

## Contents

Executive Summary .....	4
1 Introduction and Background .....	6
1.1 This Report.....	6
1.2 Objectives of the Project .....	6
1.3 Objectives of the Environmental Assessment.....	7
1.4 Scope, extent of study and personnel involved in the study .....	7
1.5 Statement of Need .....	7
1.6 Required approvals and their status .....	8
1.7 Individuals and Groups Consulted in the Preparation of EA.....	8
2 Policy, Legal and Administrative Framework .....	9
(Applicable Laws, Regulations, Standards and Requirements Covering the Proposed project) .....	9
2.1 General .....	9
2.2 National Environmental Regulations and Procedures.....	9
2.3 World Bank policy on environmental safeguards .....	10
3 Description of the Proposed Project .....	11
3.1 General .....	11
3.2 Project location.....	11
3.3 Description of Proposed Development .....	12
3.3.1 Project Layout Maps (Including Reclamation Activity).....	12
3.3.2 Information on the burrow sites proposed .....	12
3.3.3 Description of Reclaiming and Construction Methodologies.....	12
3.3.4 Description of the Proposed Design .....	13
3.3.5 Use of resource energy efficient concepts .....	13
4 Description of the Existing Environment .....	14
4.1 Physical environment .....	14
4.1.1 General.....	14
4.1.2 Topography,.....	14
4.1.3 Existing land use pattern.....	14
4.1.4 Hydrology climate, .....	15
4.1.5 Geology and Soils,.....	16

4.1.6	Air quality, .....	16
4.1.7	Noise, .....	17
4.1.8	Surface water and drainage.....	17
4.1.9	Role of the land as a flood retention area .....	19
4.1.10	Ground water potential .....	19
4.2	Ecological environment.....	19
4.2.1	General.....	19
4.2.2	Marshland .....	19
4.2.3	Roadside Vegetation .....	20
4.2.4	Home Gardens and other Developments .....	20
4.2.5	Flora .....	20
4.2.6	Fauna.....	20
4.3	Socio-cultural environment .....	21
4.3.1	Administrative Status.....	21
4.3.2	Data Sources .....	22
4.3.3	Socio-economic Status of the Area .....	22
4.3.4	Availability of Infrastructure Facilities.....	22
4.3.5	Affected social groups- residents in the immediate vicinity.....	22
5	Potential Impacts of the Proposed Project .....	23
5.1	General .....	23
5.2	Construction Stage Impacts- Negative - Short Term .....	23
5.2.1	Physical onsite impacts .....	23
5.2.2	Physical offsite impacts .....	25
5.2.3	Ecological Impacts – Onsite .....	26
5.2.4	Socio Cultural Impacts - Onsite.....	26
5.3	Operational Stage Impacts- Negative - Long Term .....	27
5.3.1	Impacts on Physical/Ecological and Socio Cultural Environment .....	27
5.4	Operational Stage Impacts- Positive - Long Term.....	28
6	Analysis of Alternatives.....	29
6.1	No Action Alternative .....	29
6.2	Site Alternatives .....	29
6.3	Technological Alternatives .....	29

7	Mitigation Measures and Environmental Management Plan.....	30
7.1	Mitigation Measures Construction Stage Impacts- Negative - Short Term.....	30
7.1.1	Physical onsite impacts.....	30
7.1.2	Mitigation Measures for Physical offsite impacts.....	33
7.1.3	Mitigation Measures for Ecological Impacts – Onsite.....	34
7.1.4	Mitigation Measures for Socio Cultural Impacts - Onsite.....	34
7.2	Mitigation Measures for Operational Stage Impacts- Negative - Long Term.....	35
7.2.1	Mitigation Measures for Impacts on Physical/Ecological and Socio Cultural Environment 35	
7.3	Green building concepts- Resource sustainability and energy efficiency.....	37
7.4	Environmental Monitoring and Management.....	38
7.4.1	General.....	38
7.4.2	Institutional responsibilities and environmental management plan.....	38
7.4.3	Cost estimates for the implementation of proposed measures.....	39
7.4.4	Capacity Development and Training.....	39
8	Inter agency, public and NGO consultation.....	40
9	Conclusions and Recommendations.....	40
9.1	Conclusions.....	40
9.2	Recommendations.....	40
10	List of references and report prepares.....	41
10.1	References.....	41
10.2	List of Report Preparers.....	41
ANNEXES	.....	42
	Annex 0- Environmental Management Plan.....	42
	Annex 1: Terms of Reference.....	43
	Annex 2: List of Flora and Fauna.....	49
	Annex 3: List of interviewees.....	55
	Annex 4: Population Statistics, Details of Infrastructure and Land Use.....	56
	Annex 5- Detailed Building Plans.....	58
	Annex 6- SLLRDC’s Conditional Approval Letter.....	59
	Annex 7- Details of the Sewerage Plant.....	60

## Executive Summary

This report is the Environmental Assessment (EA) carried out under World Bank Environmental Safeguard requirements for the proposed building complex for Department of Census and Statistics which comes up under the World Bank Funded Public Sector Capacity Building Project. World Bank (Operational Policy) OP 4.01 requires environmental assessment (EA) of projects proposed for Bank financing to help ensure that these projects are environmentally sound and sustainable.

The project site is located at Polduwa Road Sri Jayawardenapura Kotte near the famous “Waters Edge” golf grounds.

The objective of this project is to construct and equip two new buildings at Sri Subothipura Grama Niladari Division of Kaduwela Divisional Secretariat Division in Colombo District to station the Department of Census and Statistics. A low lying area of about 0.4 ha will be partially (about 5% of the allocated land area) are allowed by SLLRDC to be reclaimed by filling for construction of the buildings and most parts of the buildings will be on raised columns above high flood level allowing water ingress during floods.

This EA is carried out to determine the adverse impacts especially on loss of retention and other social impacts and propose mitigatory measures. Approvals from SLLRDC UDA and Kaduwela Pradeshyha Saba are necessary to carry out the building construction.

Filling area will require uprooting of existing vegetation. The construction of buildings will include standard building construction techniques mostly using manual labour and a crane. Dump trucks will be used for material transport. As the area consists of peaty soil for the foundation works pile driving is necessary.

The proposed building design consists of pile foundations, concrete frame of columns and beams block work walls, galvanized steel sheet roof and other standard fixtures. UDA building regulations has been followed. Also some of the Green Building concepts will be adopted although the client will not go for a full fledged green building certification such as Leeds Certification.

The area is subjected to flooding because of its marshy nature and the proximity to the canals. This area is virtually the flood plain of the said canals which is fed by the low lying upper catchments. This area belongs to the declared flood retention area within Colombo District as declared by SLLRDC and is sensitive in a flood control context because the marshy areas act as a flood retention buffer. However within the same contiguous flood retention area comparatively a large extent of retention area with respect to that of the project site is available

A total number of 65 plant species including 1 endemic species were recorded during the field survey within the study area. *Osbeckia octandra* (Heen Bowitiya) is only recorded endemic plant species found in surrounding roadside vegetation within the study area and not unique or restricted to the study area. Rare or threatened plant species were not recorded during the study and all recorded flora species are not unique or restricted to the project area. Further more than 46 % of the plant species recorded at the study area are exotic species which indicates that the area is highly disturbed due to human influence. No rare threatened or endemic faunal species were found in the project area especially within the marsh where the building will be constructed.

The land of the proposed project site comes under Kaduwela DS in Colombo district and belongs to Sri Subothipura (492) GN Division. The population of Sri Subothipura GN division is 3031 comprising 50.5%

female and 49.5% male. In the GN division 92.5% of the population is Sinhala and about 2.5% is Tamil. The religion of the majority (84%) of the population present in the Sri Subothipura GN division is Buddhism, where the second most (8%) are Catholic. The people belonging to Hindu and other are less than 1%.

The project activities will render the following construction impacts; Partial loss of retention area , dust sir and noise generation from construction equipment, contamination of water and site from construction and other solid waste material , social inconvenience from prolong hours of operation, noise , dust , disposal impacts from construction waste, reduction of carbon footprint on clearing vegetation , restricted social access in the residential areas , damage to property from vibration of pile driving activity , problems owing to presence of outside labour gangs safety of public workers etc. Some of the long term impacts are, waste water and sewage disposal impacts, fire hazards, use of excessive energy, changes caused to the character of the area.

Some of the positive impacts of the project are; Further increased in land value, potential for small businesses being started in the vicinity (e.g. Food outlets, kiosks supply, lodging facilities, transport modes such as trishaws etc.),public convenience through centralizing government institutions ,creation of job opportunities for people, further development of the internal access road, easy public access to the departments etc.

The proposed summarized mitigatory measures and the management aspects are included in the Environmental Management Plan (EMP) presented in Annex 0. An “Inter Agency Committee” comprising the following should be appointed from the representatives of the following agencies – SLLRDC, UDA, Pradesheeya Saba (CEA Environmental Officer) to carry out the EMP with the help of the Resident Engineer of the Project Proponent.

It could be concluded that this construction project will not render very adverse immitigable environment impacts therefore the project belongs to Category B project according to World Bank classification. Most of the impacts are mitigable using actions stipulated in the Mitigatory measures and the Environmental Management Plan.

Some of the key mitigatory measures proposed are restricting the fill area to 500m<sup>2</sup>; raise the building above high flood level to allow flood water ingress, carrying out crack surveys and present status of the nearby houses and later make compensatory payments for the possible damages, connecting wastewater and sewage to a municipal sewer etc.

The following recommendations are made based on the findings of this EA.

1. Execution of the project is recommended with the proposed mitigatory measures and monitoring/management requirements.
2. All necessary contractual provisions and stipulations regarding mitigatory measures should be included in the contract documents prepared for construction work. The environmental monitoring plan provided could be used in this regard. Additional cost items for these should be specified in the bill of quantities if the need arises.
3. It is recommended that environmental monitoring be undertaken by Department of Census and Statistics under the supervision and guidance of an interagency committee as proposed under the Monitoring Program.
4. The social impact caused by pile driving activities should be mitigated with extra care.

# **1 Introduction and Background**

Enhancement of effectiveness, efficiency and productivity in government agencies is one of the numerous development interventions made under “*Mahinda Chinthana*” (the ten year horizon development framework 2006-2016) of Government of Sri Lanka (GoSL). Department of Census and Statistics (DCS) and Auditor General’s Department (AGD) are two such government institutes that have been selected for such development. World Bank (WB) has agreed to financially assist GoSL for this development through an International Development Association (IDA) project designated as “Public Sector Capacity Building Project” (Project ID: P097329).

The STATCAP Project is one of the two components of the Public Sector Capacity Building Project of the Government of Sri Lanka funded by the World Bank. The cost of the STATCAP Project is US\$ 14.05 mn., of which US\$ 2.0 mn is funded by the GOSL and the balance US\$ 12.05 million is funded by the World Bank. The duration of the STATCAP Project is 3 years, i.e. from 2009-2011. The key components of the STATCAP project are construction of a modern building for the DCS and the professional development of the DCS staff.

The objective of the Public Sector Capacity Building Project of the DCS component for Sri Lanka is to enhance the effectiveness, efficiency, and productivity of DCS through an investment package that includes organizational strengthening, capacity building, information management, communication improvements, physical and information technology infrastructure, and Information and Communication Technology (ICT) support.

The DCS proposes to prepare the low lying land in Sri Subuthipura at Battaramulla to site the proposed buildings. This land has already been acquired by the DCS and AGD. While the applications have been lodged by the DCS and AGD, the proposed site and construction strategy needs to meet the requirements of the Urban Development Authority (UDA) and Sri Lanka Land Reclamation and Development Corporation (SLLRDC). Filling of this land, building of the structure and equipping (here after referred as the project) can only commence once these approvals are obtained and requirements of the Environmental Safeguards Management Framework (ESMF) agreed between GoSL and WB are satisfied.

## **1.1 This Report**

This report is the Environmental Assessment for the proposed building complex for Department of Census and Statistics.

## **1.2 Objectives of the Project**

The objective of this project is to construct and equip a building at Sri Subuthipura Grama Niladari Division of Kaduwela Divisional Secretariat Division in Colombo District to station the government's Statistical and Census Department as its Head Office.

### **1.3 Objectives of the Environmental Assessment**

Objectives of this environmental assessment (EA) are to gather and provide:

- Information about the physical, biological and socio cultural within the specified project influential area;
- Identify beneficial and potential adverse impacts on the existing environment during preconstruction, construction and operational phases of the project;
- Propose effective mitigation measures to avoid/ minimize the project induced adverse impacts while enhancing the beneficial impacts, and;
- Formulate an effective Environmental Management Action Plan (EMAP) to be incorporated in the Bid documents, so as to guide respective contractors in environmental and social safeguards compliance during construction stage.

### **1.4 Scope, extent of study and personnel involved in the study**

The scope of the study is limited to the Environmental Study and preparation of the Environmental Management Plan for the proposed development work i.e. land filling (for temporary work mainly and to a limited extent guided by SLLRDC conditions for permanent works) and building construction work. And the project area is considered as a circular area of which the radius is 500m and the center in the proposed site. The scope of work is stipulated in the Terms of Reference issued by World Bank. (See Annex.1). The personnel involved in the study, are a Consultant Hydrologist/Environmental Specialist, a Social Assistant and an Ecologist.

### **1.5 Statement of Need**

The DCS has 18 divisions, which are presently located in several rented out buildings in different places due to non-availability of a building of its own to house all these divisions under one roof. With this set up, the DCS is facing inconvenience in matters that require coordination, sometimes even causing unavoidable delays. Although, all efforts are taken to minimize such delays this set up has some impact on the efficiency of the Department's routine work.

The Government of Sri Lanka has taken a policy decision to establish most of the Government offices outside Colombo and many such offices have been shifted to Sr Jayawardenapura (Batteramulla) area . In this backdrop a decision has been taken to construct the Head Office of the Department of Census and Statistics at premises in Polduwa Road Batteramulla.

### **1.6 Required approvals and their status**

The following approvals are required to carry out the construction work.

- Approval from SLLRDC as the project area is in the sensitive flood retention area within Colombo District – Approval granted under conditions. Filing is allowed only in 5% of the area. ( Refer **Annex 6**)
- Approval from UDA for the fulfillment of UDA regulations regarding building construction – Approval granted
- Approval from Kaduwela Pradeesheeya Saba for the building works – Building applications have been obtained and relevant plans will be submitted upon finalization.

### **1.7 Individuals and Groups Consulted in the Preparation of EA**

Various concerned line agencies such as Divisional Secretary, Pradeesheeya Saba, and SLLRDC and the residents living close to the building site (on the left side of Polduwa Road) were consulted and their concerns recorded. Details regarding floods and stormwater drainage aspects of the area were obtained from SLLRDC. Officers of the Department of Census and statistics were also consulted as their head office building is proposed to be constructed in the adjoining premises of the same marshy land.

## **2 Policy, Legal and Administrative Framework**

(Applicable Laws, Regulations, Standards and Requirements Covering the Proposed project)

### **2.1 General**

Projects and programs financed with IDA resources normally need to comply with World Bank Operational Policies. Accordingly, the components and activities eligible for funding under this project will be required to satisfy the World Bank's safeguard policies, in addition to conforming to environmental legislation of the GoSL. This project could only commence once the requirements of the Environmental Safeguards Management Framework (ESMF) agreed between GoSL and WB are satisfied.

### **2.2 National Environmental Regulations and Procedures**

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

A list of projects that requires Environmental Assessment (EA) has been prescribed in Gazette Extraordinary No. 772/22 of 24<sup>th</sup> June 1993 and subsequent amendments. Such projects need to go through the Environmental Impact Assessment (EIA) process and subsequent conditional approval should be obtained prior to the commencement of the project from the Central Environmental Authority (CEA) of the Ministry of Environment and Natural Resource or designated project approving authority. Under the list of prescribed projects, following guidelines are related to the proposed project

- Reclamation of land, wetland area exceeding 4 Hectares.
- Housing and building: Integrated multi-development activities consisting of housing, industry, commercial infrastructure covering a land area exceeding 10 hectares.
- And if the project is located in any area declared under the Flood Protection Ordinance (Chapter 449) and any flood protection area declared under Sri Lanka land Reclamation and Development Corporation Act 15 of 1968 as amended by Act No. 52 of 1982.

According to the SLLRDC's conditional approval dated 12 October 2009, only 5% of the land area (i.e. 8 perch which is less than 4Ha) of land could be reclaimed for this project, therefore the first two guidelines will not have a bearing on the project. The proposed development project need to obtain the approval from SLLRDC as this area is declared as a flood retention area under SLLRDC Act and subsequent regulations.

In addition to the above Pradeesheeya Saba Act and UDA act will become relevant as the approval from those agencies are necessary to construct the building.

Although it appears that the UDA and SLLRDC have permitted the reclamation of land for construction of the buildings in the vicinity of the land identified at Sri Subuthipura, the Department of Census and Statistics needs to obtain approval from UDA, SLLRDC and Kaduwela Pradeesheeya Saba

for land filling and construction works at the proposed site. It is also important to obtain approval from the Geological Survey and Mines Bureau (GS & MB) for operating new gravel quarries if the existing gravel quarries located close to the project area are not sufficient to provide the required amounts of gravel.

### **2.3 World Bank policy on environmental safeguards**

World Bank OP 4.01 requires environmental assessment (EA) of projects proposed for Bank financing to help ensure that these projects are environmentally sound and sustainable. A project is classified as Category A if it is likely to have significant adverse environmental impacts that are sensitive, diverse or unprecedented. A proposed project could be classified as Category B if its potential adverse environmental impacts on human populations or environmentally important areas including wetlands, forests, grasslands and other natural habitats are less adverse than those of Category A projects.

It is anticipated that there will not be any significant, irreversible and unprecedented adverse environmental impacts due to project activities. Therefore, this project could be classified as a Category B project for safeguards purposes.

### 3 Description of the Proposed Project

#### 3.1 General

This is a building construction project which will be used as the Head Office for Department of Census and Statistics. The land area selected to construct the buildings is about 0.8 ha (including the land allocated for The Department of Auditor General) in extent but located in a low lying area which is declared as a flood retention area by SLLRDC.

#### 3.2 Project location

The project site is located at Polduwa Road Sri Jayawardenapura Kotte near the famous “Waters Edge” golf grounds. The location of the project is given in **Figure 3.1** below. The proposed land is located at Sri Subuthipura Grama Niladari Division of Kaduwela Divisional Secretariat Division in Colombo District.

**Figure 3.1 – Project Location**



### **3.3 Description of Proposed Development**

#### **3.3.1 Project Layout Maps (Including Reclamation Activity)**

The project lay out maps and cross sectional drawings prepared according to the conditions laid out by SLLRDC are given in **Annex 5**. As the buildings will be constructed on raised foundation there will not be serious reclamation activities except for the area occupied by the building piles.

#### **3.3.2 Information on the burrow sites proposed**

As the detailed designs are still in progress details of the burrow sites have not yet been identified. Usually in this type of work the task of identification of suitable burrow pits will be entrusted to the prospective construction contractor considering the locations of the burrow pits operating at that time. As the burrow pit location will determine the haulage cost for fill and aggregate material the exact locations could only be decided at the construction stage. On inquiries made by the consultants it was found that the currently operating burrow pits are around such areas as Dekatana for earth and coarse aggregate. According to the design the soil requirements are very limited as almost the whole area will be on a raised slab on piles. It is recommended to use washed sea sand sold by SLLRDC which is now widely used for construction works. The sand piles are located at Muthurajawea. River sand also could be used from the permitted places such as Hanwella, Kaduwela, Kaluthara as GSMB permits have been given for sand mining at these places.

#### **3.3.3 Description of Reclaiming and Construction Methodologies**

##### **Reclamation Works**

As stated above and as shown in the layout plans reclamation will be carried out only in a very limited area in the building front within the limitations set out by SLLRDC. Before carrying out the building works the vegetation will be rooted out with the interspersed peaty soil in the entire area. These peaty soils will be transferred to an approved fill site with the permission of SLLRDC. The rest of the area will be filled by a very thin gravel layer (about 4”) to prepare the background and form access to the building construction works. Dump trucks, front end loaders backhoes, sheep foot rollers and such heavy machinery is need for this work.

##### **Building construction works**

The construction of buildings will include standard building construction techniques mostly using manual labour and a crane. Dump trucks will be used for material transport. As the area consists of peaty soil for the foundation works pile driving is necessary. Temporary labour huts and toilets for the labour gangs will also be necessary.

### **3.3.4 Description of the Proposed Design**

The proposed building design consists of pile foundations, concrete frame of columns and beams walls, galvanized steel sheet roof and other standard fixtures. UDA building regulations has been followed. Also some of the Green Building concepts will be adopted although the client will not go for a full fledged green building certification such as Leeds Certification.

### **3.3.5 Use of resource energy efficient concepts**

Details are provided under Section 7.2.1 (4)

## **4 Description of the Existing Environment**

### **4.1 Physical environment**

#### **4.1.1 General**

This section of the report will discuss the existing natural and socio-economic profile around the project site and existing land use pattern at Sri Subuthipura Grama Niladari Division. During the field reconnaissance, an area covering about 500 m radius from the proposed site was examined for possible environmental and social impacts. Topographic map sheets of the Survey Department (scale 1:50,000) and satellite imagery available on-line from Google maps and SLLRDC were used as a secondary information base.

#### **4.1.2 Topography,**

Geographically the area could be classified as flat terrain about 2 m above MSL. However, there is a small hillock towards to north eastern region about 0.300 km from site, and a storm water stream originates from this regions and flows in Diyawannawa lake

#### **4.1.3 Existing land use pattern**

The north western and south western region from the project site could be classified as water retention area of Diyawannawa lake, the area in this region (and within 500 m radius) also includes some untouched flood plane areas of the lake. The main stream radiating from the lake flows in the north-western direction at about 0.360 km to the nearest point (bridge across the lake along AA000 (Kollupitiya - Sri Jayawardenapura) road. Other than a few houses about 60 m from the site, “Waters edge” a recreational park and golf club are the only significant structures within the same region. In contrast to this the north eastern and south eastern regions are densely filled with buildings. Sethsiripaya building which houses important government agencies such as UDA, Road Development Authority, Ministry of Highways and Road Development is located about 0.200 km in the north eastern region.

Kollupitiya - Sri Jayawardenapura road passes within 150 m from the site on a west east direction towards Battaramulla town. Battaramulla is an urban centre with many multi story buildings, banks and shopping moles. Refer **Figure 4.1** for the details of present land use.



**Figure 4.1: Land Use Pattern of the Area**

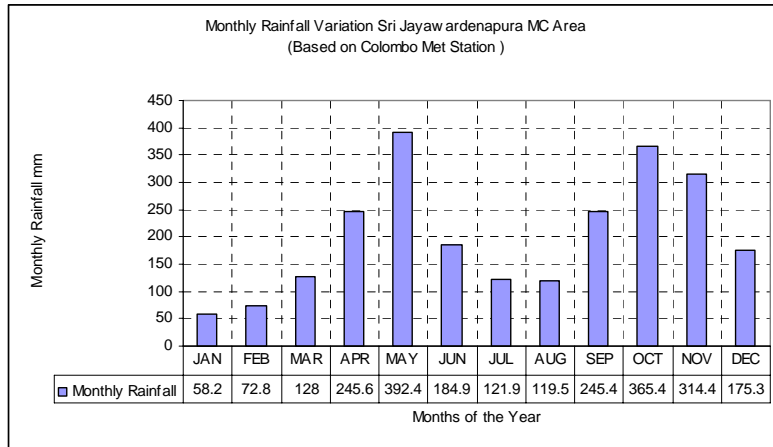
Further details about the land use (area occupied by various entities) are given in **Annex .4**.

#### **4.1.4 Hydrology climate,**

Agro-ecologically the project area is within WL3 zone which is characterized by a 75% expectancy value of annual rainfall of 2000-3000mm. mm. The area prominently belongs to the wet zone.

The average annual temperature is  $27.4C^0$  (Source Chandrapala Climate of Sri Lanka).The main rainfall seasons are the South West monsoon (May- September) and North East Monsoon (December – February) .High rainfall peaks are common in the months of May June during the South West Monsoon. Flooding takes place during these months prominently. **Figure 4.2** below shows the monthly rainfall variation in Colombo.

**Figure 4.2 Rainfall Variations in the Project Area**



#### 4.1.5 Geology and Soils,

The general terrain feature of the zone is rolling to undulating. Major soil groups found in this zone are Red Yellow Podzolic Soils with soft and hard Laterite, Low Humic Gley & Regosol soils. However, as the project area is located in a low lying land of Diyawannawa lake flood plain the major soil types within the project area are mainly Low Humic Gley & Regosol soils.

#### 4.1.6 Air quality,

Although there has not been any measurements taken on air quality in the project area, the atmosphere could be polluted with vehicular emissions as there are frequent traffic congestions along A000 road (especially near Battaramulla). According to CEA the following air quality parameters have been recorded for Fort Railway Station in February 2008. (Table 4.1)

**Table 4.1- Air Quality Details Fort Railway Station**

Emission Type	Concentration 1 Hr Average ( ppm)	SLAQI	Remark
CO	1.528	6	Good
SO <sub>2</sub>	0.041	51	Moderate
NO <sub>2</sub>	0.05	38	Good

SLAQI = Sri Lanka air Quality Index (0-50 Good, 51-100 Moderate, 101-150 Unhealthy)

The air quality of the project area could be assumed to be better than the above values as the area contains open air spaces such as Parliamentary Lake. Since the project is a building construction project there is no possibility of extra air pollution.

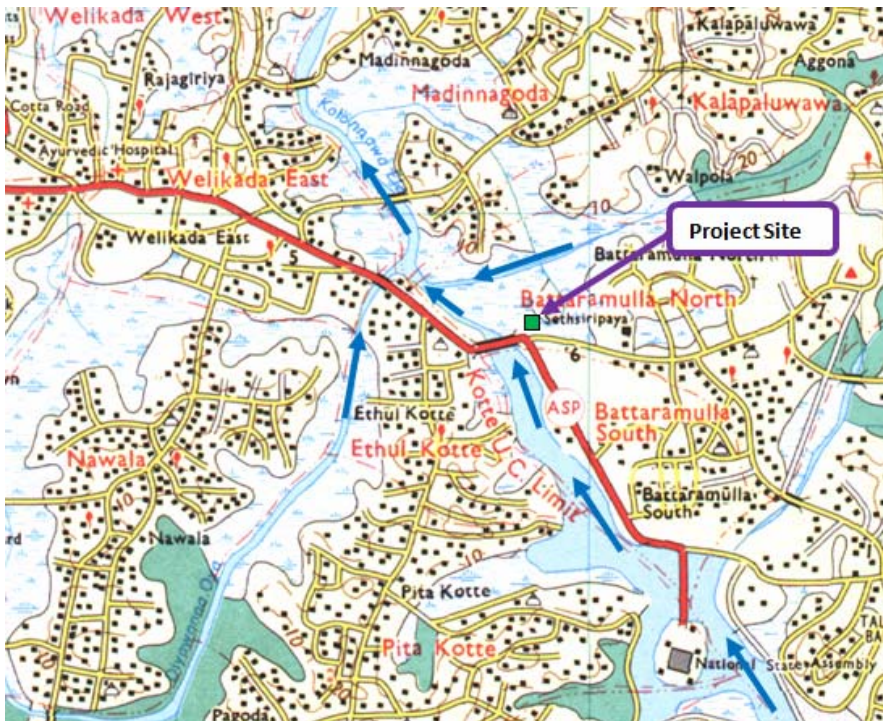
#### 4.1.7 Noise,

.As this is an urban area with commercial activities the permitted noise levels during day time is 65 db and during night time is 55db. There are no baseline noise measurements for the project area hence it is essential to measure the baseline noise levels to monitor the noise impacts caused during construction (especially pile driving activities).

#### 4.1.8 Surface water and drainage

The project site is a marshy area with a heavy growth of mainly invasive type vegetation and surface water is found at the ground level in most of the months except for very dry months such as February and August. This area is predominantly is a marshy area bounded by Kolonnawa Ela and a tributary of it. (See **Figure 4.3**). Kolonnawa Ela is connected to Kelani River which is in turn connected to sea.

**Figure 4.3 – Drainage Pattern of the Project Area**





**Marshy Areas**

**Drainage Direction**

#### **4.1.9 Role of the land as a flood retention area**

The area is subjected to flooding because of its marshy nature and the proximity to the canals. This area is virtually the flood plain of the said canals which is fed by the low lying upper catchments. This area belongs to the declared flood retention area within Colombo District as declared by SLLRDC and is sensitive in a flood control context because the marshy areas act as a flood retention buffer. However within the same contiguous flood retention area comparatively a large extent of retention area with respect to that of the project site is available

#### **4.1.10 Ground water potential**

Since the area is essentially a marshy area in the wet zone the groundwater availability is very prominent and the groundwater level is almost the ground level as the water table is very high as the groundwater reserves are recharged during most months of the year and the past few years have been wet years. According to the National Atlas of Sri Lanka 2<sup>nd</sup> Edition 2007 the groundwater aquifers in the project area is in the boundary of laterite aquifers and shallow regolith aquifers underlying deep fractured zones.

The groundwater in the area although available in abundance because of urban pollution the quality of groundwater is suspicious; hence groundwater in the area is not used for any useful purpose such as drinking.

### **4.2 Ecological environment**

#### **4.2.1 General**

Biogeographically, the proposed project area lies within the low country wet zone. Floristically it is under V (Northern wet lowland) and VIII (Wet zone freshwater bodies) floristic zone. Most of the lands in the proposed project area now under human influence and cleared for human settlements and developments. The major floristic habitats found in the proposed project area were; Marshland, Roadside Vegetation, Home Gardens and other Developments.

#### **4.2.2 Marshland**

Whole area demarcated for proposed building is a natural marshland dominated by single invasive plant species *Annona glabra* (Wel Atha / Pond Apple). Average height of the *Annona glabra* trees are about 7 m and average diameter of the trees are about 15 cm. *Syzygium caryophyllatum* (Dan), *Hibiscus tiliaceus* (Beli Patta), *Lygodium microphyllum*, *Rhynchospora corymbosa*, *Cassia alata* (Rata Torā), *Schoenoplectus grossus*, *Ludwigia perennis* are other common plant species inhabit in marshland.

**Annex 2** includes all the plant species recorded in marshland during the study with necessary information.

#### 4.2.3 Roadside Vegetation

Weedy and pioneer plant species associate with surrounding roadsides. *Achyranthes aspera* (Gas Karal Heba), *Mimosa invisa*, *Pueraria phaseoloides*, *Stachytarpheta jamaicensis* (Balu Nakuta), *Wedelia trilobata*, *Mikania cordata* (Watu Palu), *Panicum maximum* (Rata Tana) are common weedy plant species and *Macaranga peltata* (Kenda), *Trema orientalis* (Gadumba) are common pioneer plant species inhabit in roadside vegetation. **Annex 2** includes all the plant species recorded in roadside vegetation during the study with necessary information.

#### 4.2.4 Home Gardens and other Developments

*Tectona grandis* (Tekka), *Artocarpus heterophyllus* (Kos), *Artocarpus incisus* (Rata Del), *Cocos nucifera* (Pol), *Mangifera indica* (Amba), *Terminalia catappa* (Kottan), *Ficus sp.* (Nuga) are commonly planted species in surrounding home gardens and gardens of other development premises.

#### 4.2.5 Flora

A total number of 65 plant species including 1 endemic species were recorded during the field survey within the study area (Table 4.2). *Osbeckia octandra* (Heen Bowitiya) is only recorded endemic plant species found in surrounding roadside vegetation within the study area and not unique or restricted to the study area and it is common species in such habitats. Rare or threatened plant species were not recorded during the study and all recorded flora species are not unique or restricted to the project area and they are common species in such habitats. Further more than 46 % of the plant species recorded at the study area are exotic species which indicates that the area is highly disturbed due to human influence. **Annex 2** includes all the plant species recorded in the study area during the study with necessary information.

**Table 4.2: Summary of the plant species recorded during the study**

No of Species	Endemic Species	Nationally Threatened	Exotic Species
65	1 (1.5%)	0	30 (46%)

#### 4.2.6 Fauna

The fauna comprise mainly of common species that are found associated with man modified habitat. A total number of 55 faunal species (28 Birds, 16 Butterflies, 3 Dragonflies, 3 Reptiles, 1 Mammal, 3 Amphibians and 1 fish) were recorded from the study area (Table 4.3). Endemic, rare or threaten faunal

species were not recorded during the study and all recorded fauna species are not unique or restricted to the project area and they are common species in such habitats. Animal species recorded during the field study are listed in **Annex 2**.

**Table 4.3. Summary of the terrestrial faunal species recorded**

Taxonomic Group	Total Number	Endemic Species	Nationally Threatened	Exotic Species
Birds	28	0	0	0
Butterflies	16	0	0	0
Dragonflies	3	0	0	0
Reptiles	3	0	0	0
Mammals	1	0	0	0
Amphibians	3	0	0	0
Fishes	1	0	0	0
Total	55	0	0	0

*Corvus splendens* (House Crow), *Turdoides affinis* (Yellow-Billed Babbler), *Acridotheres tristis* (Common Myna), *Pycnonotus cafer* (Red-Vented Bulbul), *Nectarina zeylonica* (Purple-Rumped Sunbird), *Megalaima zeylanica* (Brown-headed Barbet), *Streptopelia chinensis* (Spotted Dove) are common bird species inhabit in the proposed project area. *Danaus chrysippus* (Plain tiger), *Euploea core* (Common crow), *Eurema hecabe* (Common grass yellow), *Junonia iphita* (Chocolate soldier), *Neptis hylas* (Common sailor), *Papilio polytes* (Common mormon) are common butterfly species and *Brachythmis contaminata* (Orange-winged Groundling) and *Neurothemis tullia* (Black Velvet-wing) are common dragonfly species inhabit in proposed project area. *Fejervarya limnocharis* (Common paddy field frog), *Euphlyctis cyanophlyctis* (Skipper frog) are common amphibian species and *Aplocheilus parvus* (Dwarf panchax) is common fish species associate with marshland in proposed project area. *Calotes versicolor* (Common Garden Lizard) is common reptile species and *Funambulus palmarum* (Palm Squirrel) is common mammal species inhabit in project area.

### 4.3 Socio-cultural environment

#### 4.3.1 Administrative Status

Province	Western
District	Colombo
Divisional Secretary	Kaduwela
Local Authority Pradeesheeya Saba)	Kaduwela
Gramaniladari Division	492 Sri Subothipura
Location	Poldoowa Road Baththaramulla

#### **4.3.2 Data Sources**

The data required assess the socio cultural environment were collected from the following sources.

- Secondary information available in the GN Officer's office for the project area
- Interviews with Grama Niladari, Divisional Secretary, Pradeesheeya Saba etc.
- Interviews with the residents of the project who live very close to the project site ( on the left hand side of Polduwa Road)

#### **4.3.3 Socio-economic Status of the Area**

The land of the proposed project site comes under Kaduwela DS in Colombo district and belongs to Sri Subothipura (492) GN Division. The population of Sri Subothipura GN division is 3031 comprising 50.5% female and 49.5% male. In the GN division 92.5% of the population is Sinhala and about 2.5% is Tamil. The religion of the majority (84%) of the population present in the Sri Subothipura GN division is Buddhism, where the second most (8%) are Catholic. The people belonging to Hindu and other are less than 1%. Refer **Annex 4** for further details.

#### **4.3.4 Availability of Infrastructure Facilities**

The main access road is Boralla – Kaduwela Public Road from Poldoowa Junction to Poldoowa (1.5 m) which is managed by Kaduwela Pradesiya Saba. Private and public transport facilities are available in the area. Majority of the community have access to the grid electricity for their day today needs.

The project area is very close to Batteramulla town and Setsiripaya office complex. The main economic activities of the project are services in the government and private offices, commercial establishments such as shops, motels, kiosks, and various types of shops and residential houses of which the occupants engage in various types of employment in Sri Jawardenapura, Colombo and suburbs. There are few upcoming high-rise and other multi storied buildings in the project area which will be used as official and residential purposes. The head office complex for the Department of Census and Statistics and the head office for Auditor General's Department will occupy the project site. Refer **Annex 4** for further details.

#### **4.3.5 Affected social groups- residents in the immediate vicinity**

The mostly affected social groups are the residents at Polduwa Road which is the main access road to the site from Batteramulla Road and the users of the Water's Edge golf course who will use the same access road (the beginning stretch). During the social consultations some the residents who live at the opposite of the project site at Polduwa Road were consulted to enlist their views regarding the likely impacts from the project and their views have been listed under **section 5.4**.

## 5 Potential Impacts of the Proposed Project

### 5.1 General

This chapter will discuss both beneficial and adverse impacts to natural environment and social environment. Most significant impacts will be discussed and the mitigation measures are provided under Environmental Monitoring and Management Plan. Impact identification will be based on construction and operational stages of the project

### 5.2 Construction Stage Impacts- Negative - Short Term

#### 5.2.1 Physical onsite impacts

##### 1. Change in local physiographic and drainage pattern due to reclamation of low land

###### General

In order to construct the new buildings at the proposed site at Battaramulla the selected land should be reclaimed at least partially. Such activity will also involve the removal of existing marsh vegetation at the selected site. As this area is located within Diyawannawa Lake flood plain, the land reclamation would cause reduction of flood retention area which will lead to aggravation of flooding and drainage problems in short term and long term.

###### Flooding and drainage

**Figure: 5.1 Flood Inundation Extents of the Greater Colombo (for Future Land Use Condition)**



The flood sensitivity of the area has been confirmed by the detailed hydrological analysis including hydraulic modeling of the Greater Colombo Basin during the flood studies by Nippon Koi Ltd. [ **Ref 1**]. Produced below is the flood inundation area map for 5 year food for the Greater Colombo Basin where the project area is situated. The map (**Figure 5.1**) indicates a scenario attached to future land use condition.

## Reduction of food retention areas by reclamation works- Disturbance to hydrology

SLLRDC has granted permission to fill only 5% portion of the land which belong to the Department of Census and Statistics. This if fully carried out will cause a marginal reduction in the retention area. The rest of the land area will not be filled.

### 2. Dust Generation

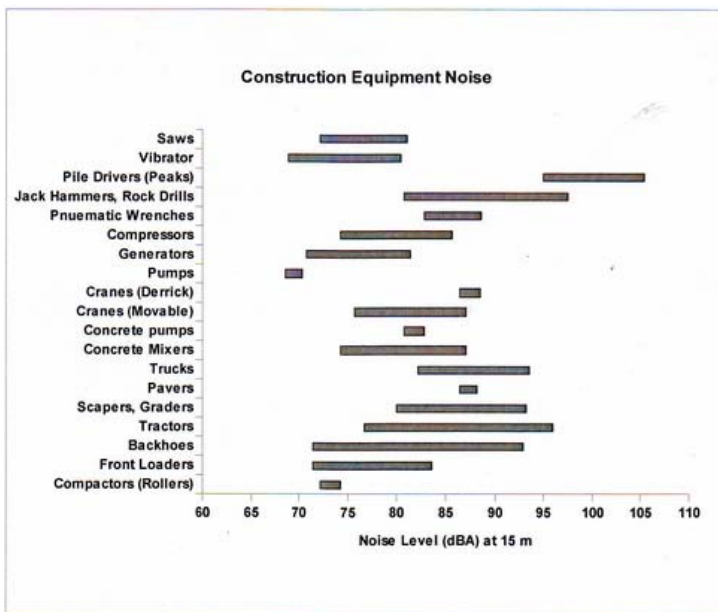
In order to fill the land gravel will be brought to the construction site and kept as soil heaps. However, if these soil/ gravel is kept for a prolonged period without any cover dust could be generated and blow towards the residential areas causing breathing problems, dusting of the residential places and associated inconveniences.

The construction vehicles and material transportation vehicles also will cause dust which will inconvenience the nearby residential areas.

### 3. Noise Generation

Dredging of existing soil, filling and compacting the dumped soil may cause noise nuisance to the residents especially on the left side of Polduwa Road. These residents will also face difficulties if other construction material such as cement, metal is kept in an open area close to the roadside. As the

foundation conditions are very weak pile driving has to be undertaken which will cause considerable noise and vibration and which will affect the nearby residential and commercial buildings. The construction vehicles and material transportation vehicles also will cause noise which will inconvenience the nearby residential areas. **Figure 5.2** given are some expected noise levels from various construction equipment.



**Figure 5.2 – Noise Level of Construction Equipment**  
(Source – EIA Havlock City Project – Ref [5]).

#### **4. Construction Waste generation**

Various construction wastes such as peaty soil, planks, steel pieces, empty cement bags, will cause inconvenience/injuries to the public and workers.

#### **5. Erosion of soil brought for filling and resulting sedimentation and stormwater runoff issues**

If the gravel brought for filling purposes are left at the site and exposed to rains during the monsoon period they could get washed off to the nearby stream and get sedimented in the low lying flood plains. Storm water congestion will take place within the site area itself which will disturb the working arrangements. Storm water congestion in the access road (Polduwa Road) will cause inconvenience to the residents.

#### **6. Surface/Groundwater contamination from temporary toilets and haphazard solid waste disposal by labour gangs**

During the construction stage labour gangs have to be deployed at the site to carry out construction work. Temporary toilets and bathing facilities will be required for these workers. The improper use of toilets, solid waste disposal will cause surface and ground water contamination. Also the waste water generated in the building compound if released untreated to nearby storm water stream it could lead to the pollution of water in Diyawannawa Lake.

#### **7. Prolong Hours of Operation**

Prolong hours of construction operations will cause undue public inconvenience, worker unrest.

### **5.2.2 Physical offsite impacts**

#### **1. Disposal of construction debris**

The dredge soil from the low land will have to be dumped away from the project site. Such dumping will cause visual segregation of such dumped area. It will also cause reduction of flood retention in the dumping area.

#### **2. Impacts to the visual environment due to gravel extraction from gravel pits**

Reclamation of the selected land will require gravel and other materials such as metal will be required for concrete works. These materials will have to be extracted from the approved burrow pits/quarries.

Unmanaged material extraction will cause visual segregation and drainage problems of such extraction sites.

### **3. Impacts on the transportation Routes**

The material (soil, metal, sand) transportation vehicles will cause dust stir in the transportation routes and also these activities will contribute to traffic congestion.

#### **5.2.3 Ecological Impacts – Onsite**

##### **1. Ecological impacts due to removal of marsh vegetation**

The selected land needs to be cleared from existing vegetation which is mainly marsh vegetation. Such activity will cause an imbalance in the existing ecological environment. The flora and fauna of the entire site will be affected as they have to be entirely removed.

#### **5.2.4 Socio Cultural Impacts - Onsite**

According to the interviews held with public the following socio cultural impacts were identified. The residents of the area cited some of these potential impacts as they are very much concerned about them.

1. Generation of dust: will disturb the surrounding environments especially during the dry period and during the wet season the access road will become muddy because of the movement of vehicles and other construction machinery. This will disturb the residents in the area who live by the side of the access road.
2. Sound pollution and vibration caused by construction equipment and material transporting vehicles will cause various mental and physical inconveniences.
3. Vibration caused by the pile driving activities may cause damages to the residential and commercial buildings and this will pose safety issues to the residents.
4. Even at present day the Sri Jayawardenapura road is congested with traffic during many hours of the day. If this road is to be used to transport construction material to the site it could lead to further increase in congestion.
5. Flooding will be increased and a proper system for drainage has to be established.
6. The access road will get damaged because of material transporting vehicles.
7. Mobility and access difficulties to the residents in the area will take place. Even though the Sri Jayawardenapura road is wide enough to accommodate heavy trucks that will bring construction materials to the site the access road to the site is much narrow. Therefore the residents who use this road may face difficulties in access to their residences.

8. Presence of outside labour gangs will cause conflicts. A construction activity of this magnitude will require extensive labour. Therefore the contractor will have to construct worker camps. Having an alien worker population in such commercial area would lead to, conflicts between workers and residents of the area.
9. Safety of workers and public will be at issue. Workers employed will have to work at high elevations and handle construction materials such as cement, concrete, steel and glass. Wiring of the new buildings also needs labour. All these operations involve a certain degree of safety risks. The building construction activity could also cause potential safety hazards to the public who move close to the construction site.

### **5.3 Operational Stage Impacts- Negative - Long Term**

#### **5.3.1 Impacts on Physical/Ecological and Socio Cultural Environment**

##### **1. The reduction of Flood Retention Area**

The reduction of flood retention area will aggravate flooding in the basin. However according to the design as the building is on raised pillars the retention area reduction is marginal.

##### **2. Rise in heat island effect and emission of green house gases**

Concrete structures usually absorb and release heat energy in quick secessions. Therefore during the day time these structures will absorb more heat energy and produce heat radiation. This heat radiation will cause difficulties to the residents living close to the building area.

##### **3. Improper Disposal of Wastewater and Sewage**

Improper disposal of wastewater and sewage will contaminate surface and groundwater emanate stench. Even sewage and wastewater is disposed through a municipal main or wastewater/sewage treatment is carried out using a sewage plant there will be similar impacts during emergencies.

##### **4. Excessive usage of energy**

Excessive amounts of energy will be required for cooling the building if the building has not been designed with sufficient ventilation systems.

##### **5. Act as breeding grounds for mosquitoes and other disease carries such as rats**

Buildings of this magnitude intend to design ponds or pools of water. If the water in such ponds is left untreated and unattended, the water will act as mosquito breeding places. This is very important as there was a recent out brake of Dengue.

Also the record rooms that keep old files are potential breeding places for rats and cockroaches.

##### **6. Add load to the existing garbage load in the Pradeshiya Saba (PS or local government)**

The new buildings will hold more than 500 persons as staff and there will be visitors on a daily basis. This will generate a lot of garbage (organic and non organic). This daily generated garbage will cause

an additional load to the daily garbage collected by the PS. This garbage will also include broken equipment which may contain harmful substances such as Mercury (Hg).

### 7. Carbon Footprint **Increase**

**Increase** of the carbon footprint because of the reduction of vegetation of the area even though the **main** vegetation types are **invasive**.

Deleted: Reduction

Deleted: Reduction

Comment [DDS1]: All plants whether invasive or not will provide some ecological value. I will put a full stop to the sentence after the word invasive

Deleted: invasive

Deleted: and common which do not have a much ecological

Deleted: value

Formatted: No underline, Font color: Auto, Highlight

Formatted: Highlight

Formatted: Font: 12 pt, Complex Script Font: 11 pt, Highlight

### 8. Alteration of the Character of the Area

The area very close to the project site in general was a residential area and its character will get changed because of these office buildings.

### 9. Accidental Fires will Cause Destruction

Accidental fires will cause damage to the building and endanger the safety of the occupants and the nearby property and residents. ,

## 5.4 Operational Stage Impacts- Positive - Long Term

1. Further increased in land value.
2. Potential for small businesses being started in the vicinity (e.g. food outlets, kiosks supply, lodging facilities, transport modes such as trishaws etc.)
3. Public convenience through centralizing government institutions
4. Creation of job opportunities for people.
5. Further development of the internal access road
6. At present the Department of Census and Statistics is isolated from the public and people have to travel a long distance to reach the existing buildings. As the new buildings are to be located close to Battaramulla, public could easily access this departments.
7. A well equipped buildings with extra facilities will assist the public and government in a more efficient and effective manner.

## 6 Analysis of Alternatives

### 6.1 No Action Alternative

No action alternative is not suitable, as the Department of Census and Statistics cannot function in its present buildings forever. According to the reasons cited under Project Justification construction of a new Head Office is necessary.

### 6.2 Site Alternatives

This site has been selected by the Urban Development Authority. Even though this site is not fully suitable for such a project in a drainage perspective as the area is located on a sensitive flood plain because of the proximity to various other Government institutions and ease of access the site is suitable in such a context. In the light of this it is not possible to compare a site alternative.

### 6.3 Technological Alternatives

Various technological alternatives are being considered during the design stage and some of the considered such alternatives were.

1. Construct the building in the entirely filled land
  2. **Construct the building in a partially filled land to ease drainage congestion**
- 
1. Use of pre cast concrete driven piles
  2. **Use of bored piles to minimize noise and vibration**
- 
1. Non use of open air spaces and full use of air conditions
  2. **Partial use of open air spaces and air conditioning to save energy and to generate thermal and psychological comfort**
- 
1. Design the buildings conventionally without using Green Building Concepts.
  2. **Use of green building concepts is far as possible to reduce environmental impacts.**

When these alternative pairs were considered the recommended alternatives are the second category (2) alternatives as those alternatives will mainly reduce environmental impacts. Further sub alternatives will be considered during the detailed design stage.

## **7 Mitigation Measures and Environmental Management Plan**

(Mitigation, monitoring, capacity development and training and implementation schedule and costs)

### **7.1 Mitigation Measures Construction Stage Impacts- Negative - Short Term**

#### **7.1.1 Physical onsite impacts**

##### **1. Change in local physiographic and drainage pattern due to reclamation of low land**

To mitigate the impact of drainage congestion and loss of retention SLLRDC has allowed only to fill an area of approximately 5% of the land and the buildings are constructed on columns to allow water ingress under the building during floods. Stormwater runoff management has to be done in four ways to mitigate the impacts rendered.

- (1) Maximizing the non filled areas and allow storm water ingress under the buildings.
- (2) Provide stormwater drain system in the filled area which will discharge water to the non filled retention area.
- (3) Carry out overall storm water management in the sub basin.
- (4) Rainwater harvesting to minimize the roof run off collection on the limited compound ( filed area)

Mitigatory measures (1) and (2) will be carried out by the project proponent under the guidance of SLLRDC while mitigatory measure (3) should be carried out by SLLRDC.

Reference was made to “Joint Master Plan for the Improvement of Retention Capacity of Diyawanna Uyana Area- January 2007 prepared by SLLRDC, CEA, UDA and Ministry of Urban Areas and Sacred Areas Development [Ref 4] “which has been prepared on the orders of the Supreme Courts related to the court order of the “Water’s Edge” case. The project area is within the Diwanua Oya basin. The report has come to a finding on studying the area capacity relationships before and after the Water’s Edge Project that the storage area of 0.75 million cubic meters before the project has increased to 0.8million cubic meters.

These findings have been further elaborated in the Final Report of the Committee Appointed under the directive of the Supreme Courts of Sri Lanka for Reconstruction and Restoration of wetlands surrounding Water’s Edge. [Ref.5]. This report has dealt with

- a. Retention capacity before and after the development of Water’s Edge.
- b. Ecology and environmental management.

- c. Encroachments and unauthorized developments.

The report has observed that the increase of the retention capacity could be further enhanced by carrying out drainage improvement measures within an outside the Water's Edge area and this includes the project area for the proposed building. The suggested further drainage improvements are;

- a. Removal of invasive vegetation in the flood plains.
- b. Removal of soil dumps from the flood plain
- c. Further capacity enhancement of canals
- d. Improvement of roadside drains and culverts.

All these mitigatory measures will reduce the impact created by the proposed filing which is relatively small when compared to the already improved retention capacity. Removal of the vegetation in the wetland marsh will also contribute to further increase of retention.

According to the JICA flood study [ Ref 1] the 50 year flood levels around the project area ( i.e. downstream of the Parliament Lake ) are as follows for the "Future Landuse Scenario" is around 2.08m MSL and according to SLLRDC sources the maximum observed flood levels ( 50 year return period) are 1.95 m MSL. Therefore the building floors will be kept around 2.5m MSL to keep flood inundation at bay.

Rainwater harvesting is now mandatory under recent UDA regulations and the rainwater collecting system will be built into the buildings. This is also one of the requirements for a Green Building.

## 2. Mitigation Measures for Dust Generation

- a. All materials should be transported under cover.
- b. For the dump trucks carrying fill materials tyre washing facilities should be established at site to avoid must patches on the road which will convert to dust after drying
- c. Continual water sprinkling should be carried out in the fill areas and the access road
- d. Fills should be watered and compacted to the specified degree of compaction.
- e. Dust masks should be provided to the labourers for the use at required times.

## 3. Mitigation Measures for Noise Generation

- a. No noise generation night work should be carried out between 6:00PM and 6:AM on the following day.
- b. All equipment should be in good serviced condition

Deleted: (need to provide a time duration)

Formatted: Font: 12 pt, Complex Script Font: 11 pt, Highlight

- c. Labour gangs should be warned to work with minimum noise. Strict labour supervision should be undertaken.
- d. Noise generating work should not be carried out during public holidays and religious days.
- e. Bored piles are more suitable than driven pre cast piles. If pre cast piling is used “Silent Piler” type equipment to reduce noise. Temporary sound barriers also should be erected.
- f. The residents should be informed on days and times in relation to activities that generate excessive noise

**4. Mitigation Measures for Construction Waste generation**

Peaty soils and vegetation including roots should be transported to an SLLRDC approved fill site. Other construction waste should be daily collected and stored in a specific place and such waste should be sent for recycling. All construction and other types of wastes should be removed from the site at least twice a week.

**5. Mitigation Measures for Erosion of soil brought for filling and resulting sedimentation and storm water runoff issues**

- a. Fills should be compacted in layers with watering to the specified degree of compaction . The degree of compaction should be more than 95%.
- b. Temporary barriers such as soil mounds, temporary drains, silt traps, etc. should be created within the site to trap silt runoff.
- c. Storing material stock piles away from water bodies (nearby stream) and covering them during rains will avoid/ minimize this impact.

Deleted: (If degree of compaction is known, please indicate it here.)

Formatted: Font: 12 pt, Complex Script Font: 11 pt, Highlight

Deleted: teraps

**6. Mitigation Measures for Surface/Groundwater contamination from temporary toilets and haphazard solid waste disposal by labour gangs**

- a. Temporary toilets should be constructed in the filled area using standard PVC or Concrete Cylindrical septic tanks. Maximum number of toilets in compatible with health and safety standards should be provided ( i.e. one toilet for 20 heads)
- b. Temporary washing and bathing facilities should also be provided to workers.
- c. All solid waste should be disposed to bins and arrangements with Kaduwela Pradeesheeya Saba should be made for garbage collection and disposal at least twice a week.

## 7. Mitigation Measures for Prolong Hours of Operation

Noise generating work should be limited to day time ~~from 6:00AM to 6:00PM~~. Other type of construction work which will not disturb the environment by noise or vibration could be carried out during the night time. Even during day time use of the access road should be minimized during departure times (7:00AM to 8:30AM), school time (1:00PM-2:00PM) and arrival times (After 4:30PM -6:00PM).

Deleted: work should be

Deleted: (indicate from-to

Formatted: Font: 12 pt, Complex Script Font: 11 pt, Highlight

## 8. Mitigation Measures for Damage to the Road due to Heavy Vehicle Use

The access road to the site and even main road could get damaged from material transportation vehicles. Some construction equipment such as bulldozers, pay loaders, dump trucks etc. could damage the access road to the site from Batteramulla Road. All such damages should be immediately restored at the expense of the project proponent. This matter also could be discussed with Kaduwela Pradeesheeya Saba and suitable arrangements should be made.

Comment [DDS2]: Please provide some measures such as maintaining the road to a better condition

Deleted: ¶

### 7.1.2 Mitigation Measures for Physical offsite impacts

## 4. Mitigation Measures for Disposal of construction debris

The dump sites should be closed by a soil layer and compacted and necessary drainage measures such as peripheral drains, silt traps should be provided. This mitigatory measure should be carried out by SLLRDC and Pradeesheeya Saba. ICTAD specifications [Ref 7] should be followed for such reclamation work. Spoil and other disposal materials should only be removed from site with prior approval from relevant authorities. The contractor should avoid any spillage of spoil when transporting such materials to the approved material dumping sites. Vehicles should be fully covered when transporting these material.

## 5. Mitigation Measures for Impacts to the visual environment due to gravel extraction from gravel pits

Once the gravel pit operations are over the ground should be made even without keeping large pits to avoid mosquito breeding. Reserved top soil layers should be re-spread in the area. ICTAD

Comment [DDS3]: What about mitigation measures for issues such as possible mosquito breeding and soil erosion?

specifications [Ref 7] should be followed for such finishing work. [The soil layers should be compacted and drainage paths should be created to avoid soil erosion.](#)

This mitigatory measure should be carried out by the respective gravel pit/quarry operator with the help of Pradeesheeya Saba.

## 6. Mitigation Measures for Impacts on the transportation Routes

All materials should be transported under cover. Rush hours should be avoided for transportation of materials..

### 7.1.3 Mitigation Measures for Ecological Impacts – Onsite

#### 1. Mitigation Measures for Ecological impacts due to removal of marsh vegetation

Suitable compensatory landscaping should be undertaken in the project area with the help of Pradeesheeya Saba. This type of activity is outside the project scope but the project proponent could assist SLLRDC Pradeesheeya saba to carry out such work under a [different project. However the project proponent should carry out landscaping as far as possible within his project premises.](#)

**Comment [DDS4]:** I do not completely agree on this suggestion. The AGD should do some tree planting within the premises.

### 7.1.4 Mitigation Measures for Socio Cultural Impacts - Onsite

According to the interviews held with public the following socio cultural impacts were identified. The residents of the area cited some of these potential impacts as they are very much concerned about them. Mitigation of these impacts carefully is essential.

1. **Generation of dust:** Use mitigatory measures already described for reduction of dust generation.
2. **Sound pollution and vibration caused by construction equipment and material transporting vehicles:** Use mitigatory measures already described for reduction of noise generation.
3. **Vibration caused by the pile driving activities:** All affect residents will be provided with the pile driving details. If pile driving is undertaken crack surveys should be carried out and information should be recorded in photographs, records etc. This activity should be carried out in collaboration with Grama Niladari, Divisional Secretary and National Building Research Organisation (NBRO) and the pile driving experts. If cracks are caused to buildings they should be restored to the original condition. Necessary compensation provisions have to be made in the project finances. Standard third party insurances, bonds should be obtained from the contractor. Measurement of baseline noise levels is necessary.

Important

4. **Traffic Congestion:** Avoid rush hours for material transportation.
5. **Flooding-** Mitigatory measures have already been provided under 7.1.1 (1).
6. **Access road damage because of material transporting vehicles-** Necessary contractual provisions should be made to make financial deposits in Pradeesheeya Saba for the road damage restoration.
7. **Mobility and access difficulties to the residents:** Rush hours should be avoided. Work programmes related to material transport should be discussed and agreed with the residents.
8. **Presence of outside labour gangs will cause conflicts.** – Strict labour supervision should be undertaken. There should be labour awareness programmes to educate the labourers about their general behavior while at work. Labour supervisors should establish a general rapport with the residents.
9. **Safety of workers and public will be at issue.** Work should be executed according to the safety regulations in Factory Ordinance and Labour Department. There should be third party insurances. Workers should be provided safety belts, helmets, gloves etc. Necessary barriers, warning signs, area demarcations should be carried out according to standard construction practice. Safety nets should also be used to cover the building.

## **7.2 Mitigation Measures for Operational Stage Impacts- Negative - Long Term**

### **7.2.1 Mitigation Measures for Impacts on Physical/Ecological and Socio Cultural Environment**

#### **1. Mitigation Measures for The reduction of Flood Retention Area**

Mitigatory measures have been already described under construction impacts.

#### **2. Mitigation Measures for Rise in heat island effect.**

Roofing sheets, tinted glasses for windows with light reflection qualities will be used.

#### **3. Mitigation Measures for Improper Disposal of Wastewater and Sewage**

a. Use of municipal sewers for sewage disposal

##### **b. Use of sewerage plant**

The plant is proposed to be located as a suspended structure from the raised ground floor level. Discharge path for the treated grey water is marked in the drawing attached and the final discharging point will be to a small canal approx: 400m away from the site.

The quality of the treated effluent discharge will be maintained below the following limits.

- BOD 5 = 30mg / l
- COD = 250 mg / l
- S.S = 50 mg / l
- PH = 6 - 8.5

As such the treated effluent will comply with the CEA standards for tolerance limits for the discharge of industrial waste in to inland surface waters ( Gazette Extraordinary of the democratic socialist Republic of Sri Lanka - No 1534 / 18, 2008. 02 . 01) .Further at least 50% Of the treated effluent will be reused for plant irrigation within the site premises itself.As illustrated in the flow diagram, the following treatment methods will be used to treat the sewage to the required standards.

1. Effluent collection / Equalization.
2. Anaerobic treatment
3. Aerobic Treatment
4. Clarification.
5. Chlorination  
Sludge Digestion

Details of the sewerage plant are presented in Annex 7.

- c. Use of emergency septic tanks for the use in case of emergencies such as a broken sewer or the sewerage plant.

The presently proposed option is to use sewerage treatment plant as given above. However emergency septic tanks also will be recommended which could be cleared by Pradesheeya Saba using gully suckers when filled.

#### **4. Mitigation Measures for Excessive usage of energy**

- a. Use of open air spaces.
- b. Use of split type air conditioners only at necessary places.
- c. Use of large doors and windows for ventilation
- d. Use of energy saving CFL lighting
- e. Use of spot lighting to light the necessary functional areas
- f. Use of solar energy for garden lighting

#### **5. Mitigation Measures for Act as breeding grounds for mosquitoes and other disease carries such as rats**

- a. Fixing of water fountains for water circulation and aeration
- b. Fish breeding in ponds
- c. Use of pest control methods.

#### **6. Mitigation Measures for Add load to the existing garbage load in the Pradeshiya Saba (PS or local government)**

The PS has to charge additional fees and handle the additional load. Hazardous waste should be disposed to a CEA approved site.

#### **7. Mitigation Measures for Carbon Footprint Reduction**

Compensatory landscaping should be carried out in the Project Area . Financial contributions could be paid to UDA to carry out landscaping work.

#### **8. Mitigation Measures for Alteration of the Character of the Area**

As this project are done according to the Government Policy and UDA development plans. This impact was a view expressed by the residents close to the building. If the residents wish they could be resettled elsewhere under a different programme. However this activity is not within the ambit of this project.

#### **9. Accidental Fires will Cause Destruction**

Design main building components for fire resistance, provide emergency exits, warning signs, provide suitable firefighting equipment, pay a fee and get registered under Colombo Municipal Council (CMC) to get emergency fire services, display the telephone numbers of CMC fire fighting unit and Fire Brigade. Obtain approval from Fire Department CMC for the design of firefighting equipment.

### **7.3 Green building concepts- Resource sustainability and energy efficiency**

It is recommended to design the building as far as possible to suit the following broad prerequisites cited under LEEDS Reference Guide [**Ref 2**].

- (1) **Sustainable site:** Reduction of overall transportation requirements- compatible with the concept of shifting offices to Sri Jayawardenapura area. Planting sustainable landscaping plant which will require minimum irrigation. Storm water management will be undertaken. Use light reflecting material such as steel roofing sheets, glazed windows to reduce heat island effect should be undertaken.
- (2) **Water efficiency-** Use of water efficient fixtures e.g. dual flushing cisterns, use of auto shut off taps, electronic controls. Use of a municipal sewer or a sewerage plant. Partial use of well water from a dug well and necessary investigations will be carried out. Rainwater harvesting will also be carried out for the use of toilet flushes.
- (3) **Energy and atmosphere-** Use of open air spaces to reduce air conditioning requirements, use of CFL energy saving lighting, use of solar lighting for at least garden lights

- (4) **Materials and resources**- Construction waste management, Recycled content, certified wood, use of non volatile organic compounds (VOC).
- (5) **Indoor air quality**- Provision of daylight and views,
- (6) **Innovation in design**- Not directly applicable as this building is predominantly in conventional nature though some of the requirements will be met.
- (7) **Regional priority**- Not strictly applicable to this building as it is a specific LEEDS point system related criteria.

## 7.4 Environmental Monitoring and Management

### 7.4.1 General

The Environmental Management Action Plan (EMAP) is developed to avoid/ minimize the adverse impacts to the physical, biological and social environments during construction and operational stages of the project. The EMAP presented in **Annex 0**- has been prepared taking in to account the adverse impacts discussed in the previous chapter and the proposed respective mitigatory measures.

The EMAP should form part of the respective bid document and the implementation of the EMAP will be the responsibility of the contractor/s and the executing agency will oversee the effectiveness of the implementation of the EMAP.

### 7.4.2 Institutional responsibilities and environmental management plan

The Environmental Management Plan should be executed under the following institutional arrangement.

- The implementation of mitigation actions lie with the contractor
- The main responsibility of Monitoring and ensure Management will lie with the Project Proponent ( DCS) and the appointed “Engineer” – Resident Engineer ( or Resident Project Manager). The DCS should facilitate the contractor in obtaining necessary clearances,
- An Inter Agency Committee comprising the following should be appointed from the representatives of the following agencies – SLLRDC, UDA, Pradesheeya Saba ( CEA Environmental Officer).

Deleted:

Deleted:

#### **7.4.3 Cost estimates for the implementation of proposed measures**

Costs are given under the EMP.

#### **7.4.4 Capacity Development and Training**

During the construction stage DCS should hire necessary Engineers, Contractors and Environmental Officer and during the operation stage a Maintenance Officer should be hired who has knowledge about the environmentally related tasks. Further training should be provided to him in this regard.

## **8 Inter agency, public and NGO consultation**

Various concerned line agencies such as Divisional Secretary, Pradeesheeya Saba, and SLLRDC and the residents living close to the building site (on the left side of Polduwa Road) were consulted and their concerns recorded. Details regarding floods and stormwater drainage aspects of the area were obtained from SLLRDC. Officers of the Department of Census and statistics were also consulted as their head office building is proposed to be constructed in the adjoining premises of the same marshy land.

## **9 Conclusions and Recommendations**

### **9.1 Conclusions**

It could be concluded that this construction project will not render very adverse immitigable environment impacts therefore the project belongs to Category B project according to World Bank classification. Most of the impacts are mitigable using actions stipulated in the Environmental Management Plan.

### **9.2 Recommendations**

1. Execution of the project is recommended with the proposed mitigatory measures and monitoring/management requirements.
2. All necessary contractual provisions and stipulations regarding mitigatory measures should be included in the contract documents prepared for construction work. The environmental monitoring plan provided could be used in this regard. Additional cost items for these should be specified in the bill of quantities if the need arises.
3. It is recommended that environmental monitoring be undertaken by Department of Census and Statistics under the supervision and guidance of an interagency committee as proposed under the Monitoring Program.
4. The social impact caused by pile driving activities should be mitigated with extra care.

## 10 List of references and report prepares

### 10.1 References

1. The Study on Stormwater Drainage Plan for the Colombo Metropolitan Region – Final Report (1) – Master Plan- JICA – Nippon Koi Ltd. Japan
2. Green Building – Design and Construction – LEEDS reference guide for the Green Buildings Design and Construction – for the Design and Construction and Major Renovations of Commercial and Institutional Buildings
3. Nation Atlas of Sri Lanka – 2<sup>nd</sup> Edition – 2008.
4. Joint Master Plan for the Improvement of Retention Capacity of Diyawanna Uyana Area- January 2007 prepared by SLLRDC, CEA, UDA and Ministry of Urban Areas and Sacred Areas Development.
5. Final Report of the Committee Appointed under the directive of the Supreme Courts of Sri Lanka for Reconstruction and Restoration of wetlands surrounding Water’s Edge- Sri Lanka Land Reclamation and Development Corporation-2009.
6. Environmental Impact Assessment Havelock City Project – EML Consultants -2008.
7. ICTAD Specifications for Reclamation Works -1999

### 10.2 List of Report Preparers

Responsible Person	Qualifications	Work Allocation
D A J Ranwala	BSc.(Eng ), M.Eng, FIE(SL), C.Eng , MIEP	<b>Team Leader</b> EA team direction, report writing, hydrological & drainage aspects, construction aspects.
Chintaka Wijewardena	B.Sc (Management)	<b>Sociological Assistant</b>  Assessment of social impacts and concerns
Nalinda Peiris	B.Sc (Biology)	<b>Ecologist</b> Carry out field reconnaissance related to ecological aspects (flora and fauna.)

## **ANNEXES**

### **Annex 0 - Environmental Management Plan**

## **Annex 1: Terms of Reference**

### **Terms of Reference for Environmental Assessment Study**

#### **Construction and equipping a building to house the Auditor General's Department and Department of Census and Statistics under the Public Sector Capacity Building Project**

##### **1. Background and Introduction**

The World Bank financed, Public Sector Capacity Building Project's development objective is to enhance the effectiveness, efficiency and productivity of two key public sector agencies, Department of Census and Statistics (DCS) and Auditor General's Department (AGD), through an investment package that includes organizational strengthening, capacity building, information management, communication improvements, physical and information technology infrastructure, and Information and Communication Technology (ICT) support. There are two components of the project, namely (1) upgrading statistical capacity and (2) improving auditing standards. Under the component two, the project supports the construction and equipping of a modern building to house AGD and DCS on a state land.

The AGD and DCS propose to reclaim an area of low-lying land in Sri Subuthipura to site the proposed AGD and DCS buildings. The lands have already been acquired by the AGD and DCS. While the applications have been lodged by the AGD and DCS, the proposed site is yet to meet the urban planning requirements under the Urban Development Authority (UDA) and Sri Lanka Land Reclamation and Development Corporation (SLLRDC). The project can only commence once these approvals are obtained and requirements of the Environmental Safeguards Management Framework (ESMF) agreed between the Government of Sri Lanka and the World Bank are satisfied.

##### **2. Objective**

The objective of this study is to ensure that an EA report is prepared documenting and assessing the impacts that may arise as a result of this proposed development including the reclamation of land and construction activities. An EMP for the mitigation of any identified negative environmental impacts will be prepared as part of the EA.

Projects and Programmes financed with IDA resources need to comply with World Bank operational policies. Accordingly, the components and activities eligible for funding under this project will be required to satisfy the World Bank's safeguard policies, in addition to conforming to environmental legislation of the Government of Sri Lanka (GOSL). As a condition of the ESMF, the Environmental Checklists for assessing the suitability of the sites selected for the construction work of the AGD and

DCS under the project was completed by the AGD and DCS. According to the findings of the checklists and subsequent site verification, it is not anticipated that there will be significant and/or irreversible adverse environmental and social impacts. However, the sites that have been selected for construction are low-lying lands adjacent to each other, which require land filling preceding construction activities, which could result in a storm water drainage problem on sites and in the immediate surrounding area. While there is no environmental assessment prerequisites as per the GOSL environmental polices for the construction of an office building in such locations, there are World Bank requirements to be fulfilled as identified in ESMF in the event land filling is required on site. While it appears that the UDA and SLLRDC have permitted the reclamation of land for construction of buildings in the vicinity of the land identified by the AGD and DCS, and AGD and DCS are awaiting approval for the identified sites from both the UDA and SLLRDC. The World Bank requires a site-specific Environmental Assessment (EA) prepared for these sites as agreed with GOSL in the ESMF prior to the commencement of reclamation activities. An EA is required to assess if the proposed reclamation will have any irreversible impacts and once there is adequate mitigation measures implemented, the World Bank will provide their concurrence for the reclamation to take place.

It has been agreed with the World Bank that a joint assessment will be conducted by the AGD and DCS, as the two lands are next to each other and have similar land features and similar interventions.

### **3. Study Area**

The lands identified for development is located in Sri Subuthipura Grama Niladari Division of Kaduwela Divisional Secretariat Division in Colombo District. The land is 0.8ha of low-lying area, which the AGD and DCS propose to reclaim by filling for constructing the building. The study will focus the proposed site as well as an area covering at least 500m radius from the site.

### **4. Scope of Work**

The consultant or the consultancy firm will carry out an Environmental Assessment and develop a report including an Environmental Management Plan as specified below.

#### ***Task 1 - Description of the Proposed Development Intervention:***

1.1 Provide a brief description of the relevant parts of the project with special focus on the proposed development, using maps at appropriate scale and including information on location, general layout and land use pattern within the study area.

1.2 Explain why, for whom and by whom the EA has been prepared, including the following:

- statement of need
- summary of all approvals required and status of applications
- individuals and groups consulted in the preparation of EA

1.3 Describe the development including the following:

- a plan showing the locations, layouts, scale and appearance of the reclamation activity
- information of the burrow sites proposed
- a description of the reclaiming and construction methodologies to be used
- a description of the proposed design of the building and use of resource/energy efficient concepts in the building

***Task 2 – Description of the Environment:***

2.1 Assemble, evaluate and present in brief, baseline data on physical, biological and socio-cultural environment within the specified study area. Special emphasis needs to be given to assess the surface and groundwater hydrology of the site and the surroundings, in particular to the role the specified study area plays as a flood/storm water retention area.

***Task 3 – Determination of the Potential Impacts of the Proposed Project:***

3.1 Identify potential significant impacts due to proposed development (including reclamation and building construction). In this analysis, distinguish between positive and negative impacts, direct and indirect impacts and immediate and long-term impacts. Clearly identify the potential impacts that may arise due to the loss of the low lying area (when reclaimed) as a flood/storm water retention area. Describe any uncertainties/assumptions associated with the predictions. This should also include:

- the suitability of design, reclamation, drainage and construction techniques
- impacts due to the reclamation and construction period activities such as transportation, hours of operation, noise and its impacts on a predominantly residential area, storm-water runoff and its management, dredging activities (if needed), removal of vegetation, disturbance to soil, disturbance to hydrology, burrow sites, etc.
- long-term effects to the hydrology and possible effects due to proposed technique of sewage disposal and grey water management.
- socio-economic effects on the surrounding neighbourhood

***Task 4 – Assess the proposed building design for resource/energy efficiency***

4.1 Identify to what extent the proposed building design has incorporated the use of green building concepts such as resource sustainability and energy efficiency. If designs have not yet reached that stage, provide guidelines that can be used in the conceptualization of the building design. The consultant is expected to liaise with building designers in this respect.

***Task 5 – Development of Environmental Management and Monitoring Plan***

5.1 Recommend feasible and cost-effective measures to prevent or reduce significant negative impacts to acceptable levels. Special emphasis should be given to the development of appropriate drainage systems to ensure that the loss of the flood retention/storm water storage service currently provided by the low lying lands to be reclaimed, will not adversely impact the surrounding area by increased flood potential. Visual inspections of the specified lands to be reclaimed is indicative of a high

groundwater table, therefore special attention needs to be paid to the sewage and grey water disposal system.

5.2 Provide cost estimates for the implementation of the proposed measures

5.3 With the inputs of AGD and DCS identify the responsible parties for each department for the implementation and monitoring of the proposed mitigation measures

5.4 Prepare detailed monitoring plans for each department to monitor the implementation of mitigation measures and the impacts of the projects during construction and operations

## 5. Deliverable and Time Schedule

The assessment is to be conducted as a combination of desk research, field study and consultations. The consultant or the consultancy firm should prepare a report to capture the EA and EMP in the formats provided in the Annex A and B respectively. The overall report should be concise, limited to significant environmental issues and focused on the tasks described in Section 4.

The duration of the assignment is for one and a half months. Time schedule for deliverables from the date of signing the contract is as following:

Sharing the details of the findings (potential environmental impacts) with the relevant staff of AGD and IDA Environmental Specialists	Within week 3
First draft of EA report including the EMP for AGD and IDA for review and comments	Within of week 4
Draft review and comments by AGD and IDA	Within of week 5
Final EA report and EMP submission to AGD	End of week 6

## 6. Qualifications

The consultant or the consultancy firm should be adequately qualified and have prior experience in conducting and developing the required deliverable satisfactorily and timely manner. Experience in designing drainage

systems, particularly for reclaimed land that served as flood retention areas is required. Prior experience in developing EAs and EMPs for World Bank funded projects will be beneficial.

### **EA Report Format ( Annex A)**

Provide an EA report that is concise and limited to significant environmental issues. The main text should focus on findings, conclusions and recommended actions, supported by summaries of the data collected and citations for any references used in interpreting those data. Detailed or uninterrupted data are not appropriate in the main text and should be presented in appendices or a separate volume. Unpublished documents used in the assessment may not be readily available and should also be assembled in an appendix. Organize the environmental assessment report according to the outline below.

- Executive Summary
- Policy, Legal and Administrative Framework
- Description of the Proposed Project
- Description of the Environment
- Significant Environmental Impacts
- Analysis of Alternatives
- Environmental Management Plan, including mitigation, monitoring, capacity development and training and implementation schedule and costs
- Inter-Agency and Public/NGO Consultation
- List of References
  
- Appendices:
  - List of Environmental Assessment Preparers;
  - Records of Inter-Agency and Public/NGO Communications;
  - Data and Unpublished Reference Documents.

### **Environmental Management Plan**

## **(Annex B)**

Based on the Environmental Assessment (EA) conducted, and Environmental Management Plan (EMP) will be developed that will indicate the impacts predicted, mitigation measures to minimize the impacts, identify the institutional arrangements for undertaking the mitigation measures and monitoring arrangements, implementation schedules of the mitigation arrangements and reporting requirements and cost estimates and sources of funds. The basic elements of the EMP are mentioned below.

- A description of possible adverse effects that the assessment is intended to deal with;
- A description of planned mitigation measures, and how and when they should be implemented, including relevant agencies from where approvals, permits and licences are needed;
- A program for monitoring the environmental effects of the project, both positive and negative and responsible parties for monitoring;
- A description of who will be responsible for implementing the mitigation measures; and
- A cost estimate and source of funds.

The EMP should also include specific guidelines for debris disposal as well as resource extraction (sand, timber, metal), if such may take place for all specific construction activities financed under the Project, as well as identified lists of sites for dumping and resource extraction. If resources are to be taken from commercial establishments, EMP should guide to ensure resources are taken always from authorized companies with necessary permits and licences.

## Annex 2: List of Flora and Fauna

### ABBREVATIONS

N – Native

<b>Bird</b>			
<b>Family</b>	<b>Species</b>	<b>Local Name</b>	<b>Status</b>
Accipitridae	<i>Haliastur indus</i>	Brahminy Kite	N
Alcedinidae	<i>Alcedo atthis</i>	Common Kingfisher	N
Alcedinidae	<i>Halcyon smyrnensis</i>	White-throated Kingfisher	N
Ardeidae	<i>Ardea purpurea</i>	Purple Heron	N
Ardeidae	<i>Ardeola grayii</i>	Pond Heron	N
Ardeidae	<i>Bubulcus ibis</i>	Cattle Egret	N
Ardeidae	<i>Casmerodius albus</i>	Great Egret	N
Centropodidae	<i>Centropus sinensis</i>	Greater Coucal	N
Charadriidae	<i>Vanellus indicus</i>	Red-wattled Lapwing	N
Columbidae	<i>Columba livia</i>	Rock Pigeon	N
Columbidae	<i>Streptopelia chinensis</i>	Spotted Dove	N
Corvidae	<i>Corvus splendens</i>	House Crow	N
Corvidae	<i>Dicrurus caeruleus</i>	White-bellied Drongo	N
Corvidae	<i>Oriolus xanthornus</i>	Black-hooded Oriole	N
Cuculidae	<i>Eudynamys scolopacea</i>	Asian Koel	N
Magalaimidae	<i>Megalaima zeylanica</i>	Brown-headed Barbet	N
Meropidae	<i>Merops orientalis</i>	Green Bee-eater	N
Muscicapidae	<i>Copsychus saularis</i>	Oriental Magpie Robin	N
Nectariniidae	<i>Dicaeum erythrorhynchos</i>	Pale-billed Flowerpecker	N
Nectariniidae	<i>Nectarina lotenia</i>	Loten's Sunbird	N
Nectariniidae	<i>Nectarina zeylonica</i>	Purple-rumped Sunbird	N
Passeridae	<i>Anthus rufulus</i>	Paddyfield Pipit	N

Passeridae	<i>Passer domesticus</i>	House Sparrow	N
Pycnonotidae	<i>Pycnonotus cafer</i>	Red-vented Bulbul	N
Rallidae	<i>Amauornis phoenicurus</i>	White-breasted Waterhen	N
Sturnidae	<i>Acridotheres tristis</i>	Common Myna	N
Sylviidae	<i>Orthotomus sutorius</i>	Common Tailorbird	N
Sylviidae	<i>Turdoides affinis</i>	Yellow-billed Babbler	N
	<b>Butterfly</b>		
<b>Family</b>	<b>Species</b>	<b>Local Name</b>	<b>Status</b>
Lycaenidae	<i>Chilades pandava</i>	Plains Cupid	N
Lycaenidae	<i>Zizina otis</i>	Lesser Grass Blue	N
Nymphalidae	<i>Acraea violae</i>	Tawny costor	N
Nymphalidae	<i>Danaus chrysippus</i>	Plain tiger	N
Nymphalidae	<i>Euploea core</i>	Common crow	N
Nymphalidae	<i>Eurema hecabe</i>	Common grass yellow	N
Nymphalidae	<i>Junonia atlites</i>	Grey pansy	N
Nymphalidae	<i>Junonia iphita</i>	Chocolate soldier	N
Nymphalidae	<i>Neptis hylas</i>	Common sailor	N
Nymphalidae	<i>Ypthima ceylonica</i>	White four-ring	N
Papilionidae	<i>Pachliopta hector</i>	Crimson rose	N
Papilionidae	<i>Papilio polytes</i>	Common mormon	N
Pieridae	<i>Appias paulina</i>	Lesser albatross	N
Pieridae	<i>Catopsilia pomona</i>	Lemon emigrant	N
Pieridae	<i>Delias eucharis</i>	Jezebel	N
Pieridae	<i>Leptosia nina</i>	Psyche	N
	<b>Dragonflies</b>		



## Terrestrial and Aquatic Flora Recorded

### ABBREVIATIONS

**HA** – Habit, **T** – Tree, **S** – Shrub, **H** – Herbaceous, **C** – Climber or Creeper, **TS** – Taxonomic Status, **E** – Endemic, **N** – Native, **I** – Introduced, **CS** – Conservation Status, **MS** – Marshland, **RS** – Roadsides, **HG** – Home Gardens

Family	Species	Local Name	HA	TS	CS	MS	RS	HG
Amaranthaceae	<i>Achyranthes aspera</i>	Gas Karal Heba	H	N			1	
Amaranthaceae	<i>Amaranthus viridis</i>	Kura Tampala	H	N			1	
Anacardiaceae	<i>Mangifera indica</i>	Amba	T	I				1
Annonaceae	<i>Annona glabra</i>	Wel Atha	T	I		1		
Araceae	<i>Alocasia macrorrhizos</i>	Habarala	H	I			1	
Araceae	<i>Colocasia esculenta</i>	Gahala	H	N		1		
Arecaceae	<i>Cocos nucifera</i>	Pol	T	N				1
Asteraceae	<i>Ageratum conyzoides</i>	Hulan tala	H	I			1	
Asteraceae	<i>Eclipta prostrata</i>	Kikirindiya	H	N			1	
Asteraceae	<i>Eupatorium odoratum</i>	Podisinnamaran	S	I			1	
Asteraceae	<i>Mikania cordata</i>	Watu Palu	C	I		1	1	
Asteraceae	<i>Struchium sparganophorum</i>		H	I			1	
Asteraceae	<i>Tridax procumbens</i>		H	I			1	
Asteraceae	<i>Vernonia cinerea</i>	Monara Kudumbiya	H	N			1	
Asteraceae	<i>Wedelia trilobata</i>		H	I			1	
Azollaceae	<i>Azolla pinnata</i>		H	N		1		
Capparaceae	<i>Cleome rutidosperma</i>		H	I			1	
Combretaceae	<i>Terminalia catappa</i>	Kottan	T	I				1
Commelinaceae	<i>Commelina sp.</i>		H	N			1	

Family	Species	Local Name	HA	TS	CS	MS	RS	HG
Convolvulaceae	<i>Cuscuta chinensis</i>	Aga Mula Neti Wel	C	N		1		
Convolvulaceae	<i>Ipomoea aquatica</i>	Kankun	C	N		1		
Convolvulaceae	<i>Merremia umbellata</i>	Kiri Madu	C	N			1	
Cyperaceae	<i>Cyperus spp.</i>		H	N		1		
Cyperaceae	<i>Eleocharis spp.</i>		H	N		1		
Cyperaceae	<i>Fimbristylis spp.</i>		H	N		1		
Cyperaceae	<i>Rhynchospora corymbosa</i>		H	N		1		
Cyperaceae	<i>Schoenoplectus grossus</i>		H	N		1		
Euphorbiaceae	<i>Croton hirtus</i>		H	I			1	
Euphorbiaceae	<i>Macaranga peltata</i>	Kenda	T	N			1	
Euphorbiaceae	<i>Ricinus communis</i>	Beheth Endaru	S	I			1	
Fabaceae	<i>Cassia alata</i>	Rata Tora	T	I		1		
Fabaceae	<i>Desmodium triflorum</i>	Undupiyaliya	H	N			1	
Fabaceae	<i>Mimosa invisa</i>		H	I			1	
Fabaceae	<i>Mimosa pudica</i>	Nidikumba	H	I			1	
Fabaceae	<i>Pueraria phaseoloides</i>		C	I			1	
Lamiaceae	<i>Hyptis suaveolens</i>		S	I			1	
Lamiaceae	<i>Leucas zeylanica</i>	Thumba	H	N			1	
Malvaceae	<i>Hibiscus tiliaceus</i>	Beli Patta	T	N		1		
Malvaceae	<i>Sida acuta</i>	Gas Bevila	H	N			1	
Malvaceae	<i>Urena lobata</i>	Patta Epala	S	N			1	
Malvaceae	<i>Urena sinuata</i>	Heen Epala	S	N			1	
Melastomataceae	<i>Osbeckia octandra</i>	Heen Bowitiya	S	E			1	
Moraceae	<i>Artocarpus heterophyllus</i>	Kos	T	I				1
Moraceae	<i>Artocarpus incisus</i>	Del	T	I				1
Moraceae	<i>Ficus sp.</i>	Nuga	T	N				1
Musaceae	<i>Musa x paradisiaca</i>	Kesel	T	I				1

Family	Species	Local Name	HA	TS	CS	MS	RS	HG
Myrtaceae	<i>Syzygium caryophyllatum</i>	Dan	T	N		1		
Myrtaceae	<i>Syzygium malaccense</i>	Pini Jambu	T	I				1
Onagraceae	<i>Ludwigia perennis</i>		H	N		1		
Onagraceae	<i>Ludwigia peruviana</i>		H	I		1		
Oxalidaceae	<i>Oxalis barrelieri</i>		H	I			1	
Passifloraceae	<i>Passiflora foetida</i>		C	I			1	
Perkeriaceae	<i>Ceratopteris thalictroides</i>		H	N		1		
Poaceae	<i>Axonopus compressus</i>	Potu Tana	H	I			1	
Poaceae	<i>Cynodon dactylon</i>	Ruha	H	N			1	
Poaceae	<i>Eleusine indica</i>	Bela Tana	H	N			1	
Poaceae	<i>Panicum maximum</i>	rata tana	H	I			1	
Pontederiaceae	<i>Monochoria vaginalis</i>	Jabara	H	N		1		
Rubiaceae	<i>Nauclea orientalis</i>	Bakmi	T	N		1		
Schizaeaceae	<i>Lygodium microphyllum</i>		C	N		1		
Scrophulariaceae	<i>Scoparia dulcis</i>		H	I			1	
Thelypteridaceae	<i>Cyclosorus interruptus</i>		H	N		1		
Ulmaceae	<i>Trema orientalis</i>	Gadumba	T	N			1	
Verbenaceae	<i>Stachytarpheta jamaicensis</i>	Balu Nakuta	H	I			1	
Verbenaceae	<i>Tectona grandis</i>	Thekka	T	I				1

**Annex 3: List of interviewees**

<b>No</b>	<b>Name</b>	<b>Sex</b>	<b>Age</b>	<b>Occupation</b>	<b>Date of Consultation</b>
1	U K S Mihindupura	Male	48	Divisional Secretary	2/08/2009
2	J M K Prianthi	Fe male	35	Ds Planning Officer	2/08/2009
3	Upuli Palhewa	Fe male	33	Management Assistant	2/08/2009
4	R A S Somarathna	Fe male	36	Grama Niladari 492 Sri Subothipura	23/07/2009
5	Asanka Perera	Male	49	Resident-Polduwa Road	22/07/2009
6	W V D Lionel	Male	49	Resident-Polduwa Road	22/07/2009
7	Sarath Weerasingha	Male	48	Resident-Polduwa Road	22/07/2009
8	Mahindra Coorey	Male	45	Resident-Polduwa Road	22/07/2009
9	Chandrasiri Pathirana	Male	32	Resident-Polduwa Road	22/07/2009
10	Agith Wasantha	Male	26	Resident-Polduwa Road	23/07/2009

#### Annex 4: Population Statistics, Details of Infrastructure and Land Use

##### Population

No	Ds	GN	Near Area
Population	244679	3031	100
Male	120178	1501	45
Female	124501	1529	55
No of Family	56891	705	40
No of House			

(Data Source Sampath Pathikada Kaduwela DS)

##### Ethnicity

	Ds	GN	Near Place
Sinhala	235894	2809	90
Tamil	4648	75	2
Muslim	1564	38	2
Burger	1134	9	
Malay	1116	35	
Chatty	82	3	
Other	212	15	6

(Data Source Sampath Pathikada Kaduwela DS)

##### Religion

Religion	Ds	GN	Near Place
Buddhist	224125	2551	82
Hindu	2800	86	2
Catholic	11694	234	
Slam	3280	102	2
Kristi on	2517	41	8
Other	199	10	6

(Data Source Sampath Pathikada Kaduwela DS)

##### Cultural Value

	Near Place
Buddhist Center	1
Kovil	1

(Data Source Sampath Pathikada Kaduwela DS)

### Infrastructure

Item	Description /Availability
Road	A Road & C1 Road
Bus services	Available
School	Government & Private School Available (Within 2 Km )
Hospital	Government & Private Hospital Available (Within 2 Km )
Play Ground	Available
Community Center	Available
Post office	Government & Private Post office Available
Police Station	
Bank	Government & Private banks Available
Electricity	Grid Electricity
Water	Tap Water available

### Land Use

Occupation	GN
	M
House	4700
Business Building	305
Other Building	175
Play Ground	25
Cultivation	1800
Forest	185
Reservation	
Road	875
Water Bodies	530
Institute	175

(Data Source Sampath Pathikada Kaduwela DS)

**Annex 5- Detailed Building Plans**

**Annex 6- SLLRDC's Conditional Approval Letter**

**Annex 7- Details of the Sewerage Plant**