: Department of Census and Statistics - 2011 and Socioeconomic study April/May 2013

#-(Resource profiles Colombo - 2010/2011, Kolonnawa – 2012, Kelaniya – 2013). There is a difference between resource profile data and census data regarding the total population. Hence results of the resource profile to be considered as approximate.

Gender Composition

The majority of the total population of Sri Lanka comprises with female population which accounts 51.5% out of the total population (Census and Statistic – 2011) Male Female proportion is almost similar in project surrounded area.

Ethnic Composition

In the Western province Sinhala population is the majority. (I.e. Colombo 76.7%, Gampaha 90.6%, - Department of Census and Statistics 2011) However, it is revealed that the Tamil population is higher in the project surrounding area as well as in the direct impact area.

Religious Composition

As far as the religion is concerned Buddhist and Hindus are present in similar percentage in the direct impact project area.

Level of Education

When determining the level of education categories under "illiterate" and "can place signature only" are considered as illiterate. Category under pre - school education applies to young children. Thus the rate of illiteracy among adult population (over 18 years) is 17.8 %

Though the Western Province of Sri Lanka has comparatively better education facilities than the other provinces, the higher rate of Illiteracy within the direct impact project area prevails. The reasons for higher illiteracy is due to poor socioeconomic status, being migrants from less developed areas such as tea estates, lack of education of parents, etc. Illiteracy is highest in Wadullawatta Gn division.

Table 4-20 Level of education –residential population in direct impact area

Level of education	Bloemendhal	Nawagampura	Sedawatta	Wadullawatta	Orugodawatta	Peliyagoda Gangabada East	Total
Illiterate							
1.Illiterate	24	6	57	148	9	2	246
2.Can place signature	6	0	24	31	2	1	64
3.Only pre-school (under 5 years)	2	0	14	35	1	1	53
Primary							
Grade 1 – 5	46	14	96	255	7	3	421
Secondary							
Secondary Grade6 – G.C.E (A/L)	-58	55	281	509	27	18	948
Higher education							
University and above	1	2	3	2	0	3	11
Total	137	77	475	980	46	28	1,743

Source: Socioeconomic study April/May 2013

Economic status of population

Economic parameters such as average household size, average land extent for housing, average household income, average household expenditure, average excess income, per capita income, per capita expenditure, dependency ratio, unemployment, income and expenditure pattern of households, physical infrastructure attached to houses, assets that belong to the household etc. of the affected households were obtained through socio-economic survey which is presented in the table below

Table 4-21 Economic parameters Vs. residential population in each GN area

Economic parameters	Administrative area							Total
	Colombo (DSD)			Kolonnawa (DSD)			Kelaniya (DSD)	
	Bloemendal	Grandpass (N)	Nawagampura	Seedawatta	Wadulawatta	Orugodawatta	Peliyagoda Gangabada (E)	
Total Land area – Surrounding area (Acres)	N/A	N/A	N/A	310 (232h)	675 (245h)	640 (112h)	110.7 (40.1h)	
Total Land area – Direct Impact Area (Perch)	67.28 (0.42A)	8.35 (0.05A)	60.5 (0.38A)	150.3 (0.94A)	284.7 (1.78A)	7.6 (1.78A)	26.6 (0.17A)	605.33 (3.78A)
Impact Land area in the Direct impact area (Perch)	66.06 (98%)	7.87 (94%)	54.8 (90.6%)	150.22 (99.9%)	283.95 (99.7%)	6.89 (90.7%)	26.6 (0.17A) (100%)	596.39 (98.5%)
Total population	137		77	475	980	46	28	1,743
Total housing units	33		14	93	240	09	06	395
Average Household size	4.1		5.5	5.1	4.1	5.1	4.7	4.4
Average land extent for housing	2.04 (perch)		4.32 (perch)	1.62 (perch)	1.19 (perch)	0.84 (perch)	4.43 (perch)	1.53 (perch)
Average population density per perch	2.04		0.79	0.32	0.29	0.17	0.95	0.35
Total income	1,154,200		650,300	4,773,500	7,967,856	394,000	470,400	15,410,256
Average household income	39,975		46,450	51,327	33,199	43,777	78,400	39,013
Total expenditure	907,589		550,633	3,846,102	6,871,621	305,780	198,750	12,698,475
Average household expenditure	27,502		39,330	41,355	28,631	33,975	33,125	32,148
Average excess income per household	12,473		7,120	9,972	4,561	9,802	45,275	6,865
Per capita income	8,424		8,455	10,049	8,130	8,565	16,800	8,841
Per capita expenditure	6,624		7,151	8,097	7,011	6,647	7,098	7,285
Labour force								
1. Male	46		32	146	277	15	13	529
2. Female	44		21	154	297	16	07	539
Total	90		53	300	574	31	20	1,068
Employed population	(54)		(27)	(204)	(395)	(23)	(13)	(716)
Dependents	36 (40%)		26 (49%)	96 (32%)	179 (31%)	8 (25%)	7 (35%)	352 (33%)
Unemployment								
1.Retired/old/disabled	1		6	15	35	1	4	62 (6%)
2.House wife	17		10	49	89	8	3	176 (18%)
3.Students	26		16	103	237	13	6	401 (40%)
4.Unemployed	36		12	91	196	20	2	357 (36%)
Total	80		44	258	557	42	15	996 (100%)
Dependency ratio	2.5		2.9	2.3	2.5	2.0	2.2	2.4

Economic parameters	Administrative area							Total
	Colombo (DSD)			Kolonnawa (DSD)			Kelaniya (DSD)	
	Bloemendal	Grandpass (N)	Nawagampura	Seedawatta	Wadullawatta	Orugodawatta	Peliyagoda Gangabada (E)	
Type of Employment								
1. Permanent	9 (7%)		13 (17%)	59 (12%)	89 (9%)	11 (24%)	8 (29%)	189 (11%)
2. Temporary	45 (33%)		14 (18%)	145 (30%)	306 (31%)	12 (26%)	5 (18%)	527 (30%)
3. Unemployed	80 (58%)		44 (57%)	258 (55%)	557 (57%)	21 (46%)	15 (53%)	975 (56%)
4. Foregin employment	3 (2%)		6 (8%)	13 (3%)	28 (3%)	2 (4%)	0	52 (3%)
Total	137 (100%)		77 (100%)	475 (100%)	980 (100%)	46 (100%)	28 (100%)	1,743 (100%)
Monthly Income (SL -Rupees)								
1.< 10,000	3		0	2	10	0	0	15 (4%)
2.10,001 – 20,000	8		1	8	61	3	0	81 (21%)
3.20,001 – 30,000	8		3	19	63	2	1	96 (24%)
4.30,001 – 40,000	5		2	22	40	2	2	73 (18%)
5.40,001 – 50,000	1		5	10	24	0	0	40 (10%)
6.50,001 – 60,000	3		1	14	18	1	0	37 (9%)
7. > 60,001	5		2	18	23	1	2	51 (13%)
8. No response	0		0	0	1	0	1	2 (1%)
Total	33		14	93	240	9	6	395 (100%)
Monthly Expenditure (SL Rupees)								
1.< 10,000	3		1	1	4	0	0	9 (2%)
2.10,001 – 20,000	4		0	14	59	2	0	79 (20%)
3.20,001 – 30,000	14		3	18	84	2	1	122 (31%)
4.30,001 – 40,000	4		2	28	43	2	2	81 (21%)
5.40,001 – 50,000	3		5	12	25	0	0	45 (11%)
6.50,001 – 60,000	3		2	5	9	2	2	23 (6%)
7. > 60,001	1		1	14	11	1	0	28 (7%)
8. No response	1		0	1	5	0	1	8 (2%)
Total	33		14	93	240	9	6	395 (100%)
Utilities attached to houses								
Availability of Electricity	20 (61%)		12 (86%)	87 (94%)	203 (85%)	6 (66%)	4 (67%)	332 (84%)
Kerosene for lighting	13 (39%)		2 (14%)	6 (6%)	37 (15%)	3 (33%)	2 (33%)	63 (16%)
Access to safe drinking Piped water (individual and public stand post)	32 (97%)		14 (100%)	89 (96%)	236 (98%)	9 (100%)	6 (100%)	386 (98%)

Source: Socioeconomic field survey April/May 2013

Average household size

Average household size means the number of family members living in a household. Average household sizes in the District Secretariat Divisions around the project area are 4.8 for Colombo DSD, 4.3, for Kolonnawa DSD and 4.1 for Kelaniya DSD while the project direct impact area has an average household size of 4.4.

The highest rate of 5.5 was recorded in Nawagampura GND. These figures highlight the overcrowded situation within the housing units.

Average land extent of housing

The regulation, for minimum lot size for housing in urban areas is 6 perch (approximately 152 m²). It is 1.53 perch (approximately 39 m²) in the Direct Impact Project Area, which is very much below the standard regulation. It is very low for the Orugodawatta GND and it further highlights the overcrowded situation in the area. According to UDA regulations for urban low income settlements declared as a special project areas the minimum lot size is 2 perch (50.8 m²).

Average income and expenditure per household

Income ranges in the affected households are given in Table 4-21 above. It should be specially noted that the income level of 4% of stakeholders are below Rs.10,000 per month which means that there poverty level is very low.

When average in expenditure of the affected parties in GN divisions is considered, it is always less than the average income of AP's for those GN Divisions. Overall average income in the project affected area is Rs.39,013 whereas the corresponding expenditure is Rs.32,148. This shows an excess income. Two percent (2%) of the households spend less than Rs.10,000 per month which directs to a higher poverty level.

Dependency

The dependency ratio in the direct impact project area is 2.3 which means that one person has to look after 2.3 persons on the average. The rate is almost similar in all the GN divisions. However, Bloemendal is has the highest dependency ratio among them.

Unemployment

Unemployment at economically active age group is more than 36%. Total unemployment in the affected households is 56%.

Employment

Daily paid labor is the predominant economic activity found in the direct impact project area. The second highest economic activity is self-employment and requires more livelihood support to improve their self-employment. Households depending on foreign employment is around 3 % .

Physical Infrastructure (Water supply, Telephone, Electricity)

Availability of utility connections to the houses is an indication of the prosperity of the household. Details are given below

Electricity

In the direct impact project area, 84% of households have electricity connection, which is a satisfactory condition. But 16% of households who do not have electricity connection use Kerosene oil lamps for lighting.

Telephone

Fixed telephone facilities in the direct impact project area is very much meagre (only 14%). This is in line with the trend in the country where all grown up members of a family have a mobile phone and the fixed line phones at home are made irrelevant.

Water Supply

Majority (97%) of households has access to safe drinking water through individual water connection or public stand post within the locality. These facilities are maintained by National Water supply and Drainage Board. Other sources are very few and it is only 3%. Well water within the area is not suitable for drinking purposes because of the low lying nature of the locations.

Household Assets

The number of appliances and other assets in a household indicate the socioeconomic status of the occupants. Vehicles, electrical appliances would be of a higher value. The distribution of household assets in each GND is shown in table 4.27 in Annex 4.3.

Factors Affecting the Economic Status of the Population

Economic status of the population might decrease if their employment gets affected by natural disasters such as cyclones, flood etc. In general, employed categories of daily paid laborers, contract laborers and cottage based self-employment categories are mostly liable for such natural disasters. In the direct impact project area, 30% of employed population are within these categories and liable for natural disasters. (Please refer to Table 4.28 in Annex 4.3).

Part of the project area (Wadullawatte and Sedawatte GND's) usually gets flooded due to low-lying nature. The impact of the flood in the direct impact project area is one of the contributing factors to degrade the economic standards of the population further. This happens because 66% of the population in the direct impact project area experience floods, 64% of them have experienced floods more than twice a year, 13% of dwellings had to be abandoned until the recession of flood and 7% of dwellings had to be abandoned totally. The impact of flood on their livelihood, economic activities, property and dwelling are highlighted in Table 4.29 in Annex 4.3.

Gender (Status of Woman)

In Sri Lanka, both men and women have voting rights since 1931 and two women have served as the nation's President and Prime Minister². The Gender situation in the country is explained in detail in the Annex 4.3 under the topic of Gender.

The gender situation in the project impact area was ascertained after studying the gender of chief householder and participation of women in decision making in households and at community level. The Gender situation in the project area is highlighted in Table 4.30 in the Annex 4.3. In social studies women headed households are considered as vulnerable. Percentage number of households headed by women is presented in the Table below.

Table 4-22 Households headed by women in Direct Impact Area

GN divisions	% of Households headed by women	Remarks
1.Bloemendal	45%	Percentages are higher than National percentage (23% - According to 2013 statistics).
2.Grandpass (North)	20%	
3.Nawagampura	23%	
4.Sedawatta	56%	
5.Wadullawatta	46%	
6.Orugodawatta	33%	
7.Peliyagoda Gangabada (East)	17%	

Reason for the existence of higher rate of women headed households in the area is that most of the males are mostly away from their homes.

Vulnerability of Women Headed Households

Factors such as old age, disability, chronic illness, being a widow are mainly considered as vulnerability factors. Such vulnerability related details are given in Table 4.30 in Annex 4.3. According to these statistics three GN Divisions (i.e. Nawagampura, Orugodawatte and Peliyagoda East) shows 100% vulnerability as all female heads in these GN divisions possess at least one of the above vulnerability factors.

Women Participation in Decision Making

In the household level, 91% of women who are above the age of 18 years have opportunities for decision making and it reduces up to 71% at the community level. Reasons for women not participating in decision making vary from GN division to GN division according to the character of the community. In Gangabada GN division, the main reason for women in not participating in decision making is that women are not given opportunities by men. In Nawagampura GN division and Orugodawatta GN division, women have no spare time owing to excessive house work and some policies/religious rules in the community that excluded women in participating in decision making

² Source: www.undp.org

activities. In Wadullawatta GN division such reasons are mainly attributed to lack of capacity or skills in women for decision making, lower level of education of women, lack of spare time, because of excessive house work etc.

Children's Rights

Some legislations and policies related to children's Rights in Sri Lanka are described in the Annex 4.3 under the topic on Children's Rights.

The majority of the Children in the project affected area live in squatter settlements on government land. There was little evidence of child labour in the communities except for their helping in the household self-employment activities such as small shops, cottage industries.

In the study area, 566 or 33% of the population is children and out of them 381 or 22% are in the school going age (6 – 17 years old). Refer, Table 4.22H in Annex 4.3. This is the group which has compulsory rights to attend schools.

HIV/AIDS

HIV/AIDS cases are recorded highest in the Western Province of Sri Lanka. (Please refer to table 4.32 on HIV/AIDS in Annex 4.3). The project impact area is located within the Western Province. According to the view of Family Health Bureau –Sri Lanka, the project affected GN divisions and the direct impact area of the project could be considered as a susceptible area for HIV/AIDS though it is not recorded. Through the household survey one HIV/AIDS case was recorded in Wadullawatta GN division. (Refer, Table 4.25 in Annex 4.3 on diseases in the direct impact project area).

4.8.3 Principal Economic Activities

The road section from Bandaranayake statue up to Ingurukade Junction and the surroundings of the Port access road are compact with commercial activities in different scales. The economic standard is also comparatively higher along that road section, than that of the other sections.

In the road section from Orugodawatta Junction up to Custom Department premises, commercial activities are predominant but the economic standard is lower than that of the road section from Bandaranayake statue up to Ingurukade Junction and its surroundings.

In the road section from Orugodawatta Junction up to Kelani River, the principal economic activities vary in accordance with the behavioral pattern of the inhabitants in the area. In that road section, majority of the population is squatters on government lands (See Table 4.33- Annex 4.3 for housing ownership in the direct impact project area). The socioeconomic standards of them are very low and they are casual laborers who work at Colombo Port, commercial ventures and government institutions located in the vicinity where the labor demand is high (Refer Social Land Use Map – in the Annex 4.2).

Home based food preparing, selling goods in some cottage based sporadic boutiques could be found as principal economic activities in the area. There are 54 business premises in the direct impact project area with 118 employees which need relocation.

Fishing is not a principal economic activity in the area though the Kelani River flows through the project area and its influence area. Agriculture is also not a predominant economic activity in the area because of higher density of physical development.

The situation of the principal economic activities in the direct impact project area is shown in Table 4.28 in Annex 4.3. Accordingly daily paid laborers are the highest among temporary employment in the area and it is 64% of the total workforce.

The situation of employment (which is an economic activity) in the direct impact project area is shown in Table 4.28 in Annex 4.3. Accordingly salaried employment in the government sector or private sector, salaried employment in skilled labor and salaried employment in unskilled labor could be considered as permanent employment categories in the project area. Other categories such as daily paid labor, contract labor, self-employment and foreign employment could be considered as temporary employment in the project impact area.

4.8.4 Planned development activities

The Katunayake – Colombo Expressway which is near the project is nearing completion. Under Urban Regeneration Project of Urban Development Authority, National Housing Development Authority is in the process of constructing housing apartments for the dwellers who stay in shanties around the project area (e.g. proposed housing scheme in State Timber Corporation Premises).

4.8.5 Availability of infrastructure facilities (roads, railway, water supply, power supply, health care, education etc.

The project area is a heavily urbanized area in the periphery Colombo City and there is a rich network of urban infrastructure and amenities which consists of major and minor roads, power transmission lines, railway , underground water supply network, underground and overhead telecommunication network, schools, religious places, government and private buildings, houses and commercial buildings etc. There is no hospital in the surroundings of the project area, but there are few dispensaries (Western and indigenous) run by Colombo and Kolonnawa Municipal Council.

There is a set of oil pipelines which carry oil from port to Kolonnawa oil storage complex. Location of the pipeline with respect to the project is given in the figure below.

The availability of infrastructure facilities in project surrounding GN Divisions is shown in Table 4.34 in Annex 4.3 and the availability of infrastructure in the direct impact project area are highlighted in the Table 4.35 in Annex 4.3.

Wadullawatta GN division is the highest impacted infrastructure containing GN division of the project and Nawagampura is the second highest.

4.8.6 Culturally, historically and archaeologically important objects/places

4.8.6.1 Culturally Important Places

Culturally and religiously important, places in the project area are presented in table 4.23 below.

Table 4-23 Culturally and religiously important places

Type	Kolonnawa DSD			Colombo DSD			Kelaniya DSD	Total	Affected No
	Sedawatta	Wadullawatta	Orugodawatta	Bloemendhal	Grandpass (North)	Nawagampura	Peliyagoda - Gangabada East		
1. Buddhist Temple	02	03	01		01			07	01
2. Christian pray room		01						01	01
3. Hindu Kovil	01	04	01				01	07	01
4. Buddha Statues	02	01	01					04	03
5. Sacred trees (Bo)		01	01		01	01		04	00
6. Statues		01						01	01
Total	05	11	04	0	02	01	01	24	07

Source: Google Earth Satellite Imagery and the socioeconomic survey of JICA Survey Team April/May 2013

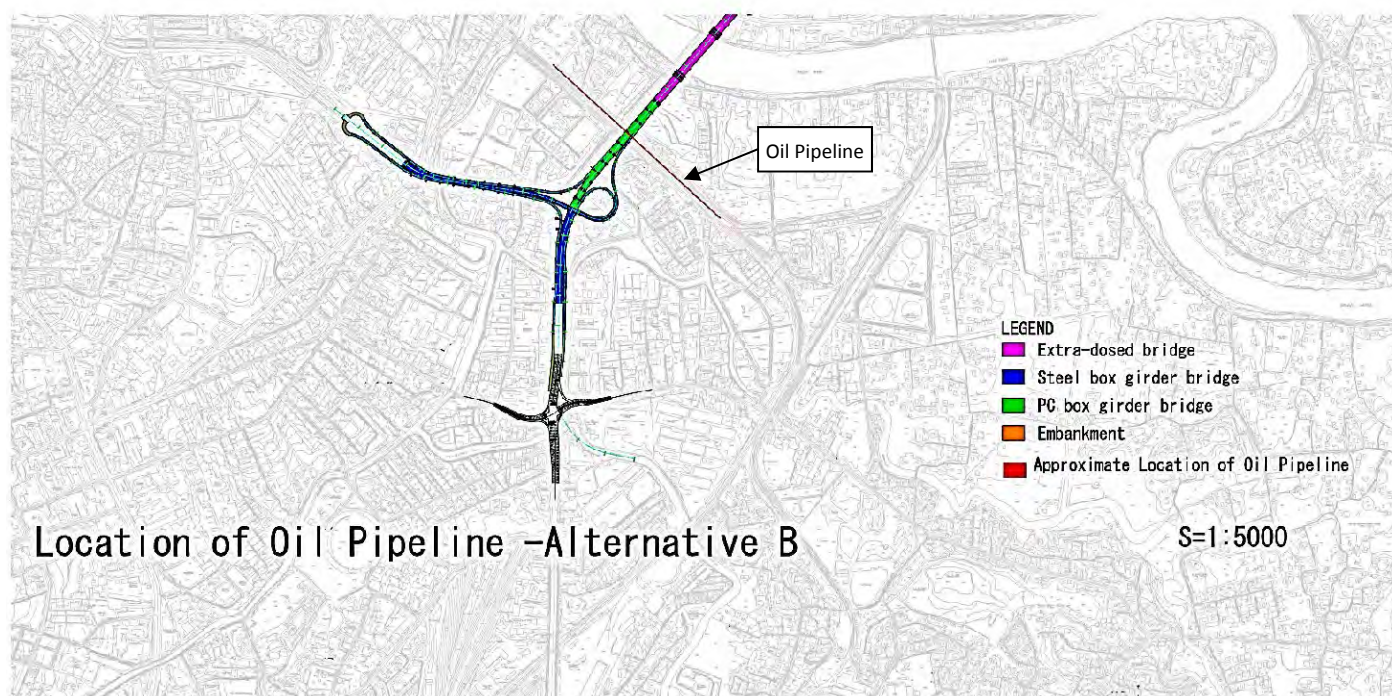


Figure 4-22- Location of oil pipelines

1. Buddhist Temples

Seven Buddhist temples could be identified within the project area. Those are Sanchi Viharaya, Swarna Viharaya, Sumedarama Viharaya in Wadullawatta, Sambuddhaloka Buddhist Temple in Orugodawatta, Sri Somaloka Viharaya in Grandpass North, Navaloka Viharaya in Sedawatte and the temple in front of the petrol shed.

The parapet wall which includes a Buddha statue and the entrance pandal (*Makara Thorana*) at the entrance of Sanchiviharaya in Wadullawatta will be affected.

2. Christian Pray Room

The prayer room is the only Church situated in Wadullawatta to serve 16% of Christians in the area and it is culturally and religiously more important to them.

3. Hindu Temples

There are 7 Hindu Temples in the project area. Four are in Wadullawatta GN division, one is in Sedawatta GN division, one is in Orugodawatta GN division and the other is in Peliyagoda Gangabada East GN division. Mentioned 7 Hindu Temples are culturally and religiously important especially for 28% of Hindu population in project influential area.

Out of 7 Hindu Temples Badrakaliamman Hindu Temple in Wadullawatta is partly affected

4. Buddha Statues

Buddha statues are mostly constructed on the edges of public lands where those are facing roads. These have been constructed by Buddhist devotees with the help of political and donor support. In the project area, 4 Buddha statues (one in the parapet wall of Sanchi Temple, two by the roadside of New Kelani Bridge Road and one at Orugodawatte Roundabout) were identified by enumerators of the household survey. Out of 4 Buddha statues 3 (except for the Buddha statue of Orugodawatte roundabout) are fully affected. Affected Buddha statues could however be shifted.

5. Sacred Trees

In Buddhist temples, Bo Trees are sacred. In the project area three Bo trees attached to three temples. One such tree is located at Orugodawatta Junction. These Bo trees are more than 15 years old and culturally important for Buddhist devotees. However, this Bo tree at Orugodawatte Junction will not be fully affected. Other Bo trees will not be affected.

6. Statue

In Sri Lanka, most of the statues are constructed in the name of public figures who had contributed to the wellbeing of the country. In the project area only one statue was identified and it was constructed to commemorate the former Prime Minister Mr. S W R D Bandaranayake. The statue is important due to its Political value and removing or shifting it to somewhere else may create political

issues if not done in a planned manner. In the past, the same statue had to be shifted owing to the road construction on the New Kelani Bridge road.

4.8.6.2 Archeological Sites

No visible archeological sites were observed within the project area. However, RDA has requested the Department of Archeology to complete an archeological assessment covering the project area. The archeological assessment reveals that there are no archeologically important places in the area directly affected by the project. The letter issued by the Department of Archeology is presented in Annex 4.4

According to historical information a ferry system had been operated between the two banks of the Kelani River to move people and goods. However this location is near the present Victoria – Japan Friendship Bridge.

4.8.7 Existing landscape

The project is located mainly within the Kelani river flood plain and in the vicinity the Kelani River flood bunds. The natural landscape in the project area has been greatly modified by human activity. Small huts made out of wood planks and permanent structures of a basic nature could be observed close to the permanent structures of the Atomic Energy Authority and Automobile Training Institute. Branch canals of Sebastian canal and Dematagoda canal are also located within the project area. The Kelani River is the main surface water body in the project area where the main bridge will be located. Existing road network in the project area is mostly at ground level except for the section between the new Kelani Bridge (Colombo end) and junction where the port access road begins. Within this section the existing road is on embankment. There are no noteworthy landscape resources in the project area.

4.8.8 Traffic congestion

Baseline road is a six lane dual carriageway urban highway. According to the observations by ComTrans project of 2013, the traffic volume is 92,720 vehicles/day around the new Kelani Bridge. This figure is already higher than the allowable traffic volume.

Traffic congestion has become routine. Average speed on this section is 20km / h according to ComTrans project's observations.

4.8.9 Noise sensitive receptors such as hospitals, schools etc.

Noise sensitive receptors such as hospitals, schools etc. are not present within the project area, except Rajasingha Central College (Approx. 300m south of the Orugodawatta Junction) in Grandpass (South) GN Division. Some facilities are located in surrounding GN divisions and they are shown in Table 4.34 in Annex 4.3.

4.8.10 Existing environmental considerations, problems or issues prevailing in the area

According to observations, the project area could be considered as a typical low lying area affecting the social and environmental life in the area by way of floods, water stagnation etc. The available canal system in the area is blocked by silted material and garbage and it's a health hazard as it is also a mosquito breeding ground.

Because of the prevailing nature, vector borne diseases are rampant in the direct impact project area. Among the GN divisions Wadullawatta and Sedawatta GN divisions are the foremost in Vector borne diseases because both areas are low-lying and not suitable for human habitation.

During the rainy season water patching is predominant in the area. Because of the flood protection bund of the Kelani River, the project area is not inundated by flood water of Kelani River, except for Seedawatta GN division. The water flowing from Danister De Silva road affects Wadullawatta and Sedawatta GN divisions. This is due to the location of these villages being at a lower elevation than that of the road. The seriousness of the problem was highlighted during the field survey by community leaders in the area.

Large number of squatter housing without sanitary facilities live in the project area. Severe shortage of proper drainage facilities prevalent in the project affected area aggravates health and environmental issues further. The situation in the project affected area is highlighted in Table 4.37 in Annex 4.3. Though the project affected area is in the highly urbanized zone, sanitary toilet facilities are not available for more than 50% of households. The situation is more serious in Wadullawatta area because 65% of households do not have sanitary facilities. As the households in the project affect area do not have sanitary facilities they use public toilets located nearby and far away, under unhygienic conditions. This is a health hazard as well as a violation of the privacy of especially the female population using public toilets. This haphazard lifestyle helps to spread communicable diseases.

A system of proper solid waste collection in this highly urbanized area is prerequisite to keep the environment clean. The direct impact project area and the surrounding DS divisions are in Municipal Council limits where a high density of population concentration is recorded. The situation of solid waste collection in the direct impact project area is given in Table 4.24 below.

Table 4-24 Solid waste collection in Direct Impact Area

DS division	GN division	Total Housing units in GN Division	Availability of solid waste collection			
			Yes		No	
			No.	%	No.	%
Colombo	Bloemendhal	33	32		1	
	Grandpass (North)	0				
	Nawagampura	14	13		1	
Kolonnawa	Seedawatta	93	92		1	
	Wadullawatta	240	238		2	
	Orugodawatta	09	9			
Kelaniya	Peliyagoda– Gangabada East	06	6			
	Total	395	390 (98%)		5 (2%)	

Source: Socioeconomic field survey April/May 2013

The solid waste collection process is available in the area for 98% of the households. But the people in the area say that system is not functioning very well. During the rainy days garbage collection system also gets affected due to the inundation of the roads especially in Wadullawatta area.

Large scale and small scale timber depots function in the area as one of the principal economic activities. Operation of timber depots renders a negative impact to the environment by adding saw dust to the environment including Kelani River. It causes respiratory system diseases to the stakeholders. This can be confirmed by the field survey data which is shown in the following table.

Table 4-25 Diseases in the direct impact area

DSD	GND	Total housing	No. diseases affected persons	Vector-borne Diseases	Food and water borne	STDs (including HIV/AIDS)	Respiratory system	Communicable	Non communicable
Colombo	1 Bloemendhal	33	115	17(11%)	0	0	5 (9%)	0	0
	2 Grandpass (North)	0	-		0				
	3 Nawagampura	14	64	11(7%)	0	0	2 (4%)	0	0
Kolonnawa	1 Seedawatta	93	410	46(30%)	4	0	13 (25%)	2	0
	2 Wadullawatta	240	867	71(46%)	3	1	30 (58%)	3	3
	3 Orugodawatta	09	67	06(4%)	0	0	2 (4%)	0	0
Kelaniya	1 Peliyagoda – Gangabada East 174B	06	24	04(2%)	0	0	0	0	0
	Total	395	1,547	155 (100%)	7	1	52 (100%)	5	3

Source: Socioeconomic survey April/May 2013

Respiratory system diseases are highest in Wadullawatta and Sedawatta GN divisions.

The water in the Kelani River is also not suitable even for bathing. The stakeholders said that some institutions located along river bank, discharge their solid and liquid waste to the river during the day season. However, people in Sedawatta area widely use the river water for bathing though water quality is not suitable for bathing. According to their experience they avoid bathing or washing during the time that most of the institutions discharge their waste to the river. Further they highlighted that, wastes normally discharging to the river in a particular time of the day and it is easy for them to avoid that time.

4.8.11 Existing Bridge across the Kelani River

The proposed project a six lane bridge across the Kelani River contiguous to the existing New Kelani Bridge. The proposed bridge will be located 10m upstream of the existing crossing. The foundation of the new bridge may cause scouring problems to the existing bridge, because of the disturbance to the current river flow by proposed constructions.

5 ANTICIPATED ENVIRONMENTAL IMPACTS OF PROPOSED PROJECT

As environmental impact is defined as any change to the existing condition of the environment. The summary of environmental impacts of the assessment for pre-construction, construction, and operation stages are presented below. Impacts were determined using a rating score as given below.

Table A: Summary of Environmental Impacts

Impact Rating: A +/- Significant positive/negative, B: +/- Moderate positive/negative

C +/- : Minor positive/negative D : No impact

Impact Theme	Impact Rating		Reasons for attributed impact rating
	Pre-Construction or Construction	Operation	
Socio Economic			
Land acquisition and resettlement	A-	D	Pre-Construction or Construction The number of affected dwellings and small business structure within the proposed ROW and service corridor are 449 and demolition/resettlement causes significant negative impacts. Operation No operational impact
Livelihood and economic activities	A-	D	Pre-Construction or Construction Livelihood of people will be affected once the land is acquired for the project. This will cause significant negative impacts as the livelihood of some community members will be temporarily lost. Operation No operational impact
Disruption of Existing Infrastructure facilities(Utilities)	A-	D	Pre-Construction or Construction Shifting of the existing high-tension (32kW) power line, Atomic Energy Authority, the Automobile Training Institute will have temporary adverse impacts as shifting may cause inconvenience to the residents and building occupants and public users. Existing oil pipeline will get affected by construction machinery etc. It is also considered necessary to relocate electricity power lines, telecommunication lines, water supply lines located within the project area during construction causing temporary adverse impacts such as power outage, water shortages etc. As far as possible constructions near oil pipeline should be done carefully without damaging it resulting in oil leakages. Operation No operational impact
Nuisance to neighborhood	C-	D	Pre-Construction or Construction Loss of access to residences and to social and administrative institutes could be considered as a nuisance to neighborhood during construction. This impact is temporary. Operation No operational impact
Violation Children's Rights	D	D	Pre-Construction or Construction There is no significant impact as child labour is prohibited by laws of Sri Lanka. Operation No operational impact
Spreading of HIV/AIDS	C-	D	Pre-Construction or Construction There could be some impact from workers coming from outside the project area. But the effects are minimal as they will be commuting rather than living in the project site. There is only one recorded case of HIV among affected people who will be shifted

Impact Theme	Impact Rating		Reasons for attributed impact rating
	Pre-Construction or Construction	Operation	
			out before commencement of construction. Operation No operational impact
Impacts from construction waste and other waste disposal	B+	D	Pre-Construction or Construction Loss of retention in marshes , odour emanation, blockage of drainage paths, water stagnation Operation No impact
Impacts extraction and transportation of materials	B+	D	Pre-Construction or Construction Dust , vibration, public nuisance , drainage congestion, disturbance to landscape Operation No impact
Health and safety impairment	B+	C-	Pre-Construction or Construction Presence of respiratory diseases because of dust. Spread of communicable diseases because improper solid waste and wastewater disposal. Construction related accidents Operation Probable accidents with high vehicular speed
Physical Environment			
Change of Existing landscape	B-	C+	Pre-Construction or Construction The existing landscape of the proposed construction area will be temporarily altered by construction activities causing fair negative impacts. Operation The iconic nature of the proposed bridge will enhance the future landscape
Hydrological			
River flow and canal flow obstruction	C-	D	Pre-Construction or Construction There could be temporary negative impacts during construction because of small coffer dams, sheet piles and such obstructions etc. Operation There will not be any significant negative impacts as there will not be any piers inside Kelani River or canals for crossings.
Alteration of the local drainage pattern	C-	C-	Pre-Construction or Construction Drainage pattern of the area could be temporarily altered by piles of construction materials causing negative impacts. Operation There could be blockage of gullies , inlets etc. causing drainage congestion but this impact will not be prominent as there will be regular maintenance
Damages to flood protection scheme	C-	D	Pre-Construction or Construction There could be damages to the flood bund from construction equipment Operation No impact
Hindrance to flood propagation	C-	D	Pre-Construction or Construction There could be hindrances to flood propagation because of material stockpiles, construction yards on the flood plain. This impact is temporary. Operation There will not be any significant impact as the structures will be elevated.
Physio-Chemical Environment			
Water quality (Contamination)	B-	D	Pre-Construction or Construction There is a possibility that the loose soil, sewage, oil and grease, bentonite or other chemicals etc. may enter water bodies or penetrate to groundwater causing water quality degradation. However Contractor will have to meet the procedures outlined in

Impact Theme	Impact Rating		Reasons for attributed impact rating
	Pre-Construction or Construction	Operation	
			the Environmental Management Plan to avoid these effects Operation Not significant impact is expected
Air quality degradation	C-	D	Pre-Construction or Construction Emission of air pollutant from construction equipment and traffic congestion may cause minor negative impacts temporarily. Operation Due to an increase in traffic volume, air quality degradation level will increase slightly but, this does not significantly deviate from current air quality levels.
Noise (Public nuisance)	B-	C+	Pre-Construction or Construction During construction, noise in the construction area will be generated by the operation of construction machines causing public nuisance. Operation The project may have modest positive impacts since driving speed will increase and noise decay distance is extended.
Vibration (Public nuisance & structure cracks)	C-	C-	Pre-Construction or Construction During construction vibration in the construction area will be generated by the operation of construction machines causing public nuisance. Cracks may appear in nearby structures Operation Vibration levels could be increased because of enhanced vehicular speed.
Global warming	D	C+	Pre-Construction or Construction Construction machines and vehicles generate greenhouse gases, and quantities of generating gases do not give serious impact as quantities are relatively low according to numerical studies carried out. Operation After implementation of the project, the amount of CO2 emission will be decreased with some positive contribution to global warming issue.
Soil Contamination	C+	D	Pre-Construction or Construction Soil contamination could take place from oil, grease and wastewater from construction area and this might give a minor negative impact. Operation Not impact is expected
Ground subsidence	C-	C-	Pre-Construction or Construction Ground subsidence not expected as there is no driven piling. Ground subsidence could take place in river and canal banks Operation Long term minor settlements within specified tolerance limits could take place
Bottom sediment disturbances	C-	D	Pre-Construction or Construction Bottom sediment of Kelani River may get disturbed because of end pier construction Operation No significant impact expected after river bed stabilisation
Traffic congestion	C-	A+	Pre-Construction or Construction Traffic congestion may be strictly temporarily Operation Traffic congestion will definitely be reduced when new bridge, access roads are operated
Terrestrial and Aquatic Ecology			
Aquatic habitat destruction	D-	D	Pre-Construction or Construction There is no significant impact as rare, threatened or endemic aquatic fauna or flora species does not exist. There could be minor hindrances to aquatic life of Kelani River during end pier

Impact Theme	Impact Rating		Reasons for attributed impact rating
	Pre-Construction or Construction	Operation	
			construction Operation Not impact is expected
Terrestrial habitats destruction	C-	D	Pre-Construction or Construction Rare threatened or endemic flora species do not exist, however about 260 trees may be removed from the project area. Operation No impact is expected
Archaeological sites disturbance	D	D	Pre-Construction or Construction Not impact is expected as no archeological sites have been found during the archeological assessment. Operation No impacts
Damages to existing New Kelani Bridge	C-	C	Pre-Construction or Construction There could be damages to existing New Kelani bridge by construction equipment or piling activities causing vibration Operation No impact

5.1 Socioeconomic Impacts

5.1.1 Land Acquisition and Resettlement Impacts

Number of settlements and other institutions to be affected

The proposed project is located in a densely populated area including government and private institutions within Colombo and Gampaha districts. Some religious and culturally important structures are also located within the project area. According to the preliminary designs the number of affected dwellings and small business structures within the proposed Right of Way and service corridor are as follows;

Table 5-1 Project affected dwellings and small business structures

Divisional Secretariat Division	Grama Niladari Division	No. of Affected Structures
Colombo	Bloemendhal	44
	Grandpass North	5
	Nawagampura	26
Kolonnawa	Sedawatta	107
	Wathullawatta	252
	Orugodawatta	9
Kelaniya	Peliyagoda Gangabada East	6
Total No. of affected structures		449

(Source: census survey, 2013)

The majority of these structures are either huts or permanent structures which are basic in nature. The census survey carried out in the project area shows that 395 families occupy these structures at present. The total residential population affected will be 1743 persons (including heads of families).

All above dwellings and small scale business structures will have to be removed from the site. Impact on the government, private and religious institutions are as follows;

Table 5-2 Nature of impact of government and private and religious institutions

Institute	Degree of impact
Atomic Energy Authority	80% of the main building will be affected as the port access road interchange will locate within this area. Therefore the entire building has to be shifted.
Main workshop of Automobile Training Centre	80% of the main building will be affected as the port access road interchange will locate within this area. Therefore the entire building has to be shifted.
Sanchi Temple	Only the parapet wall (embedded with a Buddha statue) and entrance pandal will be affected
Aman Kovil	Will be partly affected
Kelanithissa power station	Only the parapet wall will be affected.
Timber depot	Only the access is affected.
RDA quarters	80% affected
Wijeya graphics, Jayalath Multi Traders (Pvt) Ltd	Only a part of the front end parking area will be affected due to construction of the port access road. No shifting may be necessary.

Main Affected Places



Figure 5-1 Affected Religious and Social Infrastructure

The Buddhist statue close to Nawaloka ground and another roadside Buddha statue will also have to be shifted for the construction of access road to the main bridge.

About 40% of the land and the structure of Amman Kovil will have to be acquired for the proposed Right of Way of port access road and temporary access roads

Junction improvement works at Orugodawatta may have an impact on the Buddha statue and Bo-tree but it may not be needed to be shifted.

See Figure 5.1 for the location of these structures.

Impacts of land acquisition and resettlement

(Before construction)

According to the census survey carried out within the proposed ROW and the service corridor number of affected families is 395, which includes a population of 1743 persons. In addition 54 business premises, owners of those and 118 employees will be affected.

Most of these families reside in huts or permanent structures which are basic in nature. Also most of these structures have been built on government lands (unprotected area of Kelani River). According to the Land Acquisition Act such encroachers will not be eligible for compensation for loss of land and they may get a low payment for any development done on land. If such a situation arises these people will be deprived of their basic living needs.

Some of the affected families in Wadullawatta and Bloemendhal GN Divisions could be resettled in proposed housing schemes by UDA. Because UDA has been conducting housing scheme projects for the people of low income group living in the city. The housing construction project under UDA will provide accommodation needs of the affected householders.

But the remaining families will be displaced physically due to the project which will also be a significant and permanent impact. Such relocation will also affect the education of children in these families as most of them go to schools located close to the project area and to tuition classes located at Nugegoda and Borella areas.

According to the information from the affected communities it is observed that these people use government medical and other facilities such as Colombo General Hospital, Eye Hospital for their health and other official needs. If these people are resettled at a place distant to these facilities they will have to spend more money and time to reach these facilities.

5.1.2 Impacts on livelihood and economic activities

(Before construction)

Most of the people living in the affected settlement area work as laborers or porters at Pettah and Colombo port area. During the census survey carried out in the project area it came to light that some households are involved in house level business activities such as manufacturing incense sticks and doormats.

A prominent three wheeler park is located near the entrance to the Nawaloka Ground. Three small scale vehicle repairing centers and a tire repair center is located within Wadullawatta GND.

Livelihood of people will be affected once the land is acquired for the project and when people get displaced.

Loss of parking area will have a negative impact on the private business entities. Also their commercial activities would get temporarily affected as they will lose their entry or they may need to close their business during the construction period. Such a situation may affect the employees working in these private organizations.

In case the project affected persons are resettled at an alternate land, such a land needs to be developed at least with basic living facilities.

5.1.3 Disruption of existing infrastructure facilities

(Before construction)

The proposed new bridge and its approach road along Baseline road are placed at a much higher elevation than the existing road. The existing high-tension (132kV) power line to Kelanithissa power plant may need to be either raised or shifted to another location. At least the existing pylon near the Atomic Energy Authority may have to be shifted. Such an activity will have a temporary impact on the national electrical grid causing temporary power outages.

Shifting of the Atomic Energy Authority building and shifting of the main workshop of Automobile Engineering Training Institute and shifting of Amman Kovil are the other three major adverse impacts on infrastructure facilities located within the project area.

It is also considered to utilize Nawaloka Ground and nearby yard of “Logiventures” as the yard and plant area for this project. However this suggestion is only tentative.

(During construction)

Other than these major impacts the construction work will also require removing and relocating electricity power lines, telecommunication lines, and water supply lines located within the project area.

The Sri Lanka Petroleum Corporation’s oil carrying pipelines are located in the project area and during construction there is some likely hood for damages to these pipe lines located below ground and precautions need to be taken to protect them and contingency plans are necessary to be put in place to handle emergencies in case of disruptions.

5.1.4 Nuisance to neighborhood

(During construction)

Migrant labor brought in to construction site with different cultural norms may lead to conflicts among the workers and settlers. Activities such as selling of illicit liquor may also increase within the project area.

Loss of access could also be considered as a nuisance to neighborhood during construction of the project.

5.1.5 Violation of Children's Rights

(During construction)

It is assumed that "children's rights" is related to "child labor". Other than child labour there is no impact on "children's rights" from this project. Child labour has not been recorded in the case of projects under construction, such as OCH Project. Child labor is covered under contract clauses of the contract document (Sub Clause 6.21 of the JICA Standard Contract Documents FIDIC MDB Harmonized Version 2010). Sri Lanka's labor law specifically states that the minimum age of a laborer should be 18 years. Therefore there will not be any impact on children's rights.

5.1.6 Spreading of HIV/AIDS

(During construction)

During the construction period there is a possibility of causing spread of various sexually transmitted diseases including HIV/ AIDS. Laborers should be educated on this aspect and general hygiene practices. Strict labor supervision should also be carried out during the construction period to avoid such spread of sexually transmitted diseases. One aid patient was recorded in Wadullawatte area during the household survey. Sub Clause 6.7 Health and Safety of the JICA Conditions of Contract exhaustively deals with the measures for prevention of HIV/AIDS including the conducting of awareness programs and free distribution of condoms. Contractor is required to include these activities in his program and payments will be made under a Provisional Sum

5.1.7 Health and safety impairment

(During construction)

The project is located in a populated area with significant traffic flow, which means that there will be many people around the construction sites. A number of skilled and unskilled laborers will be working at site with heavy machinery and material.

Construction activities such as soil excavation, piling, backfilling, embankment work, steel girder erection and concreting will require operation of heavy machinery. Movement of dump trucks loaded with material will also be common during the early stages of construction. There is a risk of accidents.

The risk of fire and electrocution should also be considered during a project of this magnitude. Risk of fire and electrocution is significant at labor camps, material and fuel stores.

Exposure of workers into hazardous fumes is another occupational hazard during construction. Falling from heights may also happen if the workers do not use proper safety measures when working at heights above 2 m from ground level. There are conditions imposed on the Contractor under the FIDIC Conditions of Contract to ensure health and Safety of Workers and it is a requirement that he appoints an Accident Prevention Officer for this task

Stagnant water and domestic waste collected on site (especially in worker camps) may lead to spread of mosquitoes and flies causing vector borne diseases to workers and neighboring communities. Food borne diseases will also be common if the workers do not have proper facilities for cooking and storing of food items. Unhygienic site conditions will also lead to the spread of other domestic pests such as rats and cockroaches.

5.2 Impacts from construction and other waste disposal

(During construction)

The excavated soil for piers, will be used as embankment materials if the soil condition is deemed to be good.

Volume of excavated soil (Bridge section + earthwork section); 91,000m³

Volume of backfilling soil; 55,000 m³

Volume of embankment; 36,000m³

Excess waste (construction waste or domestic solid wastes from labour camps) disposal will have impacts on the disposal sites causing water stagnation, blockage of drainage paths, odour emanation, surface and groundwater contamination, disturbance to terrestrial and aquatic flora and fauna. If excess waste is disposed to nearby lowlands they too will get similar impacts.

5.2.1 Impacts due to extraction and transportation of construction material

(During construction)

During the construction stage, transportation of material through roads that are narrow and not built to withstand such loads will lead to the deterioration of such roads and this even cause traffic congestions. Such situation will cause great inconvenience to the public who live around the area.

Also falling construction materials from vehicles could lead to the deterioration of the surrounding environment and the increase the possibility of accidents.

Offsite material extraction places such as quarries metal crushers, burrow pits which supply materials, will have various impacts even if materials were purchased to the project as a market product. Such impacts are noise, dust, vibration, abandoned pits causing water stagnation, drainage blockage etc.

5.3 Change of existing landscape

(During construction)

The new bridge and the road network are designed to be built at a much higher elevation than the existing road and bridge structure. Such construction and removal of existing shanty structures will further change the landscape of the project area.

The trees along the existing roadside is the main existing landscape source. Changes in these plants due to the project implementation will directly impact on the existing landscape in the area.

Landscape of marshy lands around the project area, owing to disposal of waste material from construction activities, will be impaired. Refer section 5.2 for related other impacts.

(During operation)

Newly built 2nd New Kelani Bridge and flyovers will give a feeling of pressure, initially. However, it will be the birth of a new urban landscape, within the developed surrounding environment.

A photo documentation of project area landscape is presented in Annex 5.3.

5.4 Hydrological impacts

5.4.1 Hindrance to canal and river flow pattern

(During construction)

The proposed structure has a cross section which is larger than that of the present New Kelani Bridge therefore the proposed Bridge will not hinder the flow of the Kelani River as the existing New Kalani Bridge does not cause any flow hindrance. Ample clearance even on the flood plain is available from the proposed constructions. Proposed elevated structures over canals have adequate clearance for canal flow hence no flow hindrance occur.

5.4.2 Alteration of drainage pattern of the area

(During operation)

There will not be any permanent impact on the drainage pattern of the area as the structures will be elevated and there will be side drains provided to drain off water collected on the road surface.

5.4.3 Damages to flood protection schemes (Flood bunds/ gates etc.)

(During construction)

There are two flood bunds on the left and the right bank flood plain of the river and these flood bunds could get disturbed by the construction equipment, resulting in scrapes and minor damages in the bunds.

(During operation)

The flood bunds on the left and the right bank flood plain of the river will not have any impact as there will not be any flow hindrance caused by the main bridge during the operational stage due to reasons stated in Section 5.4.1.

5.4.4 Hindrance of flood due to loss of retention/ detention area and blockage of drainage pathways.

(During construction/ During operation)

The proposed road design does not block any drainage pathways as the system is mostly elevated. Even the bridge across the Kelani River has no piers obstructing the flow. However there could be drainage congestion in interchange areas and in the areas where ramp bridges merges with the existing ground level where

there could be embankments.

5.4.5 Impacts on bottom sediment

(During construction)

During construction bottom sediments could be disturbed near river bank areas as these places have to be drilled to install piles for bridge piers. Such bottom sediments may be reused as a soil dressing material, therefore there is no significant impact on bottom sediment

5.4.6 Hydrological Impacts “Without Mitigation Scenario”

If hydrological impacts are not mitigated drainage congestion, creation of backwater, increase of flood levels and delay of flood retention time could transpire. However such a scenario will not be enacted.

5.5 Water quality (contamination)

(During construction)

Spilled/ leaked chemicals, oil and fuel could flow on to the surface and ground water bodies after mixing with storm water or waste water discharged from worker camps, vehicle service and repair stations. Such situation would further deteriorate the surface and ground water quality of the project area.

In this project, a large scale of cut earthworks, excavation is not planned. There is no enough room within the project premises to establish labour camps or service stations. It will not be necessary to locate them close to the site.

However slight changes in groundwater quality due to the piling work is expected, but there is no major impact on wells around the project site, because these wells are not used for drinking purpose.

5.6 Air quality, noise and vibration impacts during construction and operation

5.6.1 Air Quality

The present traffic congestion in the project area already have an adverse impact on air quality because of emissions from slow moving vehicles. Emissions from the Kelanitissa power plant (especially water vapor) also affect the ambient air quality of the project area.

The level of emissions may increase due to movement of construction vehicles on site. Dust will be another substance which will be generated during demolition of existing structures, excavation and earth work. Dust will also be generated from Asphalt plant, concrete batch mixing plant, stockpiles and storage facilities and separate approvals and studies may be required if such plants are established offsite.

Table 5-3 Emission strength for construction work

Item	Unit	Strength of emission of air polutants (g/unit/day)		Height of exhaust nozle (m)
		Nox	SPM	
Earth work				
	Embankment construction(Road body, Subgrade)	8,600	260	3.0
	Slope shaping	4,400	140	2.4
Soil Improvement work				
	Sand compaction pile driving	34,000	100*	2.3
Pile work				
	Rotary penetration pile	18,000	100*	2.3
Bridge construction woork				
	Steel bridge	15,000	100*	2.1
	PC bridge	15,000	100*	2.1
Pavement woork				
	Asphalt pavement (Surface layer, Base layer)	11,000	100*	1.7

source : Technique of the Road Environmental Impact Assessment , Road environment Institute 2007. *=Assumptions

Above emission strengths were estimated after a detailed air quality analysis. Refer Annex 5.1 for details.

However, it is anticipated that there will be a reduction of vehicle emissions once the bridge and roads are operational as the movement of vehicles will be improved with less traffic congestion.

Greenhouse Gases

CO₂ emissions factor used on numerical analysis are given below. The analysis is carried out to predict the impact of greenhouse Gases due to implementation of the project.

Table 5-4 CO₂ emission Factor (Unit : g-CO₂/km)

		Standard-sized car	Small-sized cargo carrier	Standard-sized cargo carrier	Bus
Average velocity (km/h)	10	331	315	1345	1016
	20	221	251	1132	781
	30	177	212	963	660
	40	152	185	835	583
	50	138	168	750	537
	60	130	160	706	517
	70	129	159	704	520
	80	132	168	744	547
	90	141	184	826	595
	100	153	208	949	666

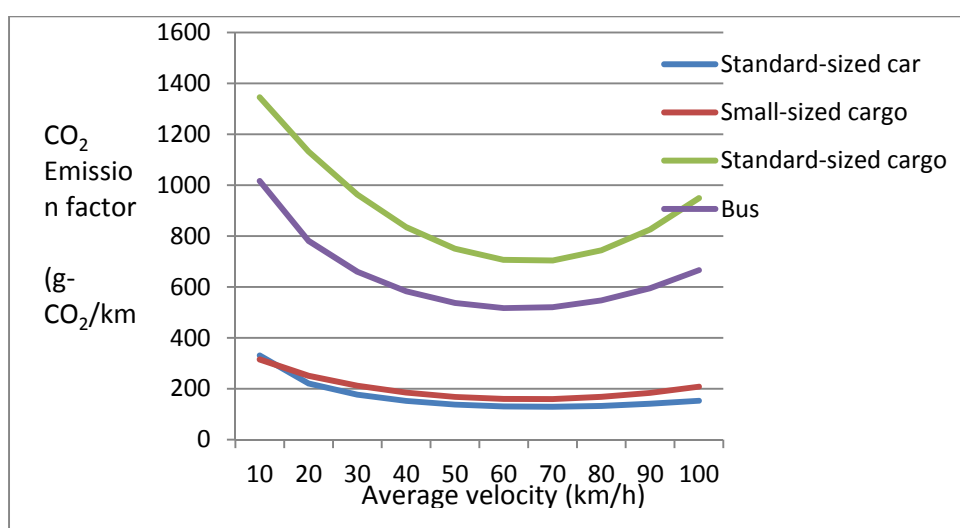


Figure 5-2 CO₂ Emission Factor

5.6.2 Noise

There could be noise generation from the heavy construction equipment such as cranes, backhoes, bulldozers etc. However the baseline noise in the area during the daytime is high as it is a high urban area. Hence noise impact will be aggravated. Noise could cause public inconvenience. Noise will especially impair religious activities of the Buddhist and Hindu temple in the project area.

5.6.3 Vibration

Vibration could be caused by heavy equipment which could crack existing building components, road surfaces and other structural elements. Vibration will also, coupled with noise causes social inconvenience. In addition, traffic vibration will be produced by the vehicles on the road

5.6.4 Overall Impacts on Air Quality Noise and Vibration (with and without the Project)

As a part of the EIA study consultants have evaluated the scenario for Air Quality, Noise, Vibration and Global warming parameters and the results are given below.

5.6.4.1 Air quality

(During construction)

The level of emissions may tentatively increase due to movement of construction equipment and vehicles on site. Dust will be another issue which will be generated during demolition of existing structures and during earthwork operations.

The numerical estimated results on changes in ambient air quality is presented in the following tables. The calculation formulas used for the estimation are presented in Annex 5.1. Background concentration of NO₂ is around 0.1ppm generally, hence adopted 0.09ppm as background concentration of this analysis is the minimum value of the measured result.

**Table 5-5 Estimated result of Air quality of Construction work
(Annual average value) (Peliyagoda-Kelanitissa)**

Construction work	Estimated Air quality	
	Boundary of Construction site	
	NO ₂ (ppm)	SPM (µg/m ³)
Sri Lanka's Ambient Air Quality Stanndard	0.05	-
WHO Ambient Air Quality Standard (1 hr)	0.10	-
Earth work	0.0206	108.8
Soil Improvement work	0.0209	108.8
Pile work & Bridge Construction work	0.0209	108.8
Pavement work	0.0206	108.8

Background concentration, assuming the minimum measured value

**Table 5-6 Estimated result of Air quality of Construction work
(Annual average value) (Kelanitissa-Orugodawatta)**

Construction work	Estimated Air quality	
	Boundary of Construction site	
	NO ₂ (ppm)	SPM (mg/m ³)
Sri Lanka's Ambient Air Quality Stanndard	0.05	-
WHO Ambient Air Quality Standard (1 hr)	0.10	-
Pile work & Bridge Construction work	0.0210	108.8
Pavement work	0.0207	108.8

Background concentration, assuming the minimum measured value

**Table 5-7 Estimated result of Air quality of Construction work
(Annual average value) (Kelanitissa-Ingurukade junction)**

Construction work	Estimated Air quality	
	Boundary of Construction site	
	NO ₂ (ppm)	SPM (mg/m ³)
Sri Lanka's Ambient Air Quality Stanndard	0.05	-
WHO Ambient Air Quality Standard (1 hr)	0.10	-
Pile work & Bridge Construction work	0.0213	108.8
Pavement work	0.0208	108.8

Background concentration, assuming the minimum measured value

From this result, it was able to determine that there is no significant impact of NO₂ or SPM due to construction work. The value of the estimated results is close to the current measured value in this study. However, there is a possibility that a negative impact could occur as many construction units will move within the project area at the same time, especially when the construction work goes on in full swing.

(During operation)

The amounts of NO₂, SPM, CO and SO₂ emission were estimated based on the increase of vehicle number and velocity.

Table below shows the speed and volume of traffic used for the numerical calculation. Wind direction and average wind speed data of Colombo from Department of Meteorology were used for the analysis. Details of the analysis are presented in the Annex 5.1.

Table 5-8 Traffic conditions for estimation

		2013				2020		
Section		①	②	③	④	(A)	(B)	(C)
Vehicles Number/day		92,721	95,260	86,357	27,075	121,439	107,206	34,075
Average vehicle Velocity (km/h)	Baseline road					40	40	40
	Proposed road					60	60	60
	Baseline road*					20	20	20

① : Peliyagoda-Sedawatta (Baseline road)

② : Sedawatta-Kelanitissa (Baseline road)

③ : Kelanitissa-Orugodawatta (Baseline road)

④ : Kelanitissa-Ingurukade junction (Prort access road)

(A): Peliyagoda-Kelanitissa (Baseline road+New road)

(B): Kelanitissa-Orugodawatta (Baseline road+New road)

(C): Kelanitissa-Ingurukade junction (Prort access road + New road)

* : Without project

Traffic volume source; "Urban Transport System Development Project for Colombo Metropolitan Region and Suberbs " The ministry of Transport.2013

The numerical estimated result has been shown in the following table, while the formulas used for estimation is presented in Annex 5.1.

Table 5-9 Estimation of NO₂ emitted (ppm)

Section	①	②	③	④
Sri Lanka's Ambient Air Quality Standard (NO₂)	0.05	0.05	0.05	0.05
WHO Ambient Air Quality Standard (NO₂, 1 hr)	0.10	0.10	0.10	0.10
2020 With project	(A) 0.0233		(B)0.0241	(C)0.0229
2020 Without project	0.027	0.0277	0.0265	0.0250

Standard value of WHO was converted to PPM.

Estimated concentration of NO₂ at the project site along the road, when the project is implemented (With project), has decreased compared to the scenario, when the project is not implemented

(Without project). In addition, predicted NO₂ concentrations are during operation stage are within the Ambient Air Quality Standards of Sri Lanka. Estimation of SPM, CO and SO₂ levels are presented below. The estimations of the SPM, CO and SO₂ levels show a similar trend to that of NO₂. The effectiveness of the project was confirmed through this analysis because the results could meet the Ambient Air Quality Standards of Sri Lanka for all items.(The standards shown Annex II-B)

Table 5-10 Estimation of SPM emitted (µg/m³)

Section	①	②	③	④
Japan's SPM standard	300.0	300.0	300.0	300.0
2020 With project	(A) 108.8		(B)108.8	(C)108.8
2020 Without project	108.8	108.8	108.8	108.8

Table 5-11 Estimation of CO emitted (ppm)

Section	①	②	③	④
Sri Lanka's Ambient Air quality standard CO (8hrs)	9.0	9.0	9.0	9.0
Japan's CO standard (8hrs)	20.0	20.0	20.0	20.0
2020 With project	(A) 7.37		(B)7.39	(C)7.37
2020 Without project	7.37	7.37	7.45	7.39

Table 5-12 Estimation of SO₂ emitted (ppm)

Section	①	②	③	④
Sri lanka's Ambient Air Quality Standard SO₂ (24 hrs)	0.03	0.03	0.03	0.03
WHO Ambient Air Quality Standard SO₂, (24 hrs)	0.008	0.008	0.008	0.008
2020 With project	(A) 0.0100		(B)0.0100	(C) 0.0100
2020 Without project	0.0103	0.0103	0.0102	0.0101

Standard value of WHO was converted to PPM. Moreover, it is anticipated that there will be a reduction of vehicle emissions once the bridge and roads are operational as the movement of vehicles will be improved with less traffic congestion.

5.6.4.2 Noise

(During construction)

Construction noise will come from construction machinery and vehicles. However, significant impact does not continue.

Major work which will create noise during construction work are highlighted below. The table also presents the results of the noise estimation generated by construction works. The calculation formulas used for the estimation calculation refer to the Annex 5.1.

Table 5-13 Result Analysis of Noise Level (Peliyagoda-Kelanitissa)

Construction work	Unit	Estimated Noise Level (dB) Boundary of Construction site
Maximum Permissible Noise level, Construction activities, -Day time (dB) by Noise Control Regulations, Sri Lanka		70
Earth work		
	Slope shaping	77
Soil Improvement work		
	Sand compaction	80
Retaining wall work		
	Cast-in-place retaining wall	77
Pile work		
	Cast-in-place-pile	54
Bridge Construction work		
	PC bridge construction work	77
Pavement work		
	Asphalt pavement work	70

Table 5-14 Result Analysis of Noise Level (Kelanitessa-Orugidawatta)

Construction work	Unit	Estimated Noise Level (dB) Boundary of Construction site
Maximum Permissible Noise level, Construction activities, -Day time (dB) by Noise Control Regulations, Sri Lanka		70
Earth work		
	Slope shaping	77
Retaining wall work		
	Cast-in-place retaining wall	54
Pile work		
	Cast-in-place pile	62
Bridge Construction work		
	Steel bridge construction work	88
Pavement work		
	Asphalt pavement work	78

Table 5-15 Result Analysis of Noise Level (Kelanitessa-Ingurukade junction)

Construction work	Unit	Estimated Noise Level (dB) Boundary of Construction site
Maximum Permissible Noise level, Construction activities, -Day time (dB) by Noise Control Regulations, Sri Lanka		70
Pile work		
	Rotary penetration pile	68
Bridge Construction work		
	Steel bridge construction work	94
Pavement work		
	Asphalt pavement work	84

It was predicted that noise associated with road construction work, will have an effect on the residents who live near the construction site. In sections of Kelanitessa-Orugodawatta and Kelanitessa-Ingurukade junction, the impact is greater than other sections owing to closeness to residential areas and construction sites.

(During operation)

The result of mathematical noise estimation is shown in Table 5-16, 5-17 and 5-18. In current time (2013), the values of noise on the boundary of existing roads are shown in bold text on the three tables. They also present the estimated noise levels once the project is in its operational phase in the year 2020. The calculation formulas used for the estimation calculation refer to the Annex 5.1.

Table 5-16 Result Analysis of Noise Level (Kelanitessa-Ingurukade junction)

Year	Time	Permissible Noise Level L_{Aeq} , dB(A) (Considered as High Noise Area)	Estimated Noise Level dB(A)		
			0m	50m	100m
2013	Day	70	79	68	
2020 with			60	56	55
2020 without			79	65	61
2013	Night	60	75	66	
2020 with			56	52	50
2020 without			76	62	58

Note1) Current evaluated point is 2013: At the boundary of the existing road edge

Note2) Future evaluated point is 2020: At the boundary of the proposed road edge

Note3) Future evaluated point in 2020 (without project) At the boundary of the existing road edge

Note4) Estimation point 0m is boundary of the proposed road edge

Note5) Permissible Noise Levels in accordance with Noise Control regulations, Sri Lanka

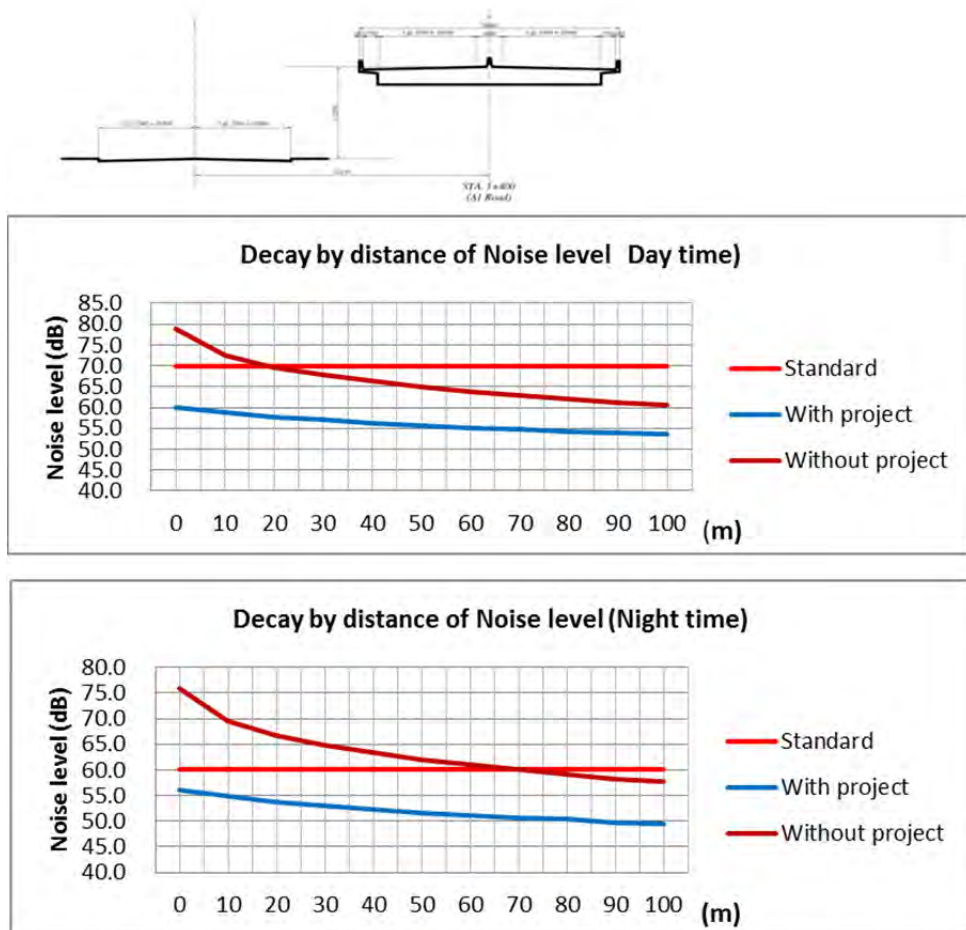


Figure 5-3 Estimated Noise level in the Future (Peliyagoda-Kelanitissa)

Table 5-17 Estimated Noise level in the Future (Kelanitissa-Orugodawatta)

Year	Time	Permissible Noise Level L_{Aeq} , dB(A) (Considered as High Noise Area)	Estimated Noise Level dB(A)		
			0m	50m	100m
2013	Day	70	73		
2020 with			62	54	51
2020 without			74	60	56
2013	Night	60	71		
2020 with			58	50	47
2020 without			72	58	54

Note1) Current evaluated point is 2013: At the boundary of the existing road edge

Note2) Future evaluated point is 2020: At the boundary of the proposed road edge

3) Future evaluated point in 2020 (without project) At the boundary of the existing road edge

Note2) Future evaluated point is 2020: At the boundary of the proposed road edge

Note3) Future evaluated point in 2020 (without project) At the boundary of the existing road edge

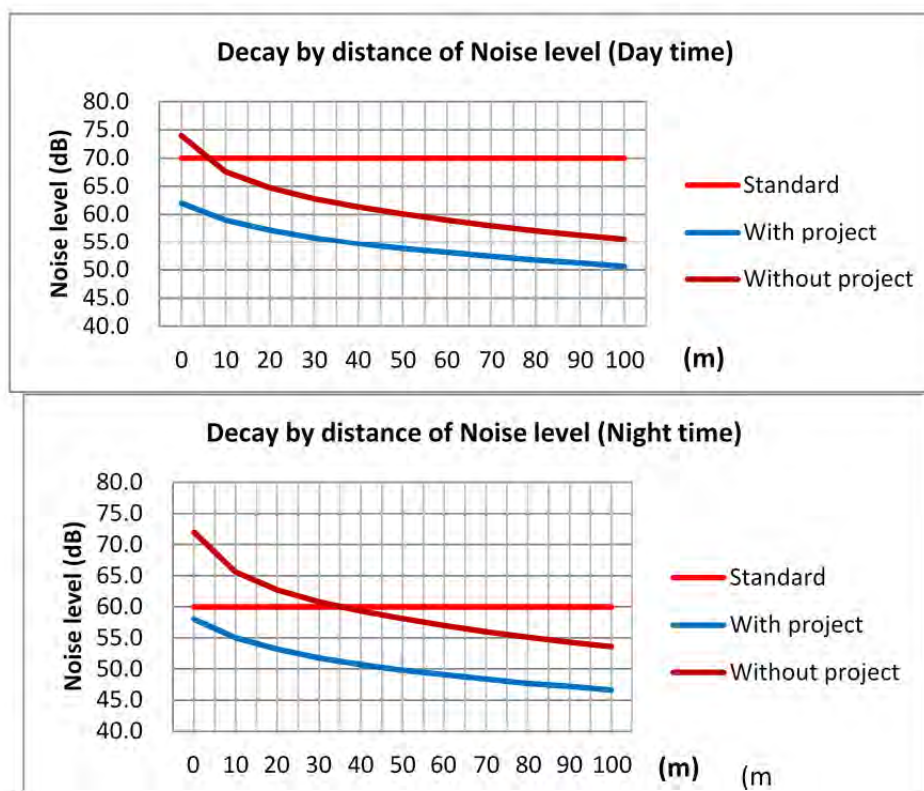
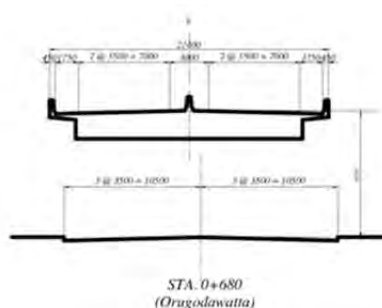


Figure 5-4 Estimated Noise level in the Future (Kelanitissa-Orugodawatta)

Table 5-18 Estimated Noise level in the Future (Kelanitissa-Ingurukade junction, Port access road)

Year	Time	Permissible Noise Level L_{Aeq} , dB(A)	Estimated Noise Level dB(A)		
			0m	50m	100m
2013	Day	70	80		
2020 with			70	57	52
2020 without			79	65	61
2013	Night	60	75		
2020 with			67	54	50
2020 without			76	62	58

Note1) Current evaluated point is 2013: At the boundary of the existing road edge

Note2) Future evaluated point is 2020: At the boundary of the proposed road edge

Note3) Future evaluated point in 2020 (without project) At the boundary of the existing road edge

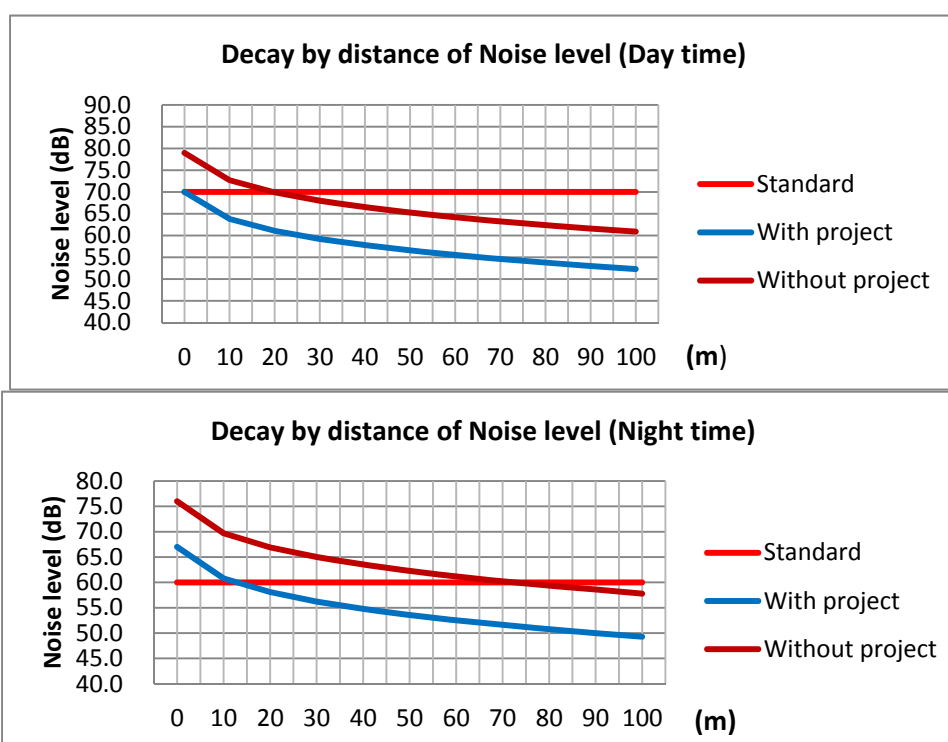
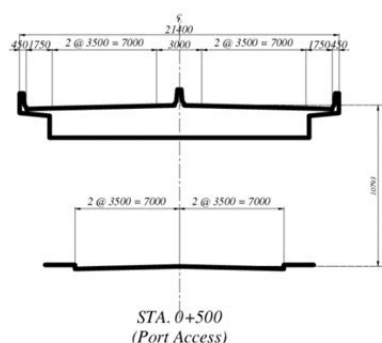


Figure 5-5 Estimated Noise level in the Future (Kelanitissa-Ingurukade junction, Port access road)

According to the estimates, the noise level will be reduced during the day time when the project is operational. However, the noise level predicted will be above the environmental standards during night time. However, it does not further aggravate the present situation, therefore, mitigation measures will not be necessary because the project will not worsen the present environment condition. (The environmental standards shown Annex II-B)

It should be noted that if the project is not implemented the noise level will be above the national standards during both day time and night time. A reduction of noise levels could be anticipated once the new bridge and new roads are opened for traffic.

5.6.4.3 Vibration

Vibration Related Noise during Construction

(During construction)

Construction work such as earth work, pile work will cause vibration related noise. Below presented are the results of the vibration related noise estimation generated by construction works. The calculation formulas used for the estimation are presented in Annex 5.1.

Table 5-19 Result Analysis of Vibration Level (Peliyagoda-Kelanitissa)

Construction work	Unit	Estimated Vibration Related Noise Level (dB)
		Boundary of Construction site
Earth work		
	Embankment construction	51
Soil Improvement work		
	Sand compaction	69
Retaining wall work		
	Cast-in-place retaining wall	51
Pile work		
	Cast-in-place pile	43
Bridge construction work		
	PC bridge	43
Pavement work		
	Asphalt pavement work	40

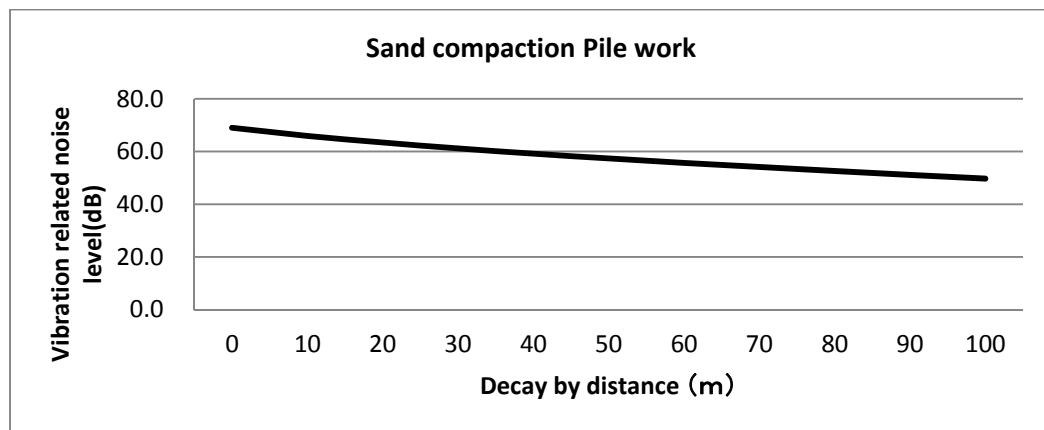


Figure 5-6 Decay by the distance of Vibration level

Table 5-20 Result Analysis of Vibration Level (Kelanitessa-Orugidawatta)

Construction work	Unit	Estimated Vibration Related Noise Level (dB)
		Boundary of Construction site
Retaining wall work		
	Cast-in-place retaining wall	58
Pile work		
	Cast-in-place pile	50
Pavement work		
	Asphalt pavement work	47

Table 5-21 Result Analysis of Vibration Level (Kelanitessa-Ingurukade junction)

Construction work	Unit	Estimated Vibration Related Noise Level (dB)
		Boundary of Construction site
Pile work		
	Rotary penetration pile	55
Pavement work		
	Asphalt pavement work	52

In the classification of vibration related noise impact on humans, the vibration related noise level of 40-69 dB is "a sensitive people feel vibration related noise level". Predicted vibration related noise associated with some road construction work is within this range. Thus it is anticipated that there will be some impact of vibration related noise to communities living close to the project construction sites. But this will be a temporary impact, occurring only during the construction period. The impact of vibration related noise will be minimized by not conducting the construction works, which generates large vibration related noise, during night time.

Predicted Vibration Levels

(During operation)

Vibration levels due to the traffic on the road were estimated for year 2035. The estimated traffic vibration levels are shown in Table 5-22. The calculation methodology is shown in Annex 5.1D. Traffic vibration forecast is carried out based on the baseline survey at 6 locations in the morning peak time.

Vibration forecasted values do not exceed Sri Lankan standard at all locations in Type 3 categorized level since approximately 50 % of traffic volume on the existing road will be diverted to the new elevated road. With regard to Type 4 categorized level in the Sri Lankan Standard, the forecasted value at V4 location exceeds the criteria. However the forecasted value is less than current traffic vibration level, thus the project does not give significant negative impact.

Table 5-22- Result of Traffic Vibration Forecast

Location	Baseline in the Morning (peak time 2013)		Standard Value by Type		Evaluation for Baseline Value (Existing Condition)		Forecast Value	Evaluation for Forecasted Value (peak time, 2035)	
	Frequency Range (Hz)	Vibration in ppv (mm/sec)	Type 3	Type 4	Type 3	Type 4	Vibration in ppv (mm/sec)	Type 3	Type 4
V1	0-10	0.27	2	0.5	Not exceed	Not exceed	0.2	Not exceed	Not exceed
V2	>50	0.56	8.0	2.0	Not exceed	Not exceed	0.41	Not exceed	Not exceed
V3	10-50	0.60	4.0	1.0	Not exceed	Not exceed	0.52	Not exceed	Not exceed
V4	0-10	1.63	2.0	0.5	Not exceed	Exceed	1.42	Not exceed	Exceed
V5	10-50	0.58	4.0	1.0	Not exceed	Not exceed	0.55	Not exceed	Not exceed
V6	>50	0.65	8.0	2.0	Not exceed	Not exceed	0.82	Not exceed	Not exceed

Note)

- 1) Vibration forecast was carried out at morning peak hour.
- 2) It is assumed that traffic driving speed is same as current speed: app. 18km/h on the existing road
- 3) It was forecasted that 50 % of traffic on the existing road is diverted to the new elevated road.
- 4) Forecast methodology is shown in Annex 5.1

5.7 Global warming

(During construction)

Although construction machines and vehicles generate greenhouse gases, the quantities of emissions do not give serious impact and negligible on this item.

(During operation)

Amount of emission of CO₂ gas based on the increase of vehicles are estimated as Table 5.25.

Table 5-23 Amount of CO₂ estimated from vehicles

Year		2013	2020
Vehicles Number		92,721	121,439
Average vehicle velocity km/h	With project		60km/40km
	Without project	20km	20km
CO ₂ emission Ton/year	With project		22,082
	Without project	26,665	34,392

Basically the amount of CO₂ emitted will increase proportionate to the increase of vehicle number moving along the project area. With the implementation of the project, vehicle numbers will increase, but the travelling speed of these vehicles will also be correspondingly increased. Hence the emissions of CO₂ will be reduced.

The volume of CO₂ emitted, is also proportional to the fuel consumption. Without the project, emissions of CO₂ gas have increased in proportion to the amount of vehicles, but with the project, the estimation results pointed out an amount which is lower than the existing amount. This indicates that the project will contribute to environmental improvement.

Thus, by the implementation of the project, the amount of CO₂ emission will be decreased aiding the prevention of the global warming issue.

5.8 Soil Contamination

(During construction)

Soil contamination could take place from oil and grease from vehicles, wastewater and solid waste and sewage in or outside the project area. Soil also could get contaminated from the substances used for road pavements, spill of paints and such chemicals.

5.9 Ground Subsidence

(During construction)

As there is no heavy earthwork involved, the impact of ground subsidence is not anticipated. River bank subsidence could take place while bridge abutment construction because of the use of heavy equipment.

There is a possibility of soil and water contamination if bentonite slurry is used for soil stabilization. However since the method of piling is encased bored piling there is a lean possibility of using bentonite.

5.10 Traffic congestion

(During construction)

At present the project area faces daily traffic congestions. As indicated the Average Daily Traffic (ADT) values along the existing road and bridge will be drastically increased once the Colombo – Katunayake Expressway is fully operational.

It is also observed that the current turning circles located especially at Orugodawatta and the port access road junctions slows down the traffic flow when turning of long vehicles and containers take place.

Detours have to be made for construction work closing the construction site to vehicular traffic. Frequent passage of construction vehicles are to be expected during the construction stage. Therefore, at the construction stage the project area and its vicinity will face more severe traffic congestions.

(During operation)

However the traffic congestion will be reduced once the new bridge and all access roads of the project are operational. This will also help the county's economy as the precious man hours spent on the road will be greatly reduced.

5.11 Impacts on aquatic/ terrestrial habitats

5.11.1 Effect on flora and fauna

(During construction)

A considerable amount of the project area is covered with man-made habitats. Since the project activities are restricted to the existing RoW and surrounding lands, the project would not lead to loss of habitats. It will not cause changes in the land use pattern and it would not affect the population of any identified floral and faunal species. Modification of existing habitats, impact to native species, causing threats to existing biodiversity or the introduction of invasive species will not be expected through the project activities. Two potential ecological impacts due to proposed construction of the bridge and flyovers include;

- (1) Destruction and disturbance of roosting and foraging habitats of several avifaunal and mammalian species which use different species of trees in the proposed construction area
- (2) Impact to the aquatic fauna of the Kelani River including fish due to construction activities.

5.11.2 Effect on Flora

(During construction)

About 260 trees have been identified for the removal during the proposed construction and associated work within the proposed site.

- Locations of trees identified for the proposed removal are located in existing road reservations, lands adjacent to the road reservations and bridge mouth. They are in private and government property. Felling of these trees will have an effect on the existing landscape of the project area.

- From the identified trees, 2 species are important as religious trees which belong to a single species Bo (*Ficus religiosa*). Of these, one tree is located within RDA premises at Orugodawatta junction, and the other one is located at Ingurukade Junction adjacent to the road.
- Majority of the trees located within road reservation are shading species such as *Polyalthialongifolia* (Weeping Willow), *Pettophorum pterocarpum* (Kahamara), *Spathodia campanulata*, *Albiziaodo ratissima* (Suriyamarra), *Albiziasaman* (Para mara) which belong to different species.
- Some trees located in the road reservations and adjacent lands in the proposed construction area are valuable fruit species such as Mango and Jack (*Mangifera indica* and *Artocarpus hetarophyllus*) trees. These are located along the roadside and adjacent lands as closely arranged rows or scattered trees.

The existing environmental friendly sources like trees, water bodies, parks /playgrounds, statues etc. were also considered. Changes in these places due to the project implementation will directly impact on the existing landscape of the area.

Table 5-24 Trees identified in the direct impact area of the project

D.S.Division	Grama Niladari Division	Tree Category			Total
		Large (>30 cm at DBH)	Medium (15 – 30 cm at DBH)	Small (<15 cm at DBH)	
Kolonnawa	Wadullawatta	30	57	110	197
	Sedawatta	6	29	10	45
	Orugodawatta	0	0	0	0
Colombo	Bloemendhal	0	1	3	4
	Nawagampura	0	0	0	0
	Grandpass	0	0	0	0
	Danister Silwa Rd.	6	2	0	8
Klaniya	Peliyagoda Gangabada	2	4	2	8
Total		44	93	125	262

Source: Socioeconomic field survey April/May 2012

5.11.3 Details of the affected trees

Based on the existing drawings, about 260 trees belong to 22 species should be removed from the proposed construction area, road reservation, river bank, and government and private properties. However any endemic, threatened or endangered species were not encountered.

5.12 Disturbance to Archeological Sites

(During construction)

According to historical information a ferry system had operated between the two banks of the Kelani River to move people and goods. However this location is near the present Victoria – Japan Friendship Bridge. Apart from this site the famous Kelani temple is located about 4.5 km from the project site.

Although no archeological impact is anticipated, the Project Proponent (RDA) has requested the Department of Archeology to carry out an archeological assessment in the project area. Department of Archeology has reported that there are no archeological sites in the project area.

5.13 Damage to existing bridge (New Kelani Bridge) across Kelani River

(During construction/During operation)

The new bridge will be located about 10 m upstream of the existing bridge. As there will be no piers on the riverbed (for the new bridge), it is anticipated that there will be no impact on the piers of the existing bridge.

6 PROPOSED MITIGATORY MEASURES

6.1 Mitigation Measures for Socioeconomic Impacts

6.1.1 Land acquisition and resettlement

Mitigation measures for a number of settlements and other institutions to be affected

The broad objective of this project is to provide an efficient and safe connectivity between CKE, Colombo port and Baseline road, thereby improving the traffic movement around existing New Kelani bridge area. However, as the project is located in a highly populated area, impact on settlements and other institutions were considered as significant. Number of affected structures were a key criterion used in evaluating the four route options. Number of affected structures in each route option could be summarized as follows;

Table 6-1 Number of affected structures in each route option

Route option	Number of affected structures	Remarks
Route A	355 structures including 12 large scale structures	Number estimated from Google maps
Route B (preferred option)	456 structures including Atomic Energy Authority (2 buildings), Automobile Engineering Training Institute (Main workshop)-1building and Amman Hindu Kovil i.e. 1 building-4 large scale buildings altogether.	Number estimated from field surveys. Number estimated from Google maps was only 325
Route option C	404 structures including 9 large scale structures	Number estimated from Google maps
Route option D	394 structures including 3 large scale structures	Number estimated from Google maps

The concept of “Mitigation by design” was utilized to further reduce the impacts on settlements and other institutions. Following are a list of such measures taken;

- Changing the location of entry and exit ramps of Port access road to avoid damage to the housing scheme which is under construction by UDA.
- Reducing the area of the service corridor near the Hindu Kovil on New Kelani bridge road to avoid demolition of nearly 90% of the Kovil. The design change helped to retain the main statue of the Kovil, and only 40% of the floor area is now affected
- Impact on Edirisinghe building was reduced by shifting the center line of Port access road.
- Reducing the service corridor area near Sena oil mills to avoid damage to the fuel tanks and cooling tower which were located within the temporary affected area (service corridor).

It is observed that, majority of dwellings affected by the project, are located within the GN divisions of Sedawatta and Wadullawatta. At this stage of the project, RDA considers to join with UDA to build a suitable housing scheme (apartment) to settle these families. The nearby land belonging to the State Timber Corporation which was transferred to UDA recently will be utilized for such a housing project.

The parapet wall of Kelanithissa Power Station could be rebuilt after setting back beyond the acquisition boundary of the project.

Shifting of Automobile Engineering Training Institute should commence as early as possible if the project is intended to commence in the year 2017. This is because such a shifting will not affect its daily academic activities, student and staff requirements. After the discussions with Automobile Engineering Training Institute (AETI) and UDA it was agreed to relocate it the Vocational Training Institute premises nearby.

Jayalath building and associated institutes requested from authorities to construct dedicated parking lots for the clients. Such measures will offset the impact of acquiring strip of land from the parking lots of the above institutes located along New Kelani bridge road.

Although the Atomic Energy Authority (AEA) is willing to be relocated, it is important that such a move is effected according to the international regulations of handling radioactive matter. This is because the authority houses radioactive waste material and the new facility built should have the same facilities. It is suggested that a phased off transfer for the Atomic Energy Authority to a more open area without many settlements is suitable. A land at Mahenawatte Pitipana Homagama area belonging to UDA has been considered for the relocation of Atomic Energy Authority. Accepted international practices should be followed during such shifting. This will be a beneficial fact for the authority as it is now located in a populated and a congested area. Shift may need a separate environmental assessment to identify possible impacts and mitigation measures. Further information refer to the Resettlement Action Plan (RAP) of this project.

Mitigation measures for impacts of relocation

(Before construction)

Out of the 395 total families affected by the project 333 families live within Sedawatta and Wadullawatta GN Divisions. Even though most of these affected families live as encroachers on government land (unprotected area of Kelani River) they would be adequately compensated for the development done on the land.

Payment of compensation would be in line with the (Land Acquisition Act) LAA and Regulations 2008 of LAA. Under Regulations 2008 payment of compensation would be done under the concept of “value to owner”. A Resettlement Plan (RAP) has been prepared for the project with a project specific “Entitlement Matrix” which specifies the entitlements of all affected parties (Please refer Annex 6.1). According to the RAP a budget of approximately Rs. 6 billion will need to be allocated for the payment of compensation .It is the estimated value at the present time. It may change after a detailed study which will be done in future.

It is also required to have a budgetary provision under construction cost or as insurance, to compensate for any other unforeseen/ accidental damage to structures outside the ROW.

An Income Restoration Plan (IRP) and assisting APs on micro credit facilities could also be considered as a means of offsetting any adverse impact of land acquisition and resettlement of the project.

Special attention will also be paid to 96 families in the project affected area with vulnerable persons. A special vulnerable allowance would be paid to these families according to the guidelines of the project approved entitlement matrix.

The new resettlement sites which are to be developed, may be located close to the original living areas of the people. But it is still under consideration by the relevant authorities. Such measure will greatly reduce the impact on livelihood activities of the people as most of them are working as laborers in Colombo Port and Pettah areas. Stakeholder access to existing educational, health and administrative facilities in the project area or its outskirts will not be thus hampered.

Summary Details of Resettlement including locations given in Resettlement Action Plan

In order to discuss the relocation scheme for the AHs, a meeting was held at Sethsiripaya on 27th June 2013 chaired by the Secretary of Ministry of Defense and Urban Development.

There is the Project called “*Urban Regeneration Project*” which is being implemented by UDA to eliminate shanties, slums and other dilapidated housing from the city of Colombo by resettlement of the families presently living under unhygienic and poor environmental conditions. By providing new housing schemes of internationally recognized standards, the Sri Lanka Government intends to make the City of Colombo the most attractive city in South Asia

The Secretary of Ministry of Defense and Urban Development requested the Chairman of the Urban Development Authority to extend their support to provide houses for the Project since this is a national requirement at this time.

As the conclusion, the allocation of 395 housing units which are necessary for resettlement of the AHs of the Project into the “*Urban Regeneration Project*” was proposed and basically agreed between the RDA and Urban Development Authority (UDA), under Ministry of Defense and Urban Development. (The final estimated requirement is only 365 housing units after excluding title holders who will receive compensation for land as well as buildings for self-relocation.

UDA’s officers conducted field visits based on the directive above to examine the feasibility of constructing housing schemes. The Secretary of Defense issued the approving letter for allocation of the housing units.

The “Urban Regeneration Project” will allocate the required housing units for the Project with following three sub-projects.

(1) Timber Corporation Land, Orugodawatta – 1500 housing Units



Figure 6-1 Location of Timber Corporation Land

Source: UDA, *Urban Regeneration Project Website*

(2) Government Factory Quarters Land, Kollonnawa – 696 housing Units



Figure 6-2 Location of Government Factory Quarters Land

Source: UDA, Urban Regeneration Project Website

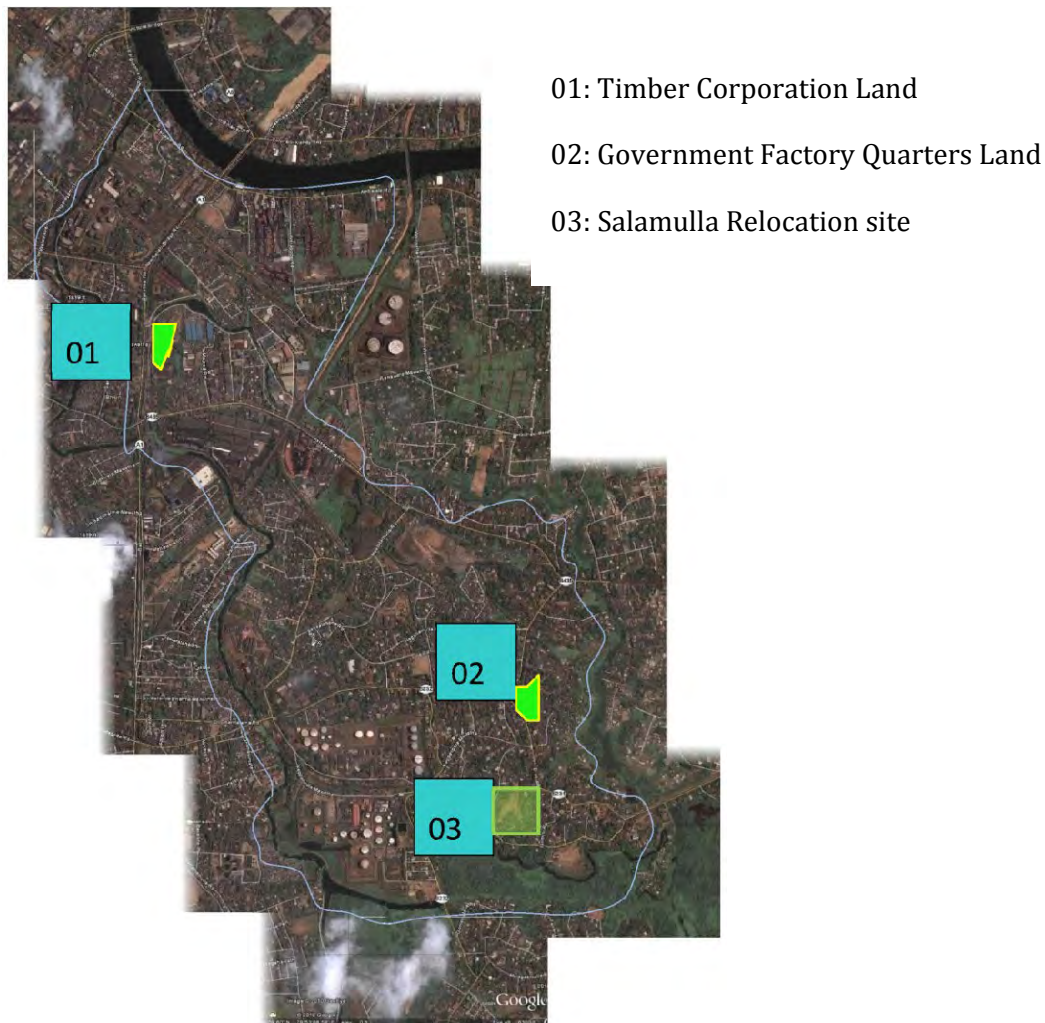
(3) Salamulla Relocation site – 1,008 housing Units



Figure 6-3 Location of Salamulla Relocation site

Source: UDA, Urban Regeneration Project Website

UDA will decide the Project which will allocate the necessary housing units through close consultation with the affected householders.



Source: UDA, Urban Regeneration Project Website

Figure 6-4 Locations of the resettlement sites

Buildings belonging to Government Agencies

National Apprenticeship Industrial Training Authority (NAITA)

The part of the workshop of NAITA will be affected by the Project. It was decided to relocate them to the part of the land of “Vocational Training Center” at Orrogodawatte. The area of Vocational Training Center consists of training facilities, accommodation for students, canteen etc. and the extent is approximately 6 acres.

The location of the relocation site is shown in the figure below. The cost of reconstruction and relocation of NAITA is LKR 850 million.



Figure 6-5 Location of the Relocation Site for NAITA

Source: RDA



Figure 6-6 Location of the Relocation Site for NAITA

Source: RDA

Atomic Energy Authority

Atomic Energy Authority (AEA) will be affected completely by the Project. The UDA has already agreed to provide the land in Mahahenawatte Pitipana Homagama. The location of the relocation site is shown in the figures below.

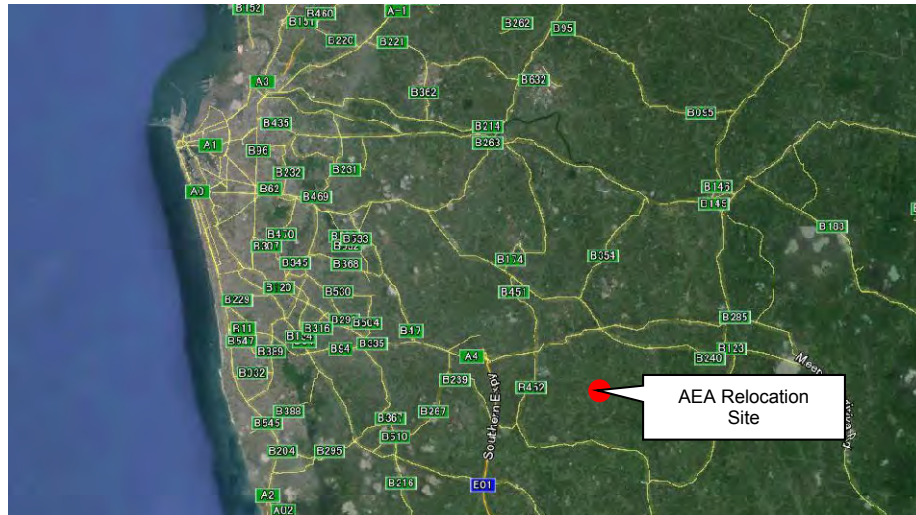


Figure 6-7 Relocation Site for AEA

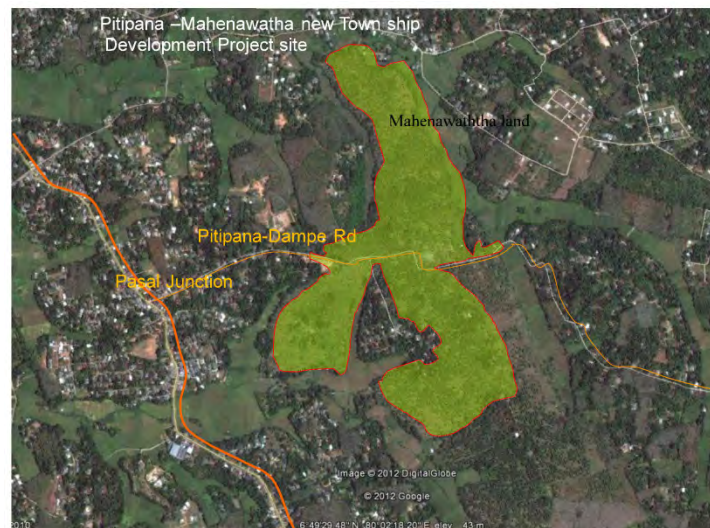


Figure 6-8 Relocation Site for AEA

Further details are provided in the Resettlement Action Plan- [Reference 3]

6.2 Mitigation measures for impacts on livelihood and economic activities

Any resettlement scheme (apartments) developed, should be at a place where the Affected Persons could continue their livelihood activities. RDA will continue to have discussions with Ministry of Defense and Urban Development and UDA to secure such sites. However, the GOSL will not deprive the existing livelihood and economic activities of the people in the project area, instead the government will assist the public to improve their present status of living conditions.

The project specific entitlement matrix has clearly listed the entitlements that would be applicable for Affected Persons whose livelihood and economic activities are affected (either temporarily or permanently).

A payment based on the salary and allowances would be paid to employees in institutions which need to be closed during the construction period. In case employment is permanently affected, a payment equivalent to 6 months' salary/ wages would be paid and RDA will encourage the employers to provide severance pay for such employees. Where possible such employees would have preferential access to

project construction employment (please refer item “Loss of income of employees or hired laborers” of entitlement matrix).

Alternate parking areas will be provided for institutes which lose land from their parking lots. Land area under the pier/ viaduct section could be utilized as effective parking lots especially along New Kelani bridge road where most of these private institutions are located.

6.3 Mitigation measures for impact due to disruption of existing infrastructure facilities (Utilities)

(Before construction)

RDA has already opened a dialog with CEB to shift the 132 KV high tension power line and pylons. At this stage of study it has been proposed to take these high tension power lines underground. Detailed studies need to be carried out jointly with CEB to ensure the viability of such measures.

Ensuring the safety of public, in dealing with other utilities such as oil transmission lines, water supply lines and the power transmission lines etc. is essential. Therefore it is needed that the detailed design team for the project, to work in close coordination with line agency officials on this matter.

Shifting of Automobile Engineering Training Institute should commence as early as possible to avoid any disruption to ongoing training activities. It should also not affect the academic programs of about 1200 students who undergo training in a given year.

RDA with the advice of MOPH will hold discussions with Atomic Energy Authority and Automobile Engineering Training Institute to ensure that these facilities are shifted with no impact to their functionalities.

CMC has pointed out that the condition of the Stace Road Bridge and the present width of Aluth Mawatha will be critical to the project, as during construction diverted traffic in these places will be increased. As mitigation measures the Stace Road Bridge should be replaced with a new one and the narrow section of Aluth Mawatha should be widened before starting the project.

(During construction)

Impacts of shifting electricity lines, water supply lines, telecommunication lines and other resources could be mitigated by proper co-ordination with the concerned authorities, such as the Ceylon Electricity Board, National Water Supply and Drainage Board, Ceylon Petroleum Corporation and Sri Lanka Telecom when shifting the relevant utilities if and when necessary.

Risks of accidental disruption can be reduced by ensuring that machinery such as excavators, cranes are operated by trained personnel and that operations are adequately supervised. A layout plan with location details of all utility lines should be given to the work supervisor. This will allow the supervisor to warn the machine operator about utility lines within the work area.

Advance notice to the public about the times that the utility supplies will be disrupted will help public to adjust to the situation beforehand and thereby minimize the difficulties that they will face in the case of sudden disruption of these services. Temporary water supply, electricity for them may have to be provided.

6.4 Measures to reduce possible nuisance to neighborhood

(During construction)

All possibilities will be considered to secure labor from areas close to construction sites. By such measures the necessity of setting up labor camps could be avoided. When labor is to be brought from outside locations, strict labor supervision is required to avoid any conflicts arising due to migrant labor. Awareness programs will be conducted at worker camps on sanitation, diseases etc. It is necessary to avoid any worker camp waste being disposed near settlement areas to avoid any disease spread.

Providing temporary bypasses during construction, advance notice to the public will reduce the inconvenience caused to the public during the construction stage. Use of flagmen and/or temporary traffic lights to control traffic flows at constricted sites, including safe crossing for pedestrians will also be considered as mitigation measures for the inconvenience to the public.

6.5 Mitigation measures for violation of Children's Rights

As child labour is protect by law there is no significant impacts. Hence no mitigation measures are necessary.

6.6 Mitigation Measures for construction waste and other waste disposal

(During construction)

A large quantity of peat or muck is not expected during drilling activities. Disposal sites to dispose peat/muck etc. from construction activities such as excavations, boring for piles have to be identified before construction, through technical investigations and approvals for such disposal sites will be obtained from the local authority and SLLRDC (if it is in a low lying area) . Drainage management plans will be prepared for such sites.

No waste should be disposed to any marsh without such approvals.

6.7 Mitigation measures for impacts of material transportation

(During construction)

Impacts due to transportation of material could be minimized through adopting the following measures;

Use of covers over for transported materials to guard against dust blow and water spraying to dampen any dusty surface will mitigate the impacts due to transportation of construction material.

6.8 Mitigation measures to minimize health and safety impairment

(During construction)

Ensuring the health and safety of worker groups and the public around the project area could be considered as an important aspect during the construction stage of the project. Following measures will be adopted to ensure health and safety during construction period;

- Awareness programs for all worker groups on sanitation and diseases,
- Regular inspections to worker camps to inspect the level of sanitation maintained at camp sites and waste management,

- Avoid worker camp waste being disposed near settlement areas and to avoid any disease spread,
- Proper briefing and training of workers on safety precautions, and their responsibilities about the safety of themselves and others,
- Providing all workers with protective clothing including hard hats, protective footwear, and high visibility jackets for use when construction activities take place at night,
- Ensuring that plant and vehicle operators are properly licensed, experienced and trained,
- Arranging provision of first aid facilities, readily available trained paramedical personnel, and emergency transport to the nearest hospitals.
- Arranging regular safety checks of vehicles and material, and allocation of responsibility to supervisors on storing material and maintaining vehicles.
- Provision of hazard warning signs around construction sites, and directing vehicle and pedestrian traffic away from work sites.
- Provision of traffic management plans during construction including barricading of openings and lighting at night.
- Placing suitable firefighting material such as sand, different types of fire extinguishers in places where fuel and other flammable chemicals are stored,
- In case of temporary electricity power lines are required within construction area, it is considered that such power lines to be taken below ground level with adequate warning signs to workers and machine operators.
- Special consideration will be given to avoid water stagnation at the work site and labor camps which lead to the breeding of mosquitoes. All such potholes depressions will be filled and leveled so that no water will remain on the surface.
- All food waste material, tin cans and barrels will be placed inside proper garbage collectors with the provisions of roofing to avoid accumulation of rainwater.
- There are special concerns regarding the pipelines of Ceylon Petroleum Corporation which carries oil from Colombo Port to the oil farm. Work near these pipelines should be undertaken with strict supervision of Ceylon Petroleum Corporation.

6.9 Existing landscape

(Before or During Construction)

The project will have a beneficial impact on the existing landscape. This is because the present landscape with many unplanned development (especially within Sedawatta and Wathullawatta GN divisions) will be removed and provided with more systematic settlement schemes.

New tree species will be introduced which will suit the environmental condition in the project area and vegetation will be grown in interchange areas.

6.10 Mitigation Measures for Hydrological Impacts

6.10.1 Mitigation measures for river flow and canal flow obstruction

Provision of elevated sections over canals and river is a mitigation measure. Maximum flood levels of Kelani River and canals have to be obtained from Irrigation Department and SLLRDC. There could be diversions to the existing canals by SLLRDC under Colombo Metro Area Environmental Improvement Project. However at the time of writing of this report no such diversions have been planned. When the detailed designs are carried out these organizations should be consulted to finalise the opening size.

6.10.2 Mitigation measures for alteration of drainage pattern of the area

(During Detailed Designs)

Drainage facilities shall be provided in the following manner.

- Size of facilities will be determined based on water inflow and water levels.
- Drainage crossings for river and canals will be determined based on the agreement by related agencies in Sri Lanka such as SLLRDC and CMC.

No waste should be disposed in the marshy areas or any other place without securing approvals from relevant organisations. For selected waste disposal sites necessary drainage management plans should be formulated. Natural drainage paths should not be disturbed by construction material stockpiles, construction waste disposal etc. If such disturbance takes place temporary diversions should be provided to detour the concerned drainage paths. A drainage management plan should be prepared for the entire worksite area identifying most suitable areas for material stockpiling etc.

6.10.3 Mitigation measures for Impacts on flood protection schemes

(During Construction)

Caution will be exercised when doing construction work near flood bund and construction should be carried out without disturbing the flood bunds as far as possible. The contractor will be instructed to liaise with the Irrigation Department and obtain their instructions.

(During Operation)

As there will be no significant impact no mitigation measures are necessary.

6.10.4 Mitigation measures for Impacts of flood propagation

(due to loss of retention/ detention area and blockage of drainage pathways)

(During construction)

There will not be a significant loss of retention as the structures are elevated and floods could pass under the piers.

Tentative drainage management plan is given in the figure below.

Figure 6-9 Drainage Management Plan



6.11 Mitigation measures for water quality (contamination)

(to Mitigate Surface and Groundwater Pollution)

(During construction)

According to the designs for the main bridge across the Kelani River there will be no piers on the river bed. Therefore, during the dredging operations on river bed , increase of the turbidity and suspended solids of river water will not rise. As construction of some end piers will cause disturbance to the river sediments, this activity should be monitored.

Oil and grease traps will be installed at yard and workshop area to filter the waste oil, other petroleum products and wastewater before discharging outside the yard or workshop area. Measures such as a settling tank, will be taken to avoid any direct discharge of waste water on to the soil or nearby surface water bodies to avoid any contamination of surface and groundwater in the project area.

All cement, bitumen (barrels), oil and other chemicals will be stored and handled on an impervious surface (concrete slab) above ground level. The storage facility for cement, bitumen (barrels), oil and other chemicals will be an enclosed structure to ensure that no storm water flows into the structure. A ridge will also be placed around the storage facility to avoid runoff getting into the structure. Such measures will avoid any storm water being contaminated with above materials and subsequently polluting surface and ground water within the project area.

(During operation)

Only road surface drainage of the bridge and ramps will exist, but it does not have a significant impact

6.12 Mitigation Measures for Air Quality, Noise and Vibration Impacts during Construction and Operation

6.12.1 Mitigation measures for impacts on air quality

(During construction)

The impacts of construction emissions near settlement areas can be mitigated by;

- Ensuring that construction vehicles and equipment is maintained to a high operable standard,
- Regular sprinkling of water to dampen the construction surface to reduce emission of dust,
- Covering the construction site especially close to sensitive locations such as near Sanchi temple, Hindu Kovil, settlement area will also reduce the blowing of dust.
- Storage of material such as cement and other flammable chemicals in enclosed structures but with adequate ventilation
- Material such as soil, asphalt should be transported only with proper cover.

In case of Asphalt plants, Concrete batch mixing plants are to be operated they should obtain Environmental Protection Licenses from CEA and operate according to the conditions given in the approval. If such plants, borrow pits are located offsite separate studies will have to be carried out and approvals should be obtained.

Workers should be advised to collect all waste material to a central location and dispose only at approved locations of the Colombo Municipal Council. It is advised to collect and return used cement bags to the cement manufacturer without burning them at site.

(During operation)

A reduction of vehicle emissions could be anticipated once the project comes to operation. This is due to the fact that traffic flow will be eased with less congestion. Thorough traffic rules, such as idling stop is required at the same time.

6.12.2 Mitigation measures for noise and vibration impacts

(During construction)

Noise and vibration nuisance would be significant only during the construction stage where a piling operations and earth compaction works would commence. The impact of noise and vibration nuisance could be minimized through the following measures;

- Fitting of exhaust baffles and maintaining construction vehicle and machinery in a high operable condition,
- Use the low noise, low-vibration type machine and/or vehicles,
- The construction site is separated with corrugated sheets or other suitable material especially at locations near Sanchi temple and Hindu Kovil and residential areas.
- Scheduling of construction work that cause high noise and vibration must be within authorized construction embodiment times with the least inconvenience to the public,
- Avoid construction work on Poya days and days of other religious importance,
- Carry out a property condition survey of nearby structures and record the present condition of the structure,

(During operation)

However, it is anticipated that the noise levels may reduce during the operational stage of the project as the movement of vehicles will be improved.

6.13 Mitigation measures for global warming

As there is no significant impact no mitigation measures are necessary

6.14 Mitigation measures for soil contamination

(During construction)

Most of the mitigation measures give under Section 6.9 applies. Bentonite slurry will not be used in the cast-in-place pile method which uses an enclosed casing. However, using a settling tank for drain the sediments from excavated soil, muddy water etc. will be required to avoid soil contamination.

6.15 Mitigation measures for ground Subsidence

(During construction)

A precondition survey of the properties within 25m corridor on either side to the proposed ROW will be carried out before the construction works. These records will be useful in determining any damages caused to buildings in case of ground subsidence occur. However, the contractor will also maintain records of any settlement of soil fills and foundations.

Kelani River banks should be stabilized with sheet piles etc. if there is a risk of ground subsidence during bridge pier construction.

6.15.1 Mitigation measures for impact on bottom sediments

As the impact on bottom sediment will be temporary no mitigation measures are necessary.

6.16 Mitigation Measures to Avoid Traffic Congestion

(During construction/During operation)

The main objective of the project is to reduce the present traffic congestion around the New Kelani bridge area. This objective will be fulfilled once the project is operational. However, as stated in Chapter 5, it is anticipated that severe traffic congestions would arise during construction.

If traffic will be diverted along sub/minor roads the capacity of those should be confirmed and they should be in motorable conditions. This aspect should be considered in the traffic management plan which should be formulated before construction.

A dedicated service corridor about 10 m width will be partly placed outside the ROW for movement of construction vehicles. However, traffic diversion plans at the New Kelani bridge interchange, Kelanithissa intersection and Orugodawatte interchange are suggested to manage the traffic congestion during the construction period. A detailed account of these traffic diversion plans are given in Annex 6.2.

6.17 Mitigation Measures for Impacts on Flora and Fauna Including Aquatic Flora and Fauna

Terrestrial and aquatic habitat destruction

(During construction)

Attention should be made especially during the construction phase to avoid or minimize clearing of natural habitats, replacement of natural vegetation and activities which can cause the introduction of invasive species.

The contractor should especially be made aware not to introduce invasive species during construction related activities such as transportation of construction materials, machinery, vehicles or equipment from the outside areas, sometimes from other countries.

Proposed mitigation actions for Impact to the flora (trees)

- Landscaping should be done to minimize the impact caused by clearing of natural vegetation. Removed essential trees will be replanted considering the possibility of practical survival under future conditions.
- Minimize impact to the night roost of avifaunal species which will occur if trees are felled during the dry season. Because, during the rainy season it is not difficult for avifauna to find a new roosting place.
- Reduce impact to the foraging behavior of birds and mammals (squirrels and bats), by conducting felling of fruit trees etc. during the no-fruit season.
- When conducting tree felling it is important to confirm that no eggs and nestlings or roosting are there. Also it is important to remove trees during the non-breeding season.
- Avoid removal of trees from temporarily used lands for the project activities such as material storage yards, labor camps etc. unless it is very essential.
- Any guidelines and recommendations made by the CEA or other line agency with regard to felling of trees should be strictly followed

6.18 Mitigation Measures for disturbance on Archeological sites or artifacts

(During construction)

The following mitigation measures should be included in the contract documents to safeguard any artifact which may get exposed during the construction period even if there are no archeological sites in the project area.

- All fossils, coins, articles of value of antiquity and structures and other remains or things of geological or archaeological interest etc. discovered on the site during construction work shall be the property of the Government of Sri Lanka, and shall be dealt with according to provisions of the Antiquities Ordinance of 1940 (Revised in 1956 and 1998).
- Instructing the contractor to take reasonable precaution to prevent his workmen or any other persons from removing and damaging any such article or thing.
- All construction activities within 100m in all directions from the point of interest should be stopped until further instructions from Supervision Consultant/ Engineer and RDA.
- The RDA should without any delay inform the Department of Archeology about the incident and obtain their expertise to relocate the artifact from the site.
- Sub Clause 4.24 Fossils, of the FIDIC Conditions of Contract covers the actions to be taken by the Contractor if any archeological artefacts are found during construction

6.19 Mitigation Measures for any Damages on Existing Bridge

(During construction)

The construction site of the main bridge to be covered and separated from existing bridge.

Under FIDIC Conditions of Contract Sub Clause 4.15 Access Routes, the Contractor is responsible to maintain the access routes including the existing bridge if he uses it. Any damage due to contractor's activities will be rectified by him.

A precondition survey will be carried out on the existing bridge and its support structures. Such measures will enable the contractor and RDA to have an idea on the condition of existing bridge and to rectify any serious defects before any further damages are caused to the bridge. Separate technical study is needed in this regard.

Table 6-2 Summarized Significant Potential Negative Impact and Mitigation measures including Brief Monitoring Aspects

Item	Proposed Mitigation Measures			Monitoring Plan
	Before construction	During construction	During operation	
Involuntary Resettlement (impacts of relocation)	Minimizing the affected area in a design. Developing awareness among the public about the project. Carry out a census survey of all affected persons and developing a Resettlement Plan with a project specific “Entitlement Matrix” in RAP. Acquiring land and paying compensation according to Land Acquisition act, Regulations 2008 and entitlement matrix of the proposed project.	Further assistance to affected persons according to guidelines of “entitlement matrix” (if required).	Not required.	<i>Before construction</i> Monitoring and evaluation of the implementation of resettlement plan Implementation Organization: RDA Supervising Organisation: ESD RDA, UDA Estimated Cost: Included in the RAP
Economic factors such as employment and livelihood etc.	Payment of compensation according to the entitlement matrix. Assisting affected persons to restore the livelihood activities through Income Restoration Programs.	Providing adequate parking areas for private institutions which lose land from their parking lots.	Not required.	<i>Before and during construction</i> Monitoring and evaluation of resettlement plan Implementation Organization: RDA Supervising Organisation: ESD RDA , Engineering hierarchy RDA Estimated Cost: Included in the RAP
Disruption of existing infrastructure facilities	Relocation of Workshop of Automobile Training Institute, Atomic Energy Authority Building, 132 KV power lines in consultation and satisfaction of relevant line agencies. Design of bridge piers will be avoided near oil transmission lines	Risks of accidental disruption can be reduced by ensuring that trained personnel operate heavy machinery and that operations are adequately supervised. A layout plan having location details of all utility lines should be given to the work supervisor/s.	Not required.	<i>During construction</i> Monitor the shifting of the facilities and other utility supply lines Implementation Organization: RDA Supervising Organisation: ESD RDA, PIU ,UDA, Local Authorities Estimated Cost: Included in the contract for civil works
Possible nuisance to neighborhood	Not required	Thorough briefing to workers about site management Providing temporary bypass during construction	Not required	<i>During construction</i> Monitoring of labor camp facilities at least once a month Implementation Organization: RDA Supervising Organisation: PIU , Local Authorities Estimated Cost: Included in the contract for civil works
Accidents, worker health and safety	Informing the public about the project.	Awareness programs for all worker groups on sanitation and diseases. At every workplace, first aid kit shall be provided. Contractor shall comply with the provisions under the Factory Ordinance about health and safety measures at work place. All workers employed in hazardous activities shall be provided with the necessary protective gear. Precautions will be taken for electrocution prevention. Danger signboards, red lights, fencing will be provided to protect the public and workers. Enforcement of traffic control plan. Contractor will be required to adhere to Clause 6.7 Health and Safety, of the Contract Conditions (JICA Standard Contract Documents, FIDIC MDB Harmonized Version)	Not required	<i>During construction stage</i> Monitor and record the frequency of accidents of workers and traffic accidents Monitor complaints related to the environment Implementation Organization: RDA Supervising Organisation: ESD RDA, PIU , District Factory Inspection Engineer Labour Department Estimated Cost: Included in the contract for civil works
Transportation of construction materials	Not required.	Use of covers over transported materials to guard against dust blow.	Not required.	<i>During construction</i> Monitor the compliance of contractor Implementation Organization: RDA

Item	Proposed Mitigation Measures			Monitoring Plan
	Before construction	During construction	During operation	
				Supervising Organisation: ESD RDA, PIU, Local Authorities Estimated Cost: Included in the contract for civil works
Existing landscape	Not required	Adoption of a design that enhances the existing landscape	Not required	During Operation Monitor and maintain landscape Monitor the compliance of contractor Implementation Organization: RDA Supervising Organisation: ESD RDA, PIU, Local Authorities ,UDA Estimated Cost: Included in the contract for civil works
Hydrological condition	Planning of construction schedule to coincide with the dry flow period of Kelani River.	Carry out construction work during dry flow period of Kelani River. Contractor to continually liaise with Irrigation Department and obtain their flood warnings for the use of evacuation and withdrawal from the site.	Not required	During construction and operation Monitoring of the maintenance of drainage structures Implementation Organization: RDA Supervising Organisation: ESD RDA, PIU, SLLRDC, Irrigation Departments, Local Authorities Estimated Cost: Included in the contract for civil works
Water quality (Surface and Groundwater)	Not required.	Oil and grease traps should be installed at yard and workshop area to filter the waste oil, other petroleum products and wastewater before discharging outside the yard or workshop area. Avoid any direct discharge of waste water on to soil or nearby surface water bodies. All cement, bitumen (barrels), oil and other chemicals should be stored and handled on an impervious surface (concrete slab) above ground level. All bentonite clay and other materials will be recovered and any waste will be disposed off site in approved locations. Provisions are given in FIDIC sub Clause 4.18, Contractor will follow the Environmental Management Plan approved by the Employer	Not required.	During Construction Measuring selected water quality parameters according to the EMoP Implementation Organization: RDA Supervising Organisation: ESD RDA, PIU Estimated Cost: Included in the contract for civil works
Air quality	Not required.	Construction vehicles to be serviced and maintained on a regular basis. Regular sprinkling of water over construction surface. Transporting aggregate, other construction material with proper cover. Storage of cement and other chemicals in an enclosed environment with adequate ventilation Use of shielding to separate construction area from residential areas and other sensitive areas such as temple, Hindu Kovil. All plants to be operated according to the stipulated guidelines in EPL.	Regular cleaning of road surface to remove dust.	During Construction Measure dust level at locations where air quality was measured during the baseline survey. Once a month. During Operation Measuring air quality at same locations for confirmation of effects. Implementation Organization: RDA Supervising Organisation: ESD RDA, PIU Estimated Cost: Included in the contract for civil works
Noise and Vibration	Not required	Fixing construction work hours Consideration for religious activity times. Set up sound barriers on the construction boundary as required Consider using of low vibration type construction machine	Not required	During Construction Measure noise and vibration level at baseline, once a month. During operation Measure noise level at same locations for confirmation of effects. Implementation Organization: RDA

Item	Proposed Mitigation Measures			Monitoring Plan
	Before construction	During construction	During operation	
				Supervising Organisation: ESD RDA, PIU Estimated Cost: Included in the contract for civil works
Flora, Fauna and Biodiversity	Not required	Replant street trees at the roadside to enhance landscape. Trees should not be felled during roosting or fruit bearing times.	Study of recovery degree of the Natural environment	During Construction Site verification of tree survey Implementation Organization: RDA Supervising Organisation: ESD RDA, PIU Estimated Cost: Included in the contract for civil works
Soil and ground subsidence	A precondition survey of the properties within a 25 m corridor on either side to the proposed ROW to be carried out before the construction works.	Vehicles/ machinery and equipment servicing and maintenance work shall be carried out only in designated locations/ service stations approved by the engineer. Waste oil, other petroleum products (e.g. in storage tanks and containers) and untreated wastewater shall not be discharged to the ground to avoid soil pollution.	Not required.	During Construction Monitoring waste quantity and quality, such as excavated soil, waste soil and so on. Implementation Organization: RDA Supervising Organisation: ESD RDA, PIU ,Local Authorities, Irrigation Department Estimated Cost: Included in the contract for civil works
Traffic congestion	Not required	Set up diversion for minimization of construction traffic congestion, employ flagmen, provide temporary traffic lights etc. Setup of pedestrian sidewalk along the construction area	Not required	During construction stage Monitoring of traffic congestion Implementation Organization: RDA Supervising Organisation: ESD RDA, PIU ,Local Police, Local Authorities Estimated Cost: Included in the contract for civil works
Waste	Not required	<ul style="list-style-type: none"> Contractor before commencement of work shall provide a lists of hazardous chemicals or materials that will be used in the project. Labor camps shall be provided with facilities for disposal of sewage and solid waste. The sewage systems shall be properly designed, built and operated so that no pollution of ground or adjacent water bodies or watercourses takes place. Waste, oil and grease from service yards and workshop areas should only be disposed at approved locations after collection. Used cement bags should not be burned, they should be sent for recycling. Approval should be obtained for waste dumping sites. Waste should not be disposed to the low lying area close to the site. The contractor shall clean up any area including water-bodies affected or contaminated. Contractor is required to clear site as per Sub Clause 11.11 of the FIDIC Conditions of Contract 	Not required	During Construction Periodical monitoring of waste dumping sites Implementation Organization: RDA Supervising Organisation: ESD RDA, PIU , Local Authorities, SLLRDC Estimated Cost: Included in the contract for civil works

Note: CEA will only conduct periodic monitoring or it will conduct ad hoc site inspections, sometimes based on public complaints

7 Public Participation and Information Disclosure

7.1 Introduction and Background

Public participation is a must for proposed development projects at the initial steps of the project in JICA funded projects. This process aims at getting the views and experience of the stakeholders to amend development plans if necessary. In this project Public Participation was done in different ways to disclose the project information as well as to obtain ideas, views and experience of stakeholders for the project development.

7.2 Overview of Public Consultation and Information Disclosure Process

Public consultation and information disclosure process is a two way process of exchanging information regarding the project. There are three main processes and they are;

- (1) Inform all stakeholders about the key features of the project through newspaper advertisements, leaflets, stakeholder meetings, presentations, oral explanations, project layout drawings, maps etc. and provide a good idea of the project features to the likely affected stakeholders so that they could express their views regarding the likely adverse impacts.
- (2) Obtaining detailed information about the stakeholders such as their economic background, property rights and ownership, employment etc. so that a compensation method for the affected parties could be determined. During this information elicitation process information regarding, likely impacts from the project, will also be assessed. The intentions of the stakeholders regarding compensation type (i.e. alternative houses, land for resettlement or a compensation payment in lieu of the impacts) will be identified.
- (3) Making efforts to muster the opinions of ethnic minority, women, and vulnerable persons.

This three way process was designed to muster a broader and a comprehensive view regarding the project induced impacts, to disclose the proposed mitigation action by the project team, to assess the mitigation measures expected by the stakeholders, and to identify other facilities requested by the stakeholders etc.

7.3 Information Disclosure

Information disclosure to all relevant stakeholders is very essential for the successful implementation of the project. During the meeting details of the project was fully disclosed to public through presentations, explanations, maps, figures, explanations etc. Some explanations were given at the project site itself. All public questions were answered as far as possible according the information available.

For the local level awareness, leaflets printed in local languages were used and distributed among households during the household survey (please refer Annex 7.1).

7.4 Overview of Stakeholder Meetings (SHM)

7.4.1 Meeting Types

Stakeholder meetings in various forms cited above, were held to elicit the views of stakeholder and line agency views regarding the project induced impacts. A brief description of each meeting type is given below.

- (1) Formal Stakeholder meetings (awareness meetings) at different levels i.e. Divisional Secretary Level , Project Level (i.e. organized by RDA)
- (2) Formal household surveys – carried through a pre designed questionnaire
- (3) Informal social participatory rapid surveys
- (4) Informal pocket group meetings/Individual discussions
- (5) Informal homogeneous groups meetings
- (6) Formal meetings with public parties and religious sector organizations etc.

TYPE (1) Formal Stakeholder Meetings

Stakeholder meetings were held at the project level and as well as at DS level and the details of these meetings are given under “Overview of Stakeholder Meeting”. The main participant group in these meetings were the line agency officials.



TYPE (2) Formal Household Surveys

All the likely impacted households were surveyed using a pre designed questionnaire. This questionnaire was comprehensively prepared as detailed information of the stakeholders were a requirement of the resettlement survey concurrently carried with the EIA study.

TYPE (3) Informal Social Participatory Rapid Survey (SPRS)

This survey was conducted using random samples of stakeholders without any pre-determined pattern. However in general the project area was covered during this survey. Stakeholders in various business premises, people who were even idling at roadside were interviewed. Ideas of small groups were mustered and recorded.

TYPE (4) Informal Pocket Group Meetings/Individual discussions

While the household survey was in progress as a main activity individual group discussions were also held simultaneously. During these discussions with small groups or individuals people were interviewed at random and their views were recorded.

TYPE (5) Informal Homogeneous Group Meetings

During these discussions various homogeneous groups were separately interviewed. Some of the groups are (1) persons who produce incense sticks as self-employment (2) Stakeholders who use Kelani River for bathing (3) Three wheeler drivers (4) School children etc. Their views were recorded regarding probable project impacts.



TYPE (6) Formal Meeting with Public Parties and religious sector organizations etc.

This was a special meeting with the officials of the affected government institutions and clergy of the affected temples, *kovils* etc. as they were not normally interviewed during the household surveys or during the other category of meetings.



Table 7-1 Details of Stakeholder Meetings

Meeting Type	Venue	Date Held	Key Participants	Remarks
1 st Stakeholder meeting (Project Level) TYPE (1) Annex 7.1 Paper advertisement	Foundation Institute	25.03.2013	Member of Provincial Council, Western Province, Director General (RDA) and other officials, , DS Colombo, DS Kolonnawa, DS Kelaniya ,JICA representatives of Colombo office, Oriental consultants, CEAA(Consulting Firm)	Advertised in newspapers Refer, Annex 7.1 – Social for more detail
2 nd awareness meeting (DS level) TYPE (1)	Respective DS office Kolonnawa Colombo Kelaniya	08.04.2013 09.04.2013 10.04.2013	Divisional Secretary – Colombo, Kolonnawa and Kelaniya, Assistant Divisional Secretary – Colombo, Kolonnawa and Kelaniya, RDA Officials, Consultant (Land acquisition), SLLRDC, Survey Superintendent, Dept. of Survey, Scientist from NBRO, Resettlement officer, ESD, RDA, Resettlement Consultant, CEAA, Safeguard Consultant, CEAA, Socio-economist, CEAA, Coordinator, Social projects, CEAA, Supervisor, CEAA	Refer, Annex 7.1– Social for more detail
3 rd awareness creation at field level TYPE (1)	Community Hall, Wadullawatta	25.04.2013	Officer from ESD, RDA, GN, Wadullawatta, Team Leader, JICA Survey Team, Resettlement Specialist, JICA Survey Team Road Engineer, JICA Survey Team, Representative of Colombo office, JICA Survey Team, Managing Director, CEAA, Resettlement Specialist and Team Leader CEAA, Consultant (Land acquisition), SLLRDC, Coordinator, Social projects, CEAA, Supervisor, CEAA	Refer, Annex 7.1 – for more detail
4 th awareness creation at field level TYPE (5)	Community Hall, Wadullawatta	11.06.2013	CEAA Officers , GN Wadullawatte, Women participants Wadullawatte	

Meeting Type	Venue	Date Held	Key Participants	Remarks
5 th awareness creation at field level TYPE (5)	Grandpass Temple	13.06.2013	CEAA Officers , GN Grandpass, Women participants Wadullawatte, Chief Incumbent of Sri Somaloka Viharaya	
Meeting with impacted property owners of public sector and religious organizations TYPE (6)	Ministry of Ports and Highway, 9 th Floor, Sethsiripaya, Battaramulla	10.05.2013	Chief Incumbent, Sanchi Viharaya, Nawagampura, Rev. Shiwasri, Chief Incumbent, Badrakaliamman Kovil, Nawagampura, Secretary, Ministry of Ports and Highways, RDA officials, General Manager, State Timber Corporation, General Manager, State Development and Construction Corporation, Head of the Department of Electrical Engineering, Automobile Engineering Training Institute, Director Administration and HR, Director, Vocational Training Authority, Director, Atomic Energy Authority, Director/Principal, Automobile Engineering Training Institute, Additional Director, Vocational Training Authority, SDD, Atomic Energy Authority, Deputy principal, Automobile Engineering Training Institute, Bridge Engineer, Oriental Consultant, Construction Planer, Oriental Consultant, Resettlement Expert, Oriental Consultant, Environmentalist, Oriental Consultant	Refer, Annex 7.1 – Meeting with impacted property owners of public sector and religious organizations
2 nd Stakeholder meeting TYPE (1) Annex 7.1 Paper advertisement	Foundation Institute	11.07.2013	Cabinet ministers, Officials of RDA, Officials of CEA, Sri Lanka Land Reclamation and Development Corporation, Atomic Energy Authority, UDA, Ministry of Defense, Sri Lanka Police, Colombo Municipal Council, Member of Provincial Council, Ceylon Petroleum Corporation, NWS and DB, Provincial Council MP's, Municipal Council MP's, Divisional Secretaries, Grama Niladari's, Government MP's from Colombo Districts, JICA, Clergy from Amman Kovil and Sanchi Temple, Oriental consultant, CEAA. Stakeholders (affected persons, and/or their representatives) from affected GN Divisions (Wadullawatta, Sedawatta, Navagampura, Granspadass, Peliyagoda Gangabada and Bloemandhal), Media personnel	Advertised in newspapers Refer, Annex 7.1 – Social for more detail

Note: All formal meeting types could be recorded in this fashion.

Table 7-2 Brief Overviews of the “1st Stakeholders’ meeting”

Date	25 th March 2013
Time	9.30 am
Venue	Auditorium of Sri Lanka Foundation Institute, Colombo 7
Method of consultation	Verbal explanation first in general by the host and individual question/answers by the host and participants
Language spoken	Sinhalese
Agenda of the presentation	<ol style="list-style-type: none"> 1. Brief of the Project Purpose, by Director General RDA, Mr. W A S Weerasinghe 2 Contents of the Projects, by Director ,Planning division RDA, Mr. Bandara 3. EIA survey items and survey methods, RAP survey contents, by ESD-RDA Director, Mr. Hudson de Silva 4. Q and A
Q and A	<ol style="list-style-type: none"> 1.Regarding resettlement, affected area and contents, transfer destination 2. Inconvenience under construction. Ensuring safety 3. After the project, the need for further measures to eliminate road congestion 4. Implementation structure of the field survey work 5. etc.
Entry	Approximately 70 persons

Table 7-3 Number of participants of the 1st stakeholder meeting

Organisation	Gentleman	Lady
Governmental institutions	22	12
Local people	7	1
NGOs	2	None
Media	3	None
Consultant/Study team	14	3
Other	4	0
Total	51	16

Table 7-4 Brief Overviews of the “2nd Stakeholders’ meeting”

Date	11 th July 2013
Time	9.30 am
Venue	Auditorium of Sri Lanka Foundation Institute, Colombo 7
Method of consultation	Verbal explanation first in general by the host and individual question/answers by the host and participants
Language spoken	Sinhalese
Agenda of the presentation	1. Brief of the Project Purpose, by Cabinet Minister Mr. A. H. M. Fowzie and Secretary to the Ministry of Ports and Highways Mr. R. W. R. Premasiri 2. Contents of the Project, by Director, Planning division RDA, Mr. H. M. K. G. G. Bandara 3. Regarding EIA study results and results of RAP study methods, by ESD-RDA Director, Mr. Hudson de Silva 4. Q and A
Q and A	1. Regarding 25 families affected due to the shifting of Amman kovil. 2. Regarding resettlement location, stakeholders want a close location with facilities 3. Regarding the purpose of this project 4. Regarding proposed relocation site and relocation plan by the Atomic Energy Authority 5. Regarding the project schedule and the affected area 6. Starting date of construction and compensation payment time
Entry	329 participants

Table 7-5 Number of participants of the 2nd stakeholder meeting

Organisation	Gentleman	Lady
Governmental institutions	55	6
Local people	106	95
NGOs	4	6
Media	6	4
Consultant/Study team	10	2
Other	32	3
Total	213	116

7.4.2 Social Participatory Rapid Survey

Social Participatory Rapid Survey (SPRS) was done by a project consulting team on 11th March 2013 to obtain general views of the affected people. Majority of householders’ view was that the proposed project would help to increase their socioeconomic standards. This is because at present most of the householders are squatters who live on government land which are of low-lying nature and which are not fit for human habitation. They expect better housing with individual ownership within easy access to their present job locations.

Their general views are compatible with the more detailed formal household survey (TYPE (2)) of which the relevant results are highlighted in the table below.

Table 7-6 Views on resettlement

No.	Criteria	Bloemend.	Grandp. (North)	Nawagam.	Seedawa.	Wadullaw.	Orugodaw.	Peliyago. Gangabada (East)	Total
01	Willingness to vacate the present location								
	1. Yes	42	3	22	102	236	0	4	409 (91%)
	2. No	1	1	4	4	15	0	1	26 (6%)
	3. No idea	1	1	0	1	1	9	1	14 (3%)
	Total	44	5	26	107	252	9	6	449
02	Expectations for compensation								
	1.Land for Land	1	1	0	0	3	0	0	5 (1%)
	2.Cash Compensation	6	3	1	25	9	0	1	45 (10%)
	3.House for house	35	0	21	78	220	0	3	357 (80%)
	4.Not decided	1	0	0	51	5	0		7 (1%)
	5. Other	1	1	4	3	15	9	2	35 (8%)
	Total	44	5	26	107	252	9	6	449
04	Expectation for resettlement								
	1.Resettlement in a village	8	**	6	49	97	0	1	161
	2.Resettlement in Flat	24	**	5	20	131	0	2	182
	3.No idea	1	**	3	24	12	9	3	52

Source: Socioeconomic field survey April/May 2013

According to the above information majority (91%) wish to vacate the present location. Seventy nine percent (79%) households opt for alternative houses. This may be because majority of affected householders live in encroached government lands and they do not have titles for the land.

The views collected through SPRS are generally similar in the case of house as well as business premises in residential areas. However, the views of the operators of some large scale business

premises which are situated by the side of the Port Access road are somewhat different. They wanted to continue their business at similar locations because of the large scale of the investments.

Summary of All Stakeholder and Line Agency Views

This is an overall summary of the stakeholder views which were expressed during the public participation process. Views of people regarding the project and provided answers to their questions are given below as a sample in Table 7-7. Further details are given in Annex 7.1. Overall summarized stakeholder views are also presented after Table 7-7.

Table 7-7 Summary of Discussion in the 1st and 2nd Stakeholder Meetings

Position	Sex	Comment/Question	Answer by RDA officials
GN	Male	<ul style="list-style-type: none"> I am often asked by local people about the compensation package for land acquisition applying to this Project. Most of the people who live in Wadullawatte are working in Pettah of Colombo, so they hesitate to move to a remote place from the original location. There should be some action to preserve the acquired land for the project. If not people will encroach the acquired site according to past incidents. Also the people ask about the width of the affected areas for the road Project in terms of land acquisition 	<ul style="list-style-type: none"> Feasibility studies have just been started and exact widths of the roadway has not been decided as yet. Surveys will be conducted to obtain information to arrive at decisions. Access is needed for surveys as generally people oppose to surveys. Socio economic data will be collected with the help of GN. Resettlement method will be decided after socio economic surveys which will be done house to house. Further discussions will be held with the affected parties after socio economic data collection.
Local People	Male	<ul style="list-style-type: none"> I use the bridge daily. I think that the reason of traffic congestion from Dematagoda to Kiribathgoda is due to poor road condition which induces the decreasing vehicle speed. Until the project is implemented, short term mitigation measures for the traffic jam should be proposed, for example the introduction of passage control by "One way operation". 	<ul style="list-style-type: none"> RDA has been already conducting study on solutions for traffic congestion under JICA's assistance to formulate short, medium and long term plans. Land acquisition for widening of Mattakkuliya Bridge is underway. At present any container truck that goes to the ports have to move along this road section twice as the weigh bridge is located on Orrugodawatte – Ambatale road. This is greatly affecting the traffic movement along this road. A plan is being formulated to shift this weigh bridge to a location close to Colombo port. The road condition at the Peliyagoda side will be improved immediately.
Secretary of Private Organaization	Male	<ul style="list-style-type: none"> It is important to consider loss of employment as there could be pavement hawkers etc. It is important also to consider the construction of the Lake line Road which will connect the Project road before, in order to avoid additional traffic congestions. 	<ul style="list-style-type: none"> The survey and initial work for constructing the Lake line road is being done and the project will be implemented if finances are available.
Member of Municipal Council	Male	<ul style="list-style-type: none"> Some affected people are renting their shops or bearing a load of debt for their small business. The Project should consider the restoration of the livelihood of those people. Sedawatte timber mill operators should be especially considered. The local transportation of surround area of the Project road is in very dangerous condition presently, especially for pedestrians. So, the safety of pedestrians should be considered, for example, the establishment of pedestrian way at the side of the road. 	<ul style="list-style-type: none"> Resettlement will be done based on JICA and Government Policy. Voter's list will be examined to ascertain the nature of residents. Help from GN is needed in this regard. Loss of business etc. will be studied case by case. The necessity of having a pedestrian crossing was noted and it will be included in the designs. A series of pocket group meetings will be held within the project influence area with the

Position	Sex	Comment/Question	Answer by RDA officials
		<ul style="list-style-type: none"> Municipal Councils will help to implement the project but. Many people are squatters and may do not have formal land deeds. There are also a number of people who reside on payment of rent and they will be severely affected. 	assistance from local politicians and community leaders to socialize the project.
Member of Provincial Council	Male	<ul style="list-style-type: none"> According to the notions of the President of the Country all settlers will have a better living condition after resettlement than before, as was done in past projects. Discussion with AP's and line agencies before finalizing the project is an excellent measure on the part of RDA. Better to resettle people at a closer location to the original site in a flat etc. or provide money to resettle at a place on their own choice. A market complex a new city is needed in parallel with the proposed project. It is appropriate to do social consultations in a place closer to their residences. 	<ul style="list-style-type: none"> No party will be let down in the process of resettlement. RDA will take all steps towards ensuring better living conditions to all affected communities. Resettlement options will be discussed with affected communities, local politicians and community leaders.
Member of Provincial Council	Male	<ul style="list-style-type: none"> I would like to propose that the RDA coordinates closely with DSs and GNs when the socio-economic field survey will be carried out to avoid unnecessary social friction with local people. 	<ul style="list-style-type: none"> RDA will consider this suggestion
Residents	Male	<ul style="list-style-type: none"> It is said that extra 25 houses will be affected because of the shifting of Amman Kovil decision have been taken yet regarding this. People will face inconvenience because of this later development. In the affected area there are title holders, persons with no land titles, rentees etc. and all of them should be suitably considered. Rentees should be especially considered as they are very innocent people. 	<ul style="list-style-type: none"> No firm decision has been taken yet regarding the demolition of extra 25 houses. <div style="background-color: #4a7ebb; color: white; padding: 10px; margin-top: 10px;"> <p>Current (18/8/2013) is to rehabilitate the kovil in the same land without affecting houses.</p> </div>
Residents	Male	<ul style="list-style-type: none"> We do not know exactly how many houses will be affected in Kamkarupura. Resettlement should be at close proximity. If resettled at a far off place our livelihood will be affected. Please relocate us around Orugodawatte Junction. 	<ul style="list-style-type: none"> None will be resettled at far off places. All will be resettled at close proximity according to the decision taken by the Ministry of Port and Highways.
Residents	Male	<ul style="list-style-type: none"> We need resettlement at a nearby place. If we will be resettled at Homagama (unconfirmed information) our livelihood would be affected our children's schooling will be affected. Some houses are divided houses running up to 4 divisions and those should be considered. We need resettlement in Kollonnawa electorate itself. We need facilities like electricity, toilets ware supply etc. 	<ul style="list-style-type: none"> None will be resettled at far off places. All will be resettled at close proximity according to the decision taken by the Ministry of Port and Highways. Title holders and non-title holders will be suitably considered.
Staff of Ceylon Petroleum Corporation	Male	<ul style="list-style-type: none"> Many fuel bowzers ply this road and wanted to check whether there is a solution for that from this road improvement. 	<ul style="list-style-type: none"> However this matter has to be taken up in the District Development Meeting as it is not directly related to this project
Atomic Energy Authority	Male	<ul style="list-style-type: none"> We would like to be relocated in the land at Malabe and not in Homagama 	<ul style="list-style-type: none"> This has to be resolved through UDA
Affected Business man	Male	<ul style="list-style-type: none"> They wanted to know approximately when the project will start. If the affected area could be marked it will be better. 	<ul style="list-style-type: none"> Only preliminary designs are available now. Exact boundaries will be marked after the detailed designs.

Summarised Stakeholder Views

1. Uncertainty exist about the land area affected and the method of compensation. However RDA officials explained to the stakeholders that a 100m corridor has been selected. But that does not mean that all the area within this corridor will be acquired and structures within this corridor will be affected.
2. Newcomers (as squatters) to the area will increase because of the resettlement benefits accrued to them by the project. It was agreed to declare a cutoff date (8 April 2013 for Kolonnawa DS, 9 April 2013 for Colombo DS and 10 April 2013 for Kelaniya DS) for offering resettlement benefits.
3. Stakeholders wanted to know information about RAP. It was explained to them that RAP will be available in all 3 languages in the DS office for interested parties to refer.
4. There was a request from some GN's that tenants should be offered appropriate compensation as they are a highly vulnerable group.
5. Facilities such as access roads for residents who live outside the affected area should also be improved.
6. Taxpayers who do not live on site also should be benefited.
7. Stakeholders were keen to know how the resettlement process proceeds. Temporary settlements will be handled first and permanent settlement will be handled later and resettlement in a permanent settlement will be carried out in a single step, was the explanation accorded to them by the officials.
8. There is no objection to the project if the stakeholders are provided with better facilities
9. Stakeholders need additional space to continue their livelihood (e.g. production of incense sticks) in addition to housing. Also they will lose their market for these products. Housing in flats should not be offered to the people who produce incense sticks as they need space for drying their products.
10. As the road is constructed mostly on piers demolition of existing structures could be avoided in some cases.
11. The place where the road is very close to building could be damaged especially by pile driving and such impacts should be minimized.
12. Nearly 40% of Badrakaali *Amman Kovil* (Hindu temple) will be affected and the chief priest and devotees of the Kovil wished to know whether the area of the shrine stone (main shrine) in the center could be saved. The hall which is used for wedding and ceremonies can be used by the project. They requested to rebuild a kovil in a nearby premises.
13. Buddhist temple *Sanchi Vihara* will not be affected much, therefore the incumbents expect reasonable compensation to make necessary adjustments.
14. Stakeholders in Navagampura GN are now residing in Kamkarupura flat and they want a similar place in the vicinity. They go to the same family doctor and that pattern will break if they were to be resettled elsewhere. Even the doctor if shifted will lose his clientele. Transportation cost will be unaffordable to them if they are settled at a far off place.

Children's schooling will get affected as children go to school unaccompanied. Finding new schools for children elsewhere will be difficult.

15. In Wadullawatte, Nawagampura GN divisions, disabled persons, patients (e.g. with wheeze and diabetics), mothers and infants used to patronise the existing clinics in the area and they will lose that pattern of medical care if resettled in a far off place.
16. Most of the blue collar workers are coolies (*nattami's*) who go to Pettah for their day to day livelihood and if shifted elsewhere they will have to incur additional transport cost and time. Even women need extra time to take children to schools etc.
17. Affected stakeholders do not like to move to a transitional site. They need a permanent place for resettlement at once before the construction period of the project begins.
18. Parking spaces for three-wheelers will be lost (e.g. Wadullawatte) as the three wheeler drivers have got registrations for three wheeler parks.
19. Loss of English private classes to children and respective teachers will lose business.
20. Small scale sellers of bites, betel, string hoppers, vegetables, snacks etc. (mostly women) lose income and loose customers as residential flats are not suitable for such a purpose.
21. People who produce flower arrangements and incense powder to kovil lose their livelihood if the *kovil* is shifted. They also need a water supply to avoid withering of flowers.

7.5 Outcome of the meeting held with Secretary Ministry of Defense and Urban Development Authority

As the resettlement was the major aspect of this project, it was decided to have a special meeting with the secretary of the Ministry of Defense and Urban Development and UDA. The meeting was held on the 27 of June, 2013 where the following key issues were discussed;

1. Resettlement of families (especially non-title households),
2. Relocation of the main workshop of Automobile Engineering Training Institute (AETI),
3. Relocation of Atomic Energy Authority,
4. Relocation of Amman Kovil.

Following decisions and guidance was given by the Secretary of Defense and Urban Development.

1. To develop a new resettlement scheme at the newly acquired land by UDA (former land of State Timber Corporation) and in turn UDA will provide RDA with the necessary number of units for resettlement of affected people
2. RDA to provide financial assistance to UDA for construction work. Commencement of construction work as early as possible to allow the affected people to relocate themselves before the commencement of the proposed road project.
3. Relocate the main workshop of the AETI at nearby land of Vocational Training Institute Orugodawatte.
4. Relocate the Atomic Energy Authority in the new land at Mahenawatte Pitipana Homagama.
5. Shift back the Kovil at the same location and rehabilitated without any relocation of existing houses.

8 EXTENDED COST BENEFIT ANALYSIS

8.1 General Conditions of Cost Estimation

(1) Term of Cost estimation

Unit prices of resources (materials, equipment and labor) considered for this estimation reflects the actual price of resources as of October 2012. They are based on the following decisions and documents:

- Decisions of the meetings with Road Development Authority during the design period.
- Standard Specifications for Construction and Maintenance of Roads and Bridges, second edition June 2009, published by the Institute of Construction Trading and Developments, Sri Lanka.
- Highway schedule of rates Issued by Road Development Authority, Sri Lanka in year 2012.
- ICTAD Bulletin for construction statistics for the month of October 2012, issued by Institute for Construction Training and Development, Sri Lanka.
- Outer Circular Highway Southern Sector Project-Bills of Quantities and rate analysis.
- Outer Circular Highway Northern Sector Project-Bills of Quantities and rate analysis.
- Current market prices for materials and equipment prices in Sri Lanka.
- Current market prices for structural steel and related work items from Japan.

(2) Exchange Rate

The exchange rate adopted for this cost estimate is the prevailing average rate of exchange in July 2013, as shown below;

US\$ 1 = 97.4Yen
US\$ 1 = 126.3LKR
LKR 1= 0.771Yen

(4) Taxes and Duties

1. All the prices and rates are exclusive of VAT.
2. Locally imposed taxes (except Value Added Tax-VAT) in Sri Lanka for materials and works are included in the rates of the estimate.

8.2 Construction Cost

The Construction Cost has been estimated based on the following types of structure for each section:

1. Main Bridge: Extra-dosed type with PC box girders and RC piers and RC Pile foundation.
2. Approach bridges - Separated Section: PC box girders with RC piers and RC Pile foundation.
3. Approach bridges - Overlapped Section: Steel box girders with steel piers and RC Pile foundation.
4. Ramp bridges (Orugodawatta Junction IC ramps, Kelanitissa ramps, New Kelani Bridge IC ramps, Ingurkade Junction IC ramps): Steel box girders with steel piers and RC Pile foundation.

The construction cost estimation is given for each of the selected options is given in Table 8.3

8.3 Maintenance Cost

The maintenance cost has been estimated in order to ensure proper operation and maintenance of the new infrastructure. As concrete structures will require less maintenance than steel structures, their maintenance cost has been neglected.

Table 8-1 Table Maintenance Cost

Maintenance Items	Maintenance Interval	Cost(LKR)
Routine Maintenance	Every year	1,373,627
Highways		
Periodic Inspection	Every year	157,248
Pavement	10	383,387,293
Steel Bridge		
Periodic Inspection	5	157,248
Painting	20	43,601,605
Expansion Joint	20	267,858,360
PC Bridge		
Periodic Inspection	5	157,248
Expansion Joint	20	89,521,740
Bearing	40	380,880,000
Extra-dosed Bridge		
Periodic Inspection	5	157,248
Expansion Joint	20	86,088,600
Bearing	40	27,600,000
PC Cable	75	1,114,878,900

Only the maintenance cost of the steel structures, which mainly consists of the repainting cost, have been estimated. The following table shows recommended cost of painting, it was selected based on the cost, maintenance frequency and aesthetic aspect.

Table 8-2 Cost of paint

Painting Specification	Normal Painting t=300 microns
Unit rate	7,800Rs/m ²
Paint Area	50,840m ²
Initial cost	397billion Rs
Repair rate	7,600Rs/m ²
Repaint Area	50,840m ²
Repair cost	386bill Rs
Repair interval(year)	30

Note:

- As the box girders of steel bridge are embedded in piers, support bearings are not required. Thus their maintenance cost can be deducted.
- An extra cost of steel is added to the unit rate for the atmospheric corrosion resisting steel.

8.4 Total Cost

The total project cost estimated during the feasibility study is LKR. 60.9 billion. Table 8.2 presents the details of costs.

Table 8-3 Summary of Total Cost

Item	Description	Amount (LKR.)
1	Civil Works	34,769,000,000
2	Dispute Board	64,000,000
3	Price Escalation	1,968,000,000
4	Physical Contingency	3,680,000,000
5	Consulting services	5,237,000,000
6	Land Acquisition	5,108,000,000
7	Administration Cost	4,066,000,000
8	VAT	5,486,000,000
9	Import Tax	0
10	Interest during construction	154,000,000
11	Commitment Charge	367,000,000
	Total	60,900,000,000

8.5 Environmental Benefits

Benefit cost analysis aims to express all the costs and benefits of a project in monetary terms. Although the environment provides a range of functions for the general economy to operate effectively, most environmental goods and services are not valued at all in the market place. And hence not included in the conventional benefit cost analysis. The extended benefit cost analysis attempts to evaluate all environmental impacts of a project and assesses the viability of the project from both an economic and environmental perspective. In an extended benefit cost analysis, where possible, the environmental consequence is quantified using various valuation techniques. In cases of market failure, as for most environmental goods, shadow prices and surrogate market are used as these reflect the social opportunity cost of the goods. However in some cases these environmental costs and benefits cannot be quantified, even through direct or indirect market techniques are employed.

This study is at feasibility level, and detailed quantities have not been computed. During the operation of the project, positive impacts are anticipated economically and environmentally compared to the case of “No Action Alternative”.

Reduced air pollution levels

During the construction period the community living close to the project construction site will be affected by increased dust levels from site clearance, movement of heavy vehicles and other construction activities. In the long-term view, however, the impact of air pollution may decrease due to the project. The congestion on the existing roads is expected to reduce thereby reducing the concentration of the emission levels. Overall, the project is expected to benefit from the reduction in air pollution levels.

Reduced noise levels

During construction, noise from construction area and operation of construction machine and heavy vehicles will be generated. In the long term view, however, the project may have positive impacts since driving speed will increase, in consequence generation level of noise due to running vehicle is reduced. Overall, the project is expected to benefit from the suppression in noise levels.

Birth of a new urban landscape

The present ad hoc landscape will metamorphose to a new urban landscape as the new bridge and flyovers to be built by this project. Will give a good impression on people entering the Colombo central by using the CKE. Therefore, environmental value of the area will increase.

9 ENVIRONMENTAL MANAGEMENT PLAN INCLUDING MONITORING PROGRAMME

The mitigation measures discussed in chapter 6 should be considered important in avoiding and mitigating any adverse impact during, construction and operational stages of the project. However, this project is still in the feasibility study level. Hence the impacts and mitigation measures discussed under chapters 5 and 6 are based on the initial design criteria which are on a much lower perspective. During the detailed design stage these designs will be improved (to be more project specific) mainly in terms of construction aspects, economic aspects, environmental and social aspects. Even though the impacts would remain the same, more specific mitigation measures could be suggested based on the specific design details.

An Environmental Management Plan (EMP) was developed based on the impacts and mitigation measures discussed under chapters 5 and 6. This EMP is presented as Annex 9.1 of this report. It is important that this EMP is revised during the detailed design stage and the updated EMP should be part and parcel of the contract documents. Implementing the EMP during the construction period is a responsibility of the contractor under the supervision of RDA. A budgetary provision should be kept for such measures.

Even though the EMP is in place it is still important to monitor the effectiveness of the mitigation measures adopted especially by the contractor during the construction stage. This is because the construction stage is the period where most critical impacts arise. A set of baseline data was measured for this project through measuring ambient air quality, surface and ground water quality, noise and vibration levels at selected locations within the project area. The Environmental Monitoring Plan (EMoP) presented in Annex 9.1 lists out the environmental parameters that need to be measured periodically or on a complaint basis.

As stated above execution of mitigation measures during the construction period is a main responsibility of the contractor. The project proponent (RDA) holds the responsibility of carrying out the supervision of mitigation measures during construction and during operation stages. The Environmental and Social Development Division (ESD Division) of RDA will be responsible for monitoring the implementation of EMP as an internal monitor while CEA will be an external monitoring agency for the project. It is required that ESD carries out regular inspection of the project site to monitor the compliance levels, while CEA could carry out inspections on a quarterly basis.

The contractor should recruit a dedicated Environmental Officer to advise the construction staff on the needs of environmental compliance. The supervision consultant should obtain the services of an Environmental Specialist to advise the Contractor in implementing the EMP during the construction period. Contractor should conduct environmental monitoring associated with the construction, after that the contractor shall report them to the PMU (Project Management Unit). The Report is submitted to the PMU, and then PMU shall submitted it to ESD, finally ESD shall submit it to CEA after checking the report.

Below, shown is the procedure and relationships needed in carrying out the Environmental Monitoring Program by the Project Management Unit towards the implementation of the project. Effectual management and smooth progress of the project is required. PMU will be established before the commencement of detailed design. All tasks to be carried out for the project will be managed by PMU.

Implementation of the Environmental Management Plan (EMP) will also be carried out under the control of the PMU. For that purpose, an environmental division will be established within PMU in collaboration with ESD and CEA. About the implementation of EMP for the project effective guidance for the contractor will be provided at the same time.

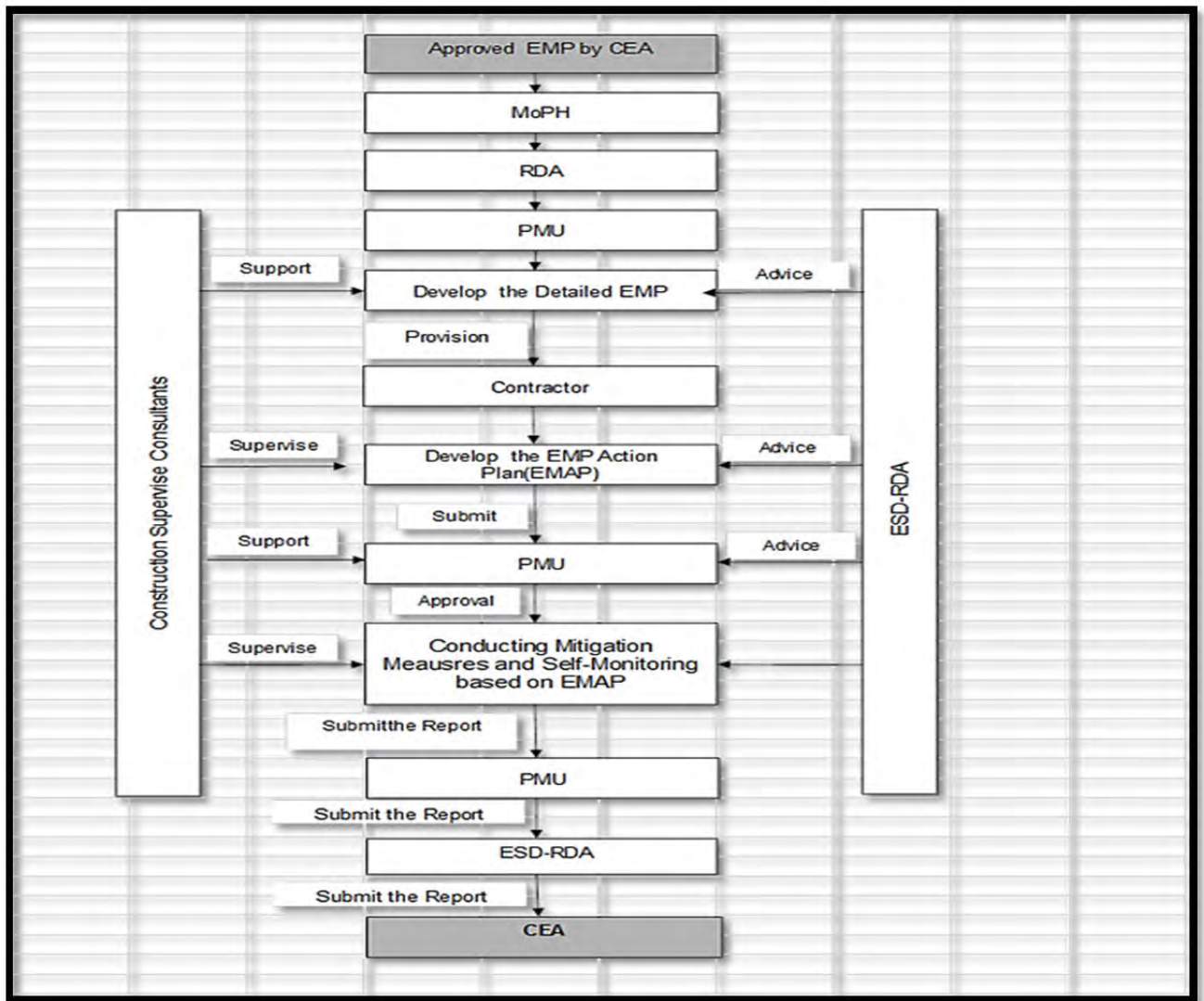


Figure 9-1 Procedure and relationship of Environmental Management Plan

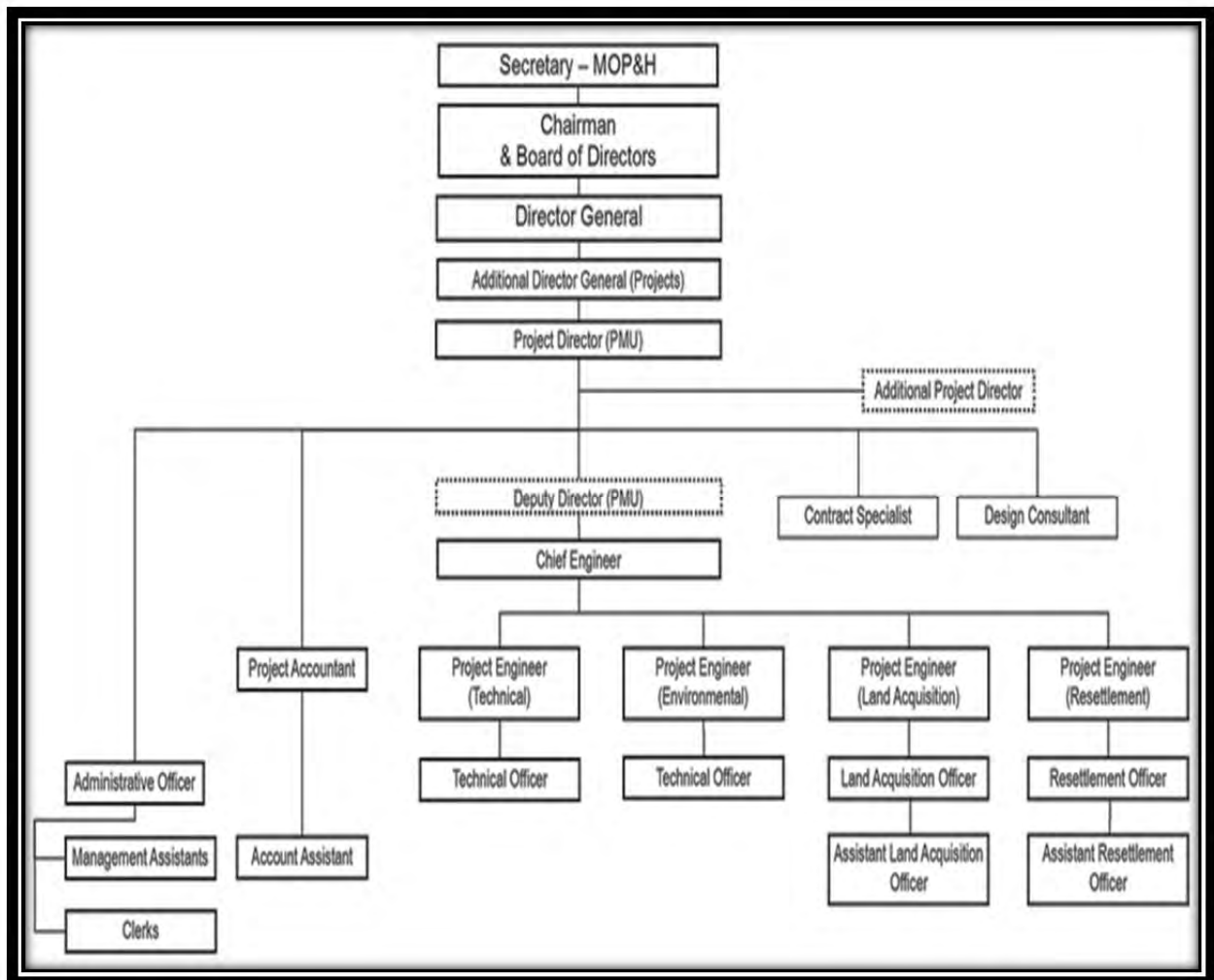


Figure 9-2 Organization of proposed Project Management Unit (PMU)

10 CONCLUSION AND RECOMMENDATIONS

10.1 General

Resettlement is a significant impact as the project displaces more than 100 families. In addition to families many small business ventures are also affected. Details are given Table 10-1 below.

Table 10-1 Summary of Affected Persons, Structures and Method of Compensation

TYPE	Number of Units	Number of occupants	Number of Employees	Mitigation Measure(Compensation Package)
Houses				
Number with titles	42	1743	Not applicable	Offer compensation to find alternative resettlement at their wish Offer houses in UDA housing scheme at State Timber Corporation site as an alternative Compensation payments for affected structures and payments for loss of livelihood
Number without Titles	353			Offer houses in UDA housing scheme at State Timber Corporation site Compensation payments for affected structures and payments for loss of livelihood
TOTAL	395			
Business Premises				
Number with titles	15	Not applicable	Not applicable	Compensation payments for affected structures and land and payments for loss of business.
Number without Titles	39	Not applicable	Not applicable	Compensation payments for affected structures and payments for loss of business
Number of employees	Not applicable	**	118	For employees a salary based compensation for affected employment
GRAND TOTAL	449	1743	118	

Estimated cost of resettlement is Rs.6 billion.

10.2 Conclusions

The following broad conclusions could be reached from this study.

1. Alternative B layout is an optimum layout for implementation in terms of transport efficiency, environmental impact, construction ease, connectivity with the existing road network etc.
2. The project in the long run will ease traffic congestions on the New Kelani Bridge and the vicinity and improve transport efficiency.
3. According to the findings of the EIA study it could be concluded that the proposed project (Alternative B) will not cause significant adverse impacts to the environment physically, chemically or ecologically.
4. However as this area is a very congested area and some negative short term significant impacts such as temporary traffic jams, noise, vibration, air pollution and some social inconvenience will take place because of construction and shifting of major buildings.
5. Most of the impact are social impacts arising on construction, displacement of people, and resettlement hence impacts of livelihood of people could occur temporarily.
6. There are minor to significant impacts on religious and cultural structures (e.g. Sanchi Temple-Marginal demolition, Amman Kovil-Partial demolition and rehabilitation, Christian pray room-full demolition etc.).
7. The present social environment, even though not very congenial at present, is an environment very familiar to the stakeholders and to their livelihood. It is firmly interwoven with the present complex social behavior pattern. There could be temporary psychological impacts on them because of displacement, even though with better living conditions.
8. It was observed that the stakeholders do not protest against the project which is an encouraging factor. Most of them are willing to move to alternative places which will not disturb their connections with external social infrastructure such as religious places, work places, and hospitals, other medical facility providing places, schools etc.
9. There are no serious hydrological or drainage impacts as most of the structures are elevated.
10. Almost all the impacts including significant social impacts related to displacement could be mitigated.

10.3 Recommendations

The following recommendations are made in this study.

10.3.1 Overall Recommendations

1. Implementation of the Alternative B layout is recommended subject to mitigation measures, Resettlement Action Plan and Environmental Monitoring and Management Plans.
2. All proposed mitigation measures and environmental monitoring and management actions should be counted as recommendations.

3. Stakeholder views should be considered as far as possible in providing those places for resettlement and/or compensation.
4. Replacement of government buildings will have to be carried out in collaboration with all relevant line agencies to suit the needs of the occupants of Government buildings, relevant institutions and the concerned public.
5. Alterations to the religious buildings should be carried out with minimum damage to the buildings and with minimum impacts to the devotees. Ideas expressed by the clergy of these religious places should be considered.

10.3.2 Special Recommendations to Address Social Concerns

1. The project area is a heavily urbanized area in the periphery of Colombo City and there is a rich network of urban infrastructure and amenities which consists of major and minor roads, power transmission lines, railway, underground water supply network, underground fuel pipelines of the Petroleum Corporation underground and overhead telecommunication network, schools, religious places, government and private buildings etc. Continuous dialogs with relevant authorities related to affected infrastructure have to be consulted to get their fullest corporation for the project development.
2. Due consideration should be given to all religious and cultural sites affected by the project.
3. Shifting of the statue of late Mr. S.W.R.D. Bandaranayake (a former head of the country) need to be done with due respect and political patronage.
4. Carry out continuous dialog with affected persons and use simple language for awareness meetings during the resettlement.
5. Women headed households, families with elderly household heads and families with disabled persons are considered as vulnerable. Special attention needs to be given to these families during implementation of the resettlement plan for the project.
6. It is important to execute the recommendations and decisions taken during the meeting held with the Secretary to the Ministry of Defense and Urban Development on 27 June, 2013 before commencing the construction works.

REFERENCES

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4. Preparatory Survey on Traffic Improvement around New Kelani Bridge- Design Criteria Oriental Consultants and Kathahira and Engineers International– January 2013