CHAPTER 6 Extended Cost and Benefit Analysis

6.1 Introduction

6.1.1 Background

This chapter presents the extended cost-benefit analysis (ECBA) of the proposed LRT Project. The purpose of the ECBA is to assess the economic viability of the project once the environmental and social costs and benefits reported in the EIA of the project had been incorporated into the analysis. The EIA of the project has identified environmental and social impacts that could lead to benefits and costs—i.e. positive or negative effects—to the economy. The ECBA is based on the principles of discounted cash flow analysis. The standard investment assessment criteria of net present value (NPV), cost-benefit ratio (CBR) and internal rates of return (IRR) were used as decision rules of the analysis.

6.1.2 Nature of the Investment and Economic Contribution of the Project

The project involves investments leading to establishment of new mode of transport currently not available in the multi-modal transport network in the Colombo Metropolitan Area. The necessity of LRT network has been identified in the Megapolis Transport Master Plan (MTMP) published in 2016 as a rapid transit system (RTS) to ease the peak hour traffic congestion and resultant passenger difficulties, especially in Central Business District (CBD) areas. The MTMP proposed a network of seven RTS routes (RTS1-RTS7) that connects CBD as well as suburban areas based on a comprehensive methodology that has taken major trip generation points, major trip attraction points and minimum spanning tree into consideration. The project involves substantial cost of capital investments on civil works for construction of the line including stations and depot area, cost of acquiring rolling stocks as well as operational costs of running the system.

The MTMP has carried out a detailed economic evaluation for the entire Plan based on output parameters of comprehensive demand forecast modelling exercise that covered the whole system of multi-modal transport network using a scenario based approach. However, the MTMP recommended undertaking detailed economic analysis in project feasibility studies to ascertain true economic value of each individual project implemented under it.

The proposed LRT line for Malabe traffic corridor from the Fort station to Depot station combines certain sections of RTS 1 and RTS 4 thereby connecting CBD with suburban areas. Out of seven major traffic corridors that enter the Colombo city, Malabe corridor has the largest volume of traffic and the lowest travel speed at peak hours which was estimated at 13.8 km/h. Shifting and expansion of government office complexes in Battaramulla, Malabe and Akuregoda areas are further increasing the demand for transport facilities in this corridor at a rapid rate. Currently, there is no rail-based public transport connection available for this traffic corridor.

The LRT Project opens a new mode of transport for passengers in this corridor in an elevated track that can operate on regular basis without being obstructed by traffic conditions in the existing road transport facilities. It will increase the capacity of total transit system while simultaneously reducing the burden of overloading the existing transit facilities by attracting passengers especially from modes of private transport such as cars, motorcycles and three wheelers. Hence, the project offers a modal choice for passengers with faster connectivity, low travel time, increased safety and comfort to their destinations.

The LRT was selected as a mode of environmental sustainable transport, one of the four major principles considered in the preparation of WRMTMP. The LRT is an electric-powered system with no or minimum emissions during its operations. Simultaneously, reduced use of emission-

intensive private transport modes and decreased traffic congestions can be expected to generate further reductions in emissions that can be considered as a major environmental benefit of the project.

6.2 Methodology of the ECBA

This section describes the general methodology adopted in undertaking the ECBA. It discusses data sources used, key steps of evaluation, standards and assumptions and decision criteria used for evaluation.

6.2.1 Data Sources of ECBA

The key data sources used for the ECBA are draft final report of the Feasibility Study[1] prepared by the expert team of Oriental Consultants Global Co., Japan, draft final report of EIA Study[1] and Resettlement Action Plan (RAP)[2] prepared by the Consulting Engineers and Architects Associated (Pvt) Ltd., Sri Lanka. The feasibility study team has undertaken an economic evaluation of the project using output parameters of the demand forecast modelling study and other relevant economic data from secondary sources. Even though this evaluation has not considered all environmental and social impacts identified in the EIA, the experts have also estimated emission reduction benefits of the project. The EIA and RAP studies have identified environmental and social impacts of the project during construction and implementation phases. The ECBA is mainly based on information from these study reports. In addition, key members of expert teams were consulted time-to-time for clarifications and further information.

6.2.2 Key Steps

Key steps of the ECBA of KHRP included the following steps:

- ≠ Extracting the required base data on project costs and benefits from the demand forecast analysis and the feasibility study
- ≠ Identifying environmental social impacts reported from the current EIA and SIA and determining whether they represent cost (negative impacts) or benefits (positive impacts)
- ≠ Acquiring required information on economically measurable impacts (costs and benefits) from experts of EIA and SIA teams and evaluating costs and benefits of environmental and social impacts using appropriate methods
- ≠ Carrying out ECBA, incorporating extended cost and benefits identified in EIA and SIA to estimate standard project evaluation parameters —i.e. NPV, CBR and IRR
- ≠ Undertaking sensitivity analysis of CBA taking alternative scenarios of benefits and costs in to consideration

6.3 Standards and Assumptions used in ECBA

The list of assumptions and standards adopted in the ECBA is given in the Table 6.1.

Table 6.1 Major Assumptions and Standards for ECBA

Parameter	Standard/Assumption	Remarks
Discount rate	12%	This is the standard rate used in CBA of the project feasibility study and ECBA of many similar projects and is based on the historical movement of the interest rates in the country.
Evaluation period	2018-2024 for construction and 30 years (2025-2054) for operations	Cost estimates for the construction were available for given number of years and consistent with the usual standards applied for similar projects.
Price year	2017 constant prices	This is a new trace and EIA for it will be completed in early 2018
Prices	Shadow prices were used.	Standard practice adopted in economic analysis. Shadow conversion factors used in the CBA of the project feasibility study were applied
Numeraire currency	LKR	Standard used in the CBA and ECBA of previous traces
Treatment of inflation	Constant prices excluding inflation was used	Standard practice adopted in economic analysis

6.4 Decision Criteria

The three decision criteria considered in the ECBA are:

- ≠ Net Present Value (NPV)
- ≠ Benefit Cost Ratio (BCR)
- ≠ Internal Rate of Return (IRR)

6.4.1 Net Present Value

The Net Present Value (NPV) measures the actual or real net economic benefit of the project. The NPV is calculated by subtracting the discounted costs from the discounted benefits. All projects with a positive NPV provide a net economic benefit and are economically justified. The NPV should be used when comparing mutually exclusive project options. The option with the highest NPV is the economically preferred option.

The formula applied for calculating NPV is as follows:

$$NPV = \sum_{t=1}^{n} \frac{(B_t - C_t)}{(1+r)^t}$$

Wherein,

B= Net annual benefits

C = Net annual costs

r = discount rate

6.4.2 Benefit Cost Ratio (BCR)

The Benefit Cost Ratio (BCR) is the ratio of the present value of benefits to the present value of costs and measures the relative net gain of the proposed expenditure. The BCR will be greater than 1 whenever discounted benefits exceed discounted costs. A project with a BCR above 1, provides a net economic gain and is therefore it is economically justified. In a budget constrained environment, projects should be prioritized according to their BCRs. The project with the higher BCR is expected to provide the greatest benefit per dollar invested and hence it should receive priority in the allocation of funding. This will ensure the efficient allocation of scarce resources.

The formula applied for computing BCR is as follows:

$$BCR = \sum_{i=1}^{n} \frac{B_i}{(1+r)^i} \Big/ \sum_{i=1}^{n} \frac{C_i}{(1+r)^i}$$

6.4.3 Internal Rate of Return (IRR)

Internal Rate of Return (IRR) is the discount rate at which the present value of benefits equals the present value of costs (where NPV equals zero). It measures the rate of return of benefits to costs. If the IRR is greater than the interest rate that would otherwise be the rate of return for the funds invested in the project concerned and it is considered as a sound investment.

6.5 Costs of the Project

(Note: Information cannot be disclosed due to confidentiality.)

6.6 Benefits of the Project

The project generates both transport and environmental benefits to the national economy. The LRT project being a transport sector project, transport benefits can naturally be considered as the most important category of the benefits.

6.6.1 Transport-related Benefits of the Project

In the Project Feasibility Study, the following transport system benefits have been identified as the key benefits of the project.

- Vehicle operation cost savings
- Travel time cost savings
- Savings of accident costs

(1) Vehicle Operations Cost Savings

Vehicle operating costs (VOC) are the costs associated with the running of a motor vehicle such as fuel, oil, tires, repair and maintenance and depreciation costs. Smooth vehicle running conditions created due to operation of LRT against the base case situation of the existing road network can be expected generate VOC savings as main economic benefit. General formula for estimating Vehicle Operating Cost Savings can be given as follows.

$$VOC\ savings = Total\ VKT\ by\ vehicle\ class \times \Delta\ unit\ OC\ per\ vehicle\ km\ by\ vehicle\ class$$

Wherein,
VKT = Vehicle km travelled
Δ Unit OC = Difference in unit operating cost between base case and LRT

The unit vehicle operating costs (VOC) were derived based on 'Assessing Public Investment in the Transport Sector 2001' by the Department of National Planning, Ministry of Finance and Planning, Sri Lanka. The price was converted to 2017 price based on the Colombo Consumer Price Index (CPI) of the transport sector. Unit vehicle operating cost estimated by the representative vehicles and operating speed in 2017 prices is shown in Annex P Table 6.

(2) Travel Time Savings

Savings in travel time is a primary economic benefit sought from many transport sector projects. These savings are enjoyed by passengers as well as freight consignees. A main benefit predicted by traffic demand models for users of LRT is travel time savings. The general formula used for estimating travel time savings is as follows.

$$TT\ savings = \Delta\ VHT\ by\ vehicle\ class \times VT\ per\ vehicle\ hour\ by\ vehicle\ class$$

ΔVHT = Difference in vehicle hours travelled between the base case and KHRP
VT = Value of time per vehicle hour by vehicle class

Hourly travel time value of passengers was estimated for three income groups based on the results of the Home Visit Survey (HVS 2013) conducted in 2013 by the CoMTrans Project and the Household Income and Expenditure Survey 2012 (HIES 2012) by the Department of Census and Statistics. Income categories were identified by the HVS considering vehicle ownership and mode choice characteristics. The mean household income was estimated by the HIES 2012. It is assumed that the future value of time by income class is consistent throughout the analysis period. The following table presents the time value of workers average trip for three income categories in 2017 prices.

Table 6.5 Hourly Value of Time by Income Group

Income Level (LKR)	Mean Household Monthly Income	Avg. No. of Workers in household	Time Value of Work Trip (LKR/h)	Work Trip Ratio	Avg. Time Value (LKR/h)
>80,000	231076	1.9	1129	23%	572
40,000-79,999	70516	1.72	381	16%	169
<40,000	29802	1.2	231	15%	100
All	87343	1.36	596	16%	265

(3) Savings of Accident Costs

Compared with situation of the existing road network (base case), reduced number of accidents is another advantage of the LRT. This results in the economic benefit of accident cost savings. The accident loss was estimated by the method proposed in 'Assessing Public Investment in the Transport Sector 2001' by the Ministry of Finance and Planning. Assumptions on the accident loss estimation are shown in Annex P Table 7. The unit accident cost per vehicle-kilometre in 1999 was converted to the 2017 value. It is assumed that traffic accidents will decline 4% every year.

6.6.2 Environmental Benefits of the Project

The major environmental benefit that can be expected from the LRT project is reduction of emissions due to modal shift from private vehicles to LRT and low traffic congestion. This could lead to improved public health and climate change mitigation due to reduction of GHG emissions.

(1) Reduction of CO_2 Emissions

For the analysis, assessment year was set at 2035 to evaluate the potential GHG emission reduction, covering both construction and operation phases. Project activities considered in the analysis and the corresponding quantification methods employed are summarized in Table 6.6

Table 6.6 Analysis Scope and Quantification Methods

Project Phase	Activities	Quantification Method
Construction	Carbon loss from disturbance on grassland by construction of depot area	Estimated by multiplying total biomass (including above- and belowground biomass in Depot construction site) and carbon fraction value to convert dry matter to carbon
Operation	Decrease of fossil fuel consumption by modal shift of passenger from existing transportation modes (e.g. buses, private car, taxi, motorbike) to LRT (Light Rail Transit)	Determined as the difference between the GHG emission of baseline activity (existing mode of transportation, e.g. buses, private car, taxi, motorbike) and project activity (e.g. LRT.).
	Increase of electricity consumption in the operation of LRT	Estimated by multiplying annual electricity consumption associated with the operation of the LRT and CO_2 emission factor of the grid electricity.

Source: JICA Study Team

Parameters considered, and conversion factors used for the analysis are summarized in Annex P Tables 2, 4 and 5. Results indicate that during construction phase, carbon loss from disturbance on grassland by depot construction is estimated to be 436.8 t-CO2e. On the other hand, during operation phase, CO2 reduction in year 2035 is estimated to be 77,184 t-CO2e/y. In order to convert the estimated GHG emission data into monetary value, carbon emission reduction credit value under the Clean Development Mechanism (CDM) has been adopted. As of October 20, 2018, the credit value is 0.19 Euro/t -CO2e. Therefore, the Project will incur cost of approximately 83EUR (approximately LKR 14,850[1]) due to GHG emission during construction; and will yield savings (positive) equivalent to approximately 14,665 EUR (approximately LKR Million 2.768) in 2035 due to GHG emission reduction. These values were incorporated in the Project's Cost and Benefit Analysis.

6.6.3 Summary of Project Benefits

According to the above estimates, the LRT project can be expected to generate LKR Billion 3,920.51 of total undiscounted benefits over 30 years period (Table 6.7) The highest share of benefits is due to travel time savings which amounts to 67% of the total benefits. The lowest share of benefits is due to reduction of emissions.

Table 6.7 Summary of Benefits of the LRT Project

Benefits	Total undiscounted value for the project evaluation period (LKR Billion)
Travel time savings	2,617.1
Vehicle operating cost savings	1,290.4
Saving of accident costs	12.9
Emission reduction benefits	0.1136
Total	3,920.51

6.6.4 Other Unquantified Benefits

In addition, following benefits can be expected due to establishment of LRT. However, they were not included in the cost benefit analysis due to lack of data for making reliable estimates.

Table 6.8 Unquantified Benefits Expected from the Project

Benefits	Remarks
Benefits during construction period	
Employment (direct + indirect) Direct Indirect	LRT project is a large scale construction project and during the construction period it is expected that a significant number of employment opportunities (direct + indirect) will be created.
Benefits after implementation of the project	
Real estate market value gains	It is expected that commissioning of LRT will bring in an upward push to real estate prices located along the route and surrounding areas.
Employment benefits Direct Indirect	LRT will generate additional employment opportunities after commissioning of the road for management and maintenance of the system

6.7 Calculation of Benefit Cost Ratios (BCR), NPV, and IRR

BCR, ENPV and EIRR were calculated applying the assumptions mentioned in Table 6.1. The Discount Rate used in the analysis was 12%. As in the usual case of large-scale infrastructure projects, capital investment of the LRT project is high at the initial stage (construction period 2017-2024). Thereafter, the project starts generating transport and environmental benefits to the national economy. The estimated BCR, ENPV and EIRR values are given in Table 6.9.

Table 6.9 ECBA Results

Decision Criteria	
BCR	**2.15**
ENPV (Billion LKR)	**169.0**
EIRR (%)	**20.2 %**

Note: E-Denotes “Environmental”

Estimated ENPV was 169.0 billion LKR. The values of EIRR and BCR were 20.2% and 2.15, respectively. Since the project records a positive ENPV together with EIRR exceeding the discount rate of 12% and BCR over 1, the project can be identified as an economically viable project.

6.7.1 Sensitivity Testing

A sensitivity testing was carried out under three adverse scenarios.

- Scenario 1: Benefits are reduced by 10%
- Scenario 2: Costs are increased by 10%
- Scenario 3: Costs are increased by 10% and benefits are reduced by 10%

The estimated BCR, ENPV and EIRR values are given in Table 6.10. It indicates economic feasibility under selected scenarios thereby confirming the resilience of the project under adverse economic conditions.

Table 6.10 Sensitivity Analysis Results

Parameter	Base Case	Benefit -10%	Cost +10%	Benefit -10% Cost +10%
EIRR	20.2%	18.9%	19.1%	17.8%
ENPV (Billion LKR)	169.0	137.4	154.3	122.7
BCR	2.15	1.93	1.95	1.75

6.8 Conclusion

The results of the ECBA (refer to Table 6.9 and Table 6.10) show the ENPV, EIRR and BCR values of the project under the base case and three selected adverse scenarios. It indicates that even under the worst scenario of 10 % cost escalation plus 10% benefit reductions; the BCR values are greater than 1.75. The EIRR value (17.8%) is higher than the discount rate and the project reports a positive ENPV of LKR Billion 122.7. Therefore, the proposed LRT project in Colombo can be considered as an economically viable project that can be recommended for implementation.

CHAPTER 7 Environmental Management and Monitoring Plan

7.1 General

The Environmental Management Plan (EMP) and Environmental Monitoring Plan (EMoP) (EMMP) are developed to avoid and/or minimize the adverse impacts to the physical, biological and social environments during construction and operational stages of the project. The EMMP presented in Annex Q has been prepared taking into account the adverse impacts and the proposed respective mitigation measures to minimize such impacts.

The EMMP will form part of the respective bid documents and it will be a part and parcel of the contract after contract award. The implementation of the EMMP will be the responsibility of the contractor/s and the executing agency (The Project Proponent) through the PMU will oversee the effectiveness of the implementation of the EMMP in collaboration with other agencies.

7.2 Institutional Responsibilities

The Environmental Monitoring Plan will be executed under the following institutional arrangement.

The implementation of mitigation actions lies with the EPC contractor during construction stage and the O&M Company during operational stage under the supervision of the Project Proponent, the Ministry of Megapolis and Western Development (MMWD)

The main responsibility for monitoring the project activities will lie with the Project Proponent (MMWD) assisted by the Project Management Unit (PMU) of LRT Project, under the appointed "Engineer" – Resident Engineer (or Resident Project Manager) and the Environmental Manager working under the above setup. The PMU will facilitate the contractors in carrying out the required work.

An Inter-Agency Committee comprising the following line agencies will be appointed for the monitoring of project activities. This may include the following – Urban Development Authority (UDA), Colombo Municipal Council (CMC), Kotte Municipal Council, Kaduwela Municipal Council, Central Environmental Authority(CEA), Divisional Secretaries (DSs) of the 4 DS Divisions (Colombo, Thimbirigasyaya, Kotte and Kaduwela), National Water Supply and Drainage Board (NWS&DB), Ceylon Electricity Board (CEB), Sri Lanka Telecom(SLT), Sri Lanka Railway (SLR), Sri Lanka Land Reclamation and Development Corporation and Department of Agrarian Development.

7.3 Contractual Requirements

The EMP and EMoP will be included in the Bid Documents, as part of the Project Requirements. The Bidders will be advised to carefully consider the EMP and EMoP requirements when preparing the bid and pricing the items of work.

In case, the Contractor or his Sub Contractors fails to implement the said requirements after informing in writing, the PMU will take whatever actions it is deemed necessary to ensure that the EMP is properly implemented. If the Contractor/Sub-contractor still fails to comply with these requirements, the PMU may levy a penalty based on the level of non-compliance, cost incurred to

rectify the damages caused by such negligence and/or recover the cost from Contractor's payments.

7.4 Refinement of the EMMP

The EMMP will be further refined after the contract award based on the "Method Statement" of the Contractor, while considering the specific contract execution methods and the results of the Detailed Design.

7.5 Reporting Procedure

During the construction stage, the Contractor is responsible to report the progress of Environmental Compliance to the MMWD (PMU) on monthly basis and MMWD (PMU) will submit progress report on Environmental Compliance to JICA and CEA on quarterly basis.

During the operational stage, O&M Company is responsible to report the progress of Environmental Compliance and will submit progress report on Environmental Compliance to JICA and CEA on twice a year.

7.6 Environmental Management Plan and Environment Monitoring Plan

The EMMP consists of two parts the Environmental Management Plan and the Environmental Monitoring Plan. The Management Plan for pre-construction /construction stage and operation stage are shown in Annex Q – Table 1 and Annex Q – Table 2 respectively. The Monitoring Plan for pre-construction /contraction stage and operation stage are shown in Annex Q – Table 3 and Annex Q – Table 4 respectively.

CHAPTER 8 Conclusion and Recommendations

8.1 Conclusion

The Environmental Impact Assessment for the proposed project has revealed that the potential impacts of the project take place mainly during the construction phase, and that the possible environmental impacts during the operational stage is minimal. However, there are landscape impacts due to the presence of LRT system such as on ceremonial access to Parliament (from Rajagiriya to Diyatha), Diyatha Uyana area and Depot Malabe.

The number of houses and commercial establishments to be relocated due to the proposed project is relatively low, since a major portion of the LRT route traverses in the middle of the already existing road network. Such building demolition is mainly needed in the bends of the LRT at road intersections. Most of the affected structures are commercial in nature and livelihood of owners, tenants and employees in those structures will be affected.

On the other hand, the LRT project could have positive impacts on ambient air quality due to the reduction in the number of vehicles on the road. The LRT is a low-emission solution by itself compared to even a usual fossil fuel driven train. The environmental impact of the LRT during the operational period will be minimal except for the noise and vibration which too could be mitigated.

The Extended Cost Benefit Analysis of the project indicated that the proposed LRT project for Malabe traffic corridor can be considered as an economically viable project suitable for implementation.

It could be concluded that the project will have some mitigable impacts during construction and mitigable low impacts during the operational stage.

8.2 Recommendations

It is recommended that the proposed LRT project from Colombo Fort to Malabe is implemented as a solution to the traffic congestion of Borella Malabe corridor, to provide passengers with a safe comfortable quick mode of transport, which has the added benefit of being environmentally friendly.

The EIA report's mitigation measures and EMMP will be made part and parcel of the tender documents for the construction work and in turn of the construction contract. The responsibility of environmental impact mitigation will be borne by the Project Proponent while the implementation of such mitigation measures will be carried by the Contractor (through contractual arrangements) under the supervision of PMU and CEA's monitoring mechanisms.

LIST OF REFERANCES

Chapter 1

[1] Colombo Metropolitan Area is defined as area covered by the following Municipal Councils: Colombo, Thimbirigasyaya, Sri Jayawardenapura Kotte, Kaduwela, Dehiwala-Mount Lavinia and Moratuwa, and surrounding suburbs.

Chapter 3

[1] Wijesundara S. (2010) Invasive Alien Flora of Sri Lanka. In Invasive Alien Species - Strengthening Capacity to Control Introduction and Spread in Sri Lanka. Marambe, B., Silva, P., Wijesundara, S., and Atapattu N. (eds.) Biodiversity Secretariat of the Ministry of Environment. Sri Lanka.

[2] Conservation Status of a sanctuary: A sanctuary is declared to ensure the protection of wildlife in private lands which are outside the state claim. Therefore sanctuaries may include private lands and permits are not required to enter) According to the IUCN system of classifying protected areas, a Sanctuary is a Category VI protected area.

[3] An Environmental Protection Area [EPA], is declared to regulate activities in private lands which are outside the state claim where the enforcing agency, the Central Environmental Authority shall exercise, perform and discharge any powers, duties, functions related to planning and development, within such protection areas.

Chapter 4

[1] Investigation on characteristics of noise generated by pilling activity, K.M. Lisan (ICSBE 2016)

[2] California Department of Transportation 2013, Transportation and Construction Vibration Guidance Manual, Sacramento, CA, p. 17. Referring to: Hendriks, R 2002. *Transportation related earthborne vibration (Caltrans experience)*. California Department of Transportation. Sacramento, CA.

[3] This vibration level is set at a higher value compared to 81dB, in order to take a conservative approach in the calculations.

[4] Conversion was calculated by using the acceleration of vibration [$L=20\log(a/a_o)$] (unit in dB), converting this into velocity [$V=(GA)/(2\pi F)$] (unit in mm/s), and correcting the value by multiplying RMS (root mean square) for waveforms.

[5] California Department of Transportation 2013, Transportation and Construction Vibration Guidance Manual, Sacramento, CA, p. 17. Referring to: Hendriks, R 2002. *Transportation related earthborne vibration (Caltrans experience)*. California Department of Transportation. Sacramento, CA.

Chapter 6

[1] *Preparatory Study on the Project for Establishment of New Rail Transit System in Colombo* submitted for approval of the JICA
[2] *Environmental Impact Assessment for Colombo Light Rail Transit (LRT) Project* prepared for submission of CEA.
[3] *Resettlement Action Plan for Colombo Light Rail Transit (LRT) Project* (unpublished)

[4] Conversion rate for Euro to Sri Lankan Rupee is 178.89, according to the Central Bank of Sri Lanka (as of 1 December 2017).

MCA	Multi Criteria Analysis
MOT	Ministry of Transport
MRT	Mass Rapid Transit
MmTH	Multimodal Transport Hub
MMWD	Ministry of Megapolis and Western Development
MSL	Mean Sea Level
MW	Mawatha
NEA	National Environmental Act
NO_2	Nitrogen Dioxide
NPV	Net Present Value
NSW EPA	New South Wales - Environmental Protection Agency
NT	Near Threatened
NWSDB	National Water Supply and Drainage Board
O&M	Operation and Maintenance
OCC	Operation Control Centre
ODA	Official Development Assistance
O/L	Ordinary Level
PAA	Project Approving Agencies
PAP	Project Affected People
P&R	Park and Ride
PC	Pre-stressed Concrete
PHC	Pre-Tensioned Spun High Strength Concrete
PIWQS	Proposed Inland Water Quality Standards
PM10	Particulate Matter (10 micrometers or less in diameter)
PMU	Project Management Unit
PSD	Platform Screen Door
PP	Project Proponent
PPE	Personal Protective Equipment
PPHPD	Passenger Per Hour, Per Direction
PPP	Public-Private Partnership
RAP	Resettlement Action Plan
RBL	Rating background level
RC	Reinforced Concrete
RDA	Road Development Authority

ROW	Right of Way
RRI	Route Relay Interlocking System
RSS	Receiving Substation
RTS	Rapid Transit System
RTU	Remote Terminal Unit
SJKMC	Sri Jayawardhanapura Kotte Municipal Council
SLLRDC	Sri Lanka Land Reclamation and Development Corporation
SLR	Sri Lanka Railway
SLS	Sri Lankan Standard
SLT	Sri Lanka Telecom
SO2	Sulphur Dioxide
SRM	Standard Reken Method
SSS	Service Substation
STEP	Special Term for Economic Partnership
TEC	Technical Evaluation Committee
TOD	Transit Oriented Development
TOR	Terms of Reference
TSS	Total Suspended Solids
TSS	Traction Substation
UDA	Urban Development Authority
UITP	International Organisation for Public Transport
VVVF	Variable Voltage Variable Frequency
VU	Vulnerable
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

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මහා නගර හා බස්නාහිර සංවර්ධන අමාත්‍යාංශය (MMWD)
இலங்கை ஜனநாயக சோசலிச குடியரசின் அரசாங்கம்
மாநகர மற்றும் மேல்மாகாண அபிவிருத்தி அமைச்சு (MMWD)
Government of the Democratic Socialist Republic of Sri Lanka
Ministry of Megapolis and Western Development (MMWD)

කොළඹ සැහැල්ලු දුම්රිය සංක්‍රමණ ව්‍යාපෘතිය සඳහා වූ පාරිසරික බලපෑම් ඇගයීම් වාර්තාව

கொழும்பு இலகு புகையிரத ட்ரான்ஸிட் (LRT) செயற்திட்டத்துக்கான சுற்றாடல் தாக்க மதிப்பீட்டு அறிக்கை

ENVIRONMENTAL IMPACT ASSESSMENT FOR COLOMBO LIGHT RAIL TRANSIT(LRT) PROJECT

ඇමුණුම් / ANNEXURES / பின்னிணைப்புகள்

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Submitted to;
Central Environmental Authority

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List of Annexures:

Annexure A **TOR for EIA study**

Annexure B **Correspondence with relevant agencies**

1. Concurrence letter of Road Development Authority
2. Concurrence letter of Road Development Authority Land acquisitions
3. Concurrence letter of Ministry of Transport & Civil Aviation
4. Concurrence letter of National Water Supply and Drainage Board
5. Concurrence letter of National Water Supply & Drainage Board sewer disposal
6. Concurrence letter of Sri Lanka Land Reclamation & Development Corporation
7. Concurrence letter of SLLRDC for construction waste disposal
8. Concurrence letter of Colombo Municipal Council
9. Concurrence letter of Colombo Municipal council for solid waste & sewer disposal
10. Concurrence letter of Sri Jayawardanapura Kotte Municipal council
11. Concurrence letter of Sri Jayawardanapura Kotte Municipal council for solid waste & sewer disposal
12. Concurrence letter of Kaduwela Municipal council
13. Concurrence letter of Kaduwela Kotte Municipal council for solid waste & sewer disposal
14. Concurrence letter of Archeological Department
15. Concurrence letter of Department of Agrarian Development
16. Concurrence letter of Department of Wildlife Conservation 1
17. Concurrence letter of Department of Wildlife Conservation 2
18. Concurrence letter of Ceylon Electricity board
19. Concurrence letter of Department of Irrigation
20. Concurrence letter of Sri Lanka Telecom
21. Concurrence letter of Dialog
22. Concurrence letter of INSEE for solid waste

Annex C **Traffic Impact Study**

Annex D **Noise Measurement Survey**

Annex E **Water Quality Survey**

Annex F **Bo Tree Survey**

Annex G **Utility Map**

Annex H **Biological Survey**

Annex I **Cabinet Memorandum on the Adoption of LARC system for the LRT project**

Annex J **Summary of Stakeholder Meetings**

Annex K **Noise Modeling**

Annex L **Flood Modelling**

Annex A

TOR for EIA study

TERMS OF REFERENCE

(This ToR is valid only for one and half years from the date of issue)

This ToR has been issued by the Central Environmental Authority (CEA) only as a means of providing guidance for preparation of the Environmental Impact Assessment (EIA) report for the proposed project. Required information on impacts, mitigation measures etc. which will be useful in decision making should be incorporated in the EIA report based on the findings of the EIA study.

Issuance of the ToR does not in any way reflect an agreement on the part of the CEA regarding the granting of approval for the project. It is the responsibility of the project proponent to clear any issues regarding land ownership and to obtain approvals required from agencies other than the CEA. In the case where the project is to be sited on state land we recommend obtaining "in principle" approval of the land owner, prior to embarking on the EIA report preparation. The CEA will not be responsible for any costs incurred by the project proponent in EIA report preparation in case the project is rejected.

Project Name	:	COLOMBO LIGHT RAIL TRANSIT PROJECT
Project Proponent	:	Ministry of Megapolis and Western Development
Project Approving Agency	:	Central Environmental Authority
Report requirement	:	Environmental Impact Assessment (EIA) report
Date of issue of the ToR	:	23.05.2017

Report format :

Executive Summary

1. Introduction
2. Description of the Project and reasonable alternatives
3. Description of the existing environment
4. Anticipated environmental impacts of proposed project
5. Proposed mitigatory measures
6. Extended Cost - Benefit Analysis
7. Environmental Management Plan
8. Conclusion and Recommendation

Annexure

I Terms of Reference
II References
III Sources of data & information
IV List of preparers including their work allocation (Report should be authenticated by the preparers.)
V Comments made by the public, NGOs and other agencies during formal and informal scoping meetings held by the EIA study team
VI Complete set of relevant maps, tables, charts, layout plans and other details.

Executive Summary

The summary should be a brief, non-technical summary of the justification of the proposed project, description of the salient features of the project, the existing environment of the project sites and its environs, key environmental impacts, the measures proposed to mitigate the environmental impacts, extended cost benefit analysis monitoring programme and conclusion.

A one page summary table indicating the significant impacts and proposed mitigatory measures should be presented.

1. INTRODUCTION

- Background of the project (Brief history of the project, its current status, implementing agency including an organization chart and its operation mechanism etc.)
- Objective of the proposed project and justification of the project (Summarize the need or problem being addressed by the project and how the proposed project is expected to resolve the problem).
- Objective of the EIA report (Specify the objectives of the assessment and the relationship of the results to project design and implementation).
- Methodologies and technologies adopted in EIA report preparation.
- Conformity with Government policies and plans.
- Preliminary approvals needed for the project and any conditions laid down by state agencies in granting preliminary clearance for the project

2. DESCRIPTION OF THE PROPOSED PROJECT AND REASONABLE ALTERNATIVES

2.1 Description of the proposed project

Following details should be given in order to get a clear picture of the project.

i. Location, indicating the Divisional Secretariat Division(s) and the Local Authority area(s) within which the Light Rail Transit System (project) site falls.

ii. Location map of appropriate scale indicating the project site. Clear coloured and readable maps together with diagrams and photographs to be provided for the reviewer to get a clear understanding of the project area. (The location map should include general location of the project site and exact location with clear coordinates.)

iii. State the present ownership of the project site. If state owned, please submit a letter of consent from the relevant state agency/agencies.
(If any activity of the project falls within a protected area declared under the Forest Ordinance/Flora and Fauna Protection Act, consent of the Forest Department/Department of Wildlife Conservation should be obtained on release of land prior to embarking on the EIA study).

iv. Description of all components relevant to the project.

(a) Description of project components such as extent (both width and length) of Right of Way of the project, rail track (railroad), U turn space, Terminal Buildings, Station Plazas (if any), light train (rolling stocks) parking (Depot) and servicing/repairing facilities, signal control and signaling system passenger vehicles parking facilities and other relevant structures (temporary and permanent) etc.

(b) The layout plan(s) of the project at appropriate scale. This should indicate all the project components mentioned in above (a) and reservation/s to be maintained.

v. The details on pre-construction and construction activities, phased implementation schedule, staffing/workforce, future development/expansion etc.

vi. Method/s of construction, raw materials requirement including quantities and sustainable sources etc. (If any filling of lowlands is envisaged in permanent and/or temporary basis, the location/s of such filling together with the extent, method of filing and level in terms of MSL should be given).

vii. Methodology of operation and maintenance of project including institutional arrangements.

viii. Type of energy to be used to power the light rails; either fossil fuel or electricity.

ix. Anticipated types and source/s of wastewater generation and pollution load (Quality of raw wastewater) together with the details of the wastewater collection, treatment and final disposal. Conceptual plans on the wastewater treatment plants, expected quality of treated wastewater etc. should be given.

x. Details of generation of sludge from wastewater treatment, other wastes such as waste oil and solid wastes including municipal solid wastes, plastics, iron etc. their quantities and management including final disposal.

xi. Any infrastructure facilities required by the project.
- Energy including fossil fuel/electricity and source/s
- Water and source/s
- Access roads
- Parking, service, maintenance facilities for constructions equipment/vehicles

xii. Project cost, investment and funding sources.

2.2 Evaluation of Alternatives

- Describe reasonable alternatives considered in the course of developing the project (e.g. alternative transport modes, siting, design, technology selection, construction methods etc.) including no action alternative.

- Compare alternatives in terms of potential environmental impacts, mitigation of environmental impacts, capital and operating costs, reliability etc.

- Give the reasons for why such alternatives were rejected.

3. DESCRIPTION OF THE EXISTING ENVIRONMENT

Study Area

The study area for the assessment shall include the following;

i) Project site (area within proposed Right of Way)

ii) The area beyond the Right of Way that has a likelihood of being significantly impacted ("influenced area"). (The limits of "influenced area" should be identified by the study team with clear justification).

iii) Off site locations which will be affected due to activities of the project.

Assemble, evaluate and present baseline data on the relevant environmental characteristics of the study area.

This chapter should provide information on physical, biological and socio cultural aspects of the environment likely to be affected by any activity of the project during and after the project construction period. Information should be presented using photographs, tables, maps and diagrams where appropriate. The maps provided must be clear, readable and at appropriate scale. The methods used to collect data should be clearly stated under each category.

The existing environment should be described under following;

3.1 Physical environment

i. Existing land use
ii. Ambient air quality (*The ambient air quality parameters to be covered shall include PM10, PM 2.5, SO_2, NO_x, CO, and other applicable parameters to be determined depending on the project.*
iii. Noise levels (both day and night)
iv. Surface and ground water quality (*The water quality parameters to be covered shall include Total Suspended Solids, pH, Bio-chemical Oxygen Demand, Chemical Oxygen Demand, Temperature, Oil and grease, e-coli and other applicable parameters to be determined depending on the project).*
v. Wetlands and streams encountered by the project.

3.2 Socio-cultural Environment

- Existing houses, government/commercial/non-commercial/buildings etc.
- Noise sensitive receptors.
- Culturally, historically and archaeologically important objects/places.
- Existing transport network, public transport services, traffic levels on the existing roads (the road sections proposed to be used for the project and all the roads connected thereto within the Colombo Metropolitan Region within the study area) preferable with a modal split.
- Planned development activities.

3.3 Biological Environment

i. Presence of protected areas (extent, conservation status etc.) and other sensitive habitats such as wetlands and their importance
ii. Rare, threatened and endemic species (if any) within these habitats

4. ANTICIPATED ENVIRONMENTAL IMPACTS OF PROPOSED PROJECT

This chapter should show the overall effects of the project on the individual environmental components both during construction and operations phases of the project. Impacts should include the direct and indirect, long and short-term, positive and negative effects.

Significance of impacts should be assessed using appropriate techniques.
When describing the impacts indicate which are irreversible or unavoidable and which can be mitigated to the extent possible. Wherever possible describe impacts quantitatively.

Impacts should be discussed in the order of severity.

Special attention should be paid to;

i. Socio-cultural and socio-economic impacts during construction and operation phases giving special reference to impacts on the following.

   - Existing road users due to escalation of traffic congestion on such roads
   - Livelihood and economic activities
   - Health and safety impacts
   - Increased urbanization
   - Resettlement of people and/or relocation of structures/buildings etc. (if any)
   - Relocation of the utilities such as water, electricity, telecommunication (if any)
   - Socio-cultural and socio-economic benefits.

ii. Noise and vibration impacts during construction and operation phases giving special reference to noise and vibration impacts on the land uses at the boundary of the right of way of the project, users of the existing roads etc.. Vertical and horizontal distribution of noise levels at expected different operation levels should be predicted using a validated mathematical model and results should be presented to identify the impact area, land use of the impact area, affected population etc.

iii. Air quality impacts during construction and operation phases giving special reference to impacts on the land uses at the boundary of the right of way of the project, users of the existing roads due to emission construction vehicles and light rails, fugitive emission due to construction etc.

iv. Impacts on the water courses that cross by the rail track including the impacts on the drainage pattern, current uses of such water courses etc. during construction and operation phases.

v. Impacts on surface water, groundwater, soil quality due to;
   - erosion of excavated materials, construction materials etc. and spoil and other waste generated from construction activities.

- spillage, leak and accidental discharge of fossil oil, waste oil generated from rolling stocks maintenance, washing, serving etc.
- disposal of wastewater generated from workers camps, offices, station plazas, terminal buildings, rolling stocks maintenance, washing, serving etc.
- unusual occurrences such as accidents, fire, natural hazards etc..
- disposal of other liquid/solid wastes generated from workers camps, offices, station plazas, terminal buildings etc.

vi. Impacts on neighboring land uses at the Right of Way of the project due to severance of light, ventilation etc. (if any).

vii. Impacts on aquatic/ terrestrial habitats and wildlife therein.

5. PROPOSED MITIGATORY MEASURES

This chapter should set out the proposed measures to minimize the impacts identified in Chapter 4 to acceptable levels including conformity to regulations and national standards. Alternative methods of mitigation should be discussed and effectiveness of the proposed measures that are to be provided should be stated. Mitigation methods should be defined in specific practical terms. A rationale should also be presented for selection of chosen mitigatory measures.

6. EXTENDED COST BENEFIT ANALYSIS

Total environmental cost (the cost of direct and indirect negative impacts, proposed mitigation cost, administration and monitoring costs etc.) and benefits arising out of the project should be incorporated and discussed. Findings should reflect the benefits arising out of the project.

7. ENVIRONMENTAL MANAGEMENT PLAN

An Environmental Management Plan (EMP) should be submitted including the followings;

- A summary of anticipated significant adverse environmental impacts together with the mitigation measures with technical details for each anticipated significant environmental impact.

- Monitoring plan including;
  - Parameters/ Indicators/Criteria/to be monitored
  - Proposed locations of sampling points
  - Frequency of monitoring

- Implementation arrangement including;
    - Responsibility and Implementation schedule for mitigation, monitoring and reporting along with specifying the exact parties responsible for these actions and the schedule for these tasks.
    - Institutional framework, namely who is responsible for carrying out the mitigation and monitoring.
    - Costs of implementation of mitigation and monitoring measures described above. Identify the availability and source of funds to implement the measures.

8. CONCLUSION AND RECOMMENDATION

The environmental acceptability of the proposed project and key findings and recommendations of the assessment should be clearly stated.

Annex B
Correspondence with relevant agencies

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வீதி அபிவிருத்தி அதிகாரசபை
Road Development Authority

"මගනැගුම මහමැදුර" ඩෙන්සිල් කොබ්බෑකඩුව මාවත,
කොස්වත්ත, බත්තරමුල්ල, ශ්‍රී ලංකාව.
"மகநெகும மஹமெதுர", டென்சில் கொப்பேகடுவ மாவத்தை,
கொஸ்வத்தை, பத்தரமுல்லை, இலங்கை.
"Maganeguma Mahamedura",Denzil Kobbekaduwa Mawatha,
Koswatta, Battaramulla, Sri Lanka.

RDA/P NPRS RS/GEN

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எனது இல.
My No. .....

ඔබේ අංකය
உமது இல.
Your No. .....

දිනය
திகதி
Date 09.01.2018

Secretary
Ministry of Megapolis and Western Development
Suhurupaya
Battaramulla

Light Rail Transit Project-JICA
RECEIVED
10 JAN 2018
Ministry of Megapolis & Western Development

CLEARENCE FOR THE STUDY ROUTE

LIGHT RAIL TRANSIT PROJECT - JICA

This refers to your letter No LRT/JICA/PLN/05 dated 09.08.2017 regarding the above matter.

Road Development Authority hereby grants clearance to the proposed Light Rail Transit (LRT) Project under the following conditions.

1. As the existing center median width is 1.2m. width of the center median should be widened according to the width of the column which are going to position along the center median.

2. Traffic management plan for the construction period to be addressed clearly and get the approval from RDA before commencing the work.

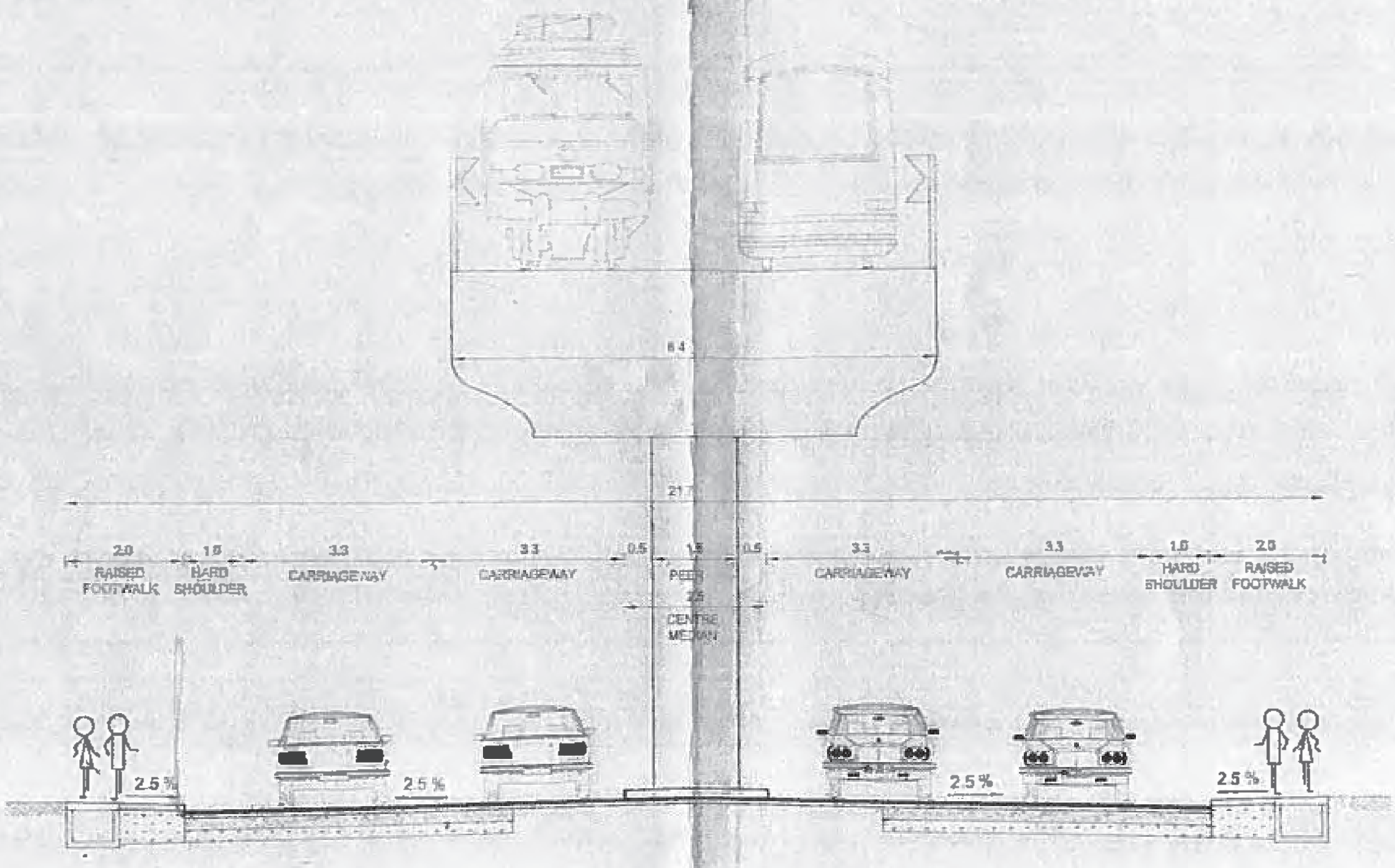
3. No of lanes and width of traffic lane, width of walkways and center median should be according to the design drawing submitted by the RDA as discussed in the Technical Committee Meeting.

4. Additional acquisition is to be done according to the letter No RDA/CH/HYD/MEGAPOLIS dated 20.12.2017 signed by the Chairman Road Development Authority.

The above factors are clearly addressed in the final design and the approval to be sought from the RDA.

Director General
Road Development Authority

Telephones:-
Chairman 2862767, Director General 2862795, Working Director 2887257, General Number ++94-11-2046200
Additional Director Generals {Projects 2862485, AO&M 2864804, CD 2882194, NP 2886923 }
Directorates {Administration 2865245, Construction 2864388, Engineering Services 2864803, EO&M 038-2291373, ESD 2187165, Finance 2864799, Highway Designs 2874024, Internal Audit 2872661, Lands 2889350, Legal 2186044, Mechanical 2872273, MM 2882196, Planning 2882995, Procurement 2886863, QA&PM 2887235, R&D 2632649, Rural Bridges 2623896, Training 2869342 }



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REV	DESCRIPTION	DATE	DO	D(H/D)

WIDENING & IMPROVEMENTS TO COTTA ROAD WITH LRT

TYPICAL CROSS SECTION

DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA
MINISTRY OF HIGHWAYS

HIGHWAY DESIGNS DIVISION
ROAD DEVELOPMENT AUTHORITY
"MAGANEGUMA MAHAMEDURA"
BATTARAMULLA.

SURVEYED & PLOTTED - Licensed Surveyor	DESIGNED - S A S T Salawevidana	CHECKED - R A S K Katuarachchi	DRAWN - J A R Sembukuttiarachchi	CHECKED - K.K.C Perera
DEPUTY DIRECTOR	DIRECTOR	ADDITIONAL DIRECTOR GENERAL (CD) for DIRECTOR GENERAL		DATE - 11.10.2017 DRG.No. W/B435/R/1/TCS-2

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வீதி அபிவிருத்தி அதிகாரசபை
Road Development Authority

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"මගනැගුම මහමැදුර", ඩෙන්සිල් කොබ්බෑකඩුව මාවත, කොස්වත්ත, බත්තරමුල්ල, ශ්‍රී ලංකාව.
"மகநெகும மஹமெதுர", டென்சில் கொப்பேகடுவ மாவத்தை, கொஸ்வத்தை, பத்தரமுல்லை, இலங்கை.
"Maganeguma Mahamedura", Denzil Kobbekaduwa Mawatha, Koswatta, Battaramulla, Sri Lanka.

Light Rail Transit Project
RECEIVED
22 DEC 2017

මගේ අංකය / எனது இல / My No. } RDA/CH/HYD/MEGAPOLIS

ඔබේ අංකය / உமது இல / Your No. }

දිනය / திகதி / Date } 20th December 2017

PD (LRT, TILA)

Eng. Nihal Rupasinghe
Secretary
Ministry of Megapolis & Western Development

මහානගර හා බස්නාහිර සංවර්ධන අමාත්‍යාංශය
21 DEC 2017
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සුහුරුපාය, 17 වන මහල, සුභූතිපුර පාර, බත්තරමුල්ල.

ROAD WIDENING & LAND ACQUISITION
LIGHT RAIL TRANSIT (LRT) PROJECT - JICA

This has the reference to your letter numbered LRT-J/16/UTI/01/RDA dated 26.10.2017 regarding the above matter.

We have already forwarded our proposal regarding the required road widening to Project Director (LRT) of Ministry of Megapolis & Western Development by our Director (Highway Design). (Letter attached for your reference please).

While we RDA, can handle the land acquisition process for this project, kindly be informed that following costs should be borne by your project for this endeavor;

- Land acquisition cost for the required corridor
- 6% administration cost

This is for your information and necessary actions please.

Chairman
Road Development Authority

cc : Mr. R. Paskralingam
Senior Advisor to the Ministry of National Policies & Economic Affairs - f.i.pl.

Director General, Road Development Authority - f.i.pl.

Director (Highway Design) - f.i.pl.

Telephones:-
Chairman 2862767, Director General 2862795, Working Director 2887257, General Number ++94-11-2046200
Additional Director Generals {Projects 2862485, AO&M 2864804, CD 2882194, NP 2886923 }
Directorates {Administration 2865245, Construction 2864388, Engineering Services 2864803, EO&M 038- 2291373, ESD 2187165, Finance 2864799, Highway Designs 2874024, Internal Audit 2872661, Lands 2889350, Legal 2186044, Mechanical 2872273, MM 2882196, Planning 2882995, Procurement 2886863, QA&PM 2887235, R&D 2632649, Rural Bridges 2623896, Training 2869342 }

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போக்குவரத்து மற்றும் சிவில் விமானசேவைகள் அமைச்சு
MINISTRY OF TRANSPORT & CIVIL AVIATION

07 වෙනි මහල, සෙත්සිරිපාය, අදියර II, බත්තරමුල්ල
07 ஆவது மாடி, செத்சிரிபாய, II ஆம்கட்டம், பத்தரமுல்லை
7th Floor, Sethsiripaya, Stage II, Battaramulla

දුරකථන தொலைபேசி Telephone

වෙබ් අඩවිය இணையத்தளம் Website } www.transport.gov.lk

අමාත්‍ය அமைச்சர் Minister } 2187225
ලේකම் செயலாளர் Secretary } 2187233
කාර්යාලය அலுவலகம் Office } 2187200, 2187201
ෆැක්ස් பெக்ஸ் Fax } 2865093, 2187226
විද්‍යුත් තැපෑල් மின்னஞ்சல் E-Mail } mintransport@sltnet.lk

මගේ අංකය எனது இல. My No. } MT/06/244

ඔබේ අංකය உமது இல. Your No. }

දිනය திகதி Date } 2017.12.12

The General Manager

Sri Lanka Railways

Project: Light Rail Transit (JICA Funded) project

Subject: Concurrence for Proposed Route and Integration at Multi Modal Transport Hub (MMTH)

Reference: T.02/21308/CAPC of 27.11.2017

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1. Maradana

Reference above, attached herewith is the Aerial Map (Auto CAD Enabled) of Maradana Area applicable to LRT Route.

The LRT Project may be requested to clearly draw the Route on this diagram.

Location marked as (6) is needed for construction of 12 storied building for Railway (Specially, the New Colombo Train Control Center). Based on the outcome of the feasibility study (AFD Funded) of PMMTH, the location for Colombo Central Railway (CCR)station will be decided and with that, there will be eight Railway Lines between Colombo Fort -Maradana-Loco Junction section. Those additional Lines will pass through Item (3) of the drawing and an additional opening (to construct two Lines) on both bridges at Maradana (on Elphinstone Theater Side) will be provided.

However, the space for piers of LRT elevated track can be decided during the PMMTH Feasibility Study. The Design Consultants of CSRP will be available from January 2018.During the design stage, the location of piers of LRT elevated track can be decided.

In addition, the proposal for Maradana Multi Modal Center will also be forwarded by Ministry of Megapolis and Western Development, to ERD soon.

Hence, the LRT Project is requested to explore the possibility for designing LRT traces at Maradana along the new bridge (near item 7 at Maradana).

2. Cotta Road

The Railway Track of in KV Line will be an elevated Structure (Possibly 5.5 m above ground level). For construction of LRT route (if it runs above elevated railway), then a clearance of (minimum) 8.0 meters from railway tracks will be required.

Therefore, Railway cum LRT Station needs to be designed at Cotta Road. This can be decided jointly by CSRP Designers and LRT Designers.

Palitha Samarasinghe

Addl.Secretary (Technical)

Ministry of Transport & Civil Aviation

Copy: The Secretary -Ministry of Transport & Civil Aviation

The Secretary - Ministry of Megapolis & Western Development

The Project Director, Light Rail Transit (JICA Funded) Project.

FROM :NWSDB RSC RAJAGIRIYA FAX NO. :2812672 20 Dec. 2017 9:06AM P1

ජාතික ජල සම්පාදන හා ජලාපවහන මණ්ඩලය
தேசிய நீர் வழங்கல் வடிகாலமைப்புச் சபை
National Water Supply & Drainage Board

ප්‍රාදේශීය සහාය සේවා මධ්‍යස්ථානය - (බටහිර-මධ්‍යම)
பிரதேச ஆதார நிலையம் - (மேற்கு-மத்தி)
Regional Support Center - (Western Central)

නියෝජ්‍ය සාමාන්‍යාධිකාරී / பிரதிப் பொது முகாமையாளர் / Deputy General Manager : 2812671

සාමාන්‍ය කාර්යාලය / பொது அலுவலகம் / General Office : 2856420, 2856421, 2856422

ෆැක්ස් / பெக்ஸ் / Fax : 2812672

175 A, කළුතොට ගොඩනැගිල්ල, නාවල පාර, නුගේගොඩ.
175 A, களுத்தோட்டை கட்டிடம், நாவல வீதி, நுகேகொடை.
175 A, Kalutota Building, Nawala Road, Nugegoda.

මගේ අංකය / எனது இல. / My No. : DGM/WC/P&D/Proj. (Ext. /04)

ඔබේ අංකය / உமது இல. / Your No. :

දිනය / திகதி / Date : 19th December 2017

Light Rail Transit Project-JICA
RECEIVED
20 DEC 2017
Ministry of Megapolis & Western Development

Eng. Nihal Rupasinghe,
Secretary,
Ministry of Megapolis and Western Development,
8th Floor, Sri Subuthipura Road,
Suhurupaya,
Battaramulla.

PROJECT: LIGHT RAIL TRANSIT - JICA

SUBJECT: CLEARANCE OF THE LRT ROUTE AND WATER SUPPLY TO STATIONS AND DEPOT AT MALAMBE

This refers your letter dated 30th November 2017 regarding the above subject.

If any existing water pipe lines have to shift due to the above project, you should shift those water pipe lines through your contractor in your cost.

NWSDB will assist to you in designing, documentation and supervision work of the shifting of the existing water pipe lines.

Please note that NWSDB shall not take any responsibility for any losses or damages that may caused by you or third party to the unforeseen properties of NWSDB in the above areas. It is recommended to carryout trial pits/trenches before the commencement of the construction work to identify the exact locations of underground water pipe lines.

In addition to above, please be good enough to provide following details to check the feasibility of providing water supply to stations and depot at Malambe with application.

1. Survey Plan.
2. One set of architectural drawings attested by Architect of proposed site (In A3 Size).
3. Water demand per day for proposed buildings with necessary calculations.
4. Ground sump capacity including fire requirement and the location should be marked in drawing.
5. Entrance location to the stations and depot to be marked in the site layout plan.

The application form is enclosed herewith.

You are required to pay an amount of Rs. 12,500.00 + applicable VAT in order to process your request for development clearance of the above project.

The payment can be made in cash to the Cashier Counter of Regional Support Centre (Western –Central) at Ground Floor, Kalutota Building, No. 175 A, Nawala Road, Nugegoda or as a cheque written in favour of "General Manager" National Water Supply & Drainage Board. Please arrange to send the original receipt (if payment is in cash) or submit the cheque to Planning & Design section at 6th Floor of the same building.

Further, please contact Eng. W. D. L. Chandrasiri, Assistant General Manager (Greater Colombo Sewerage), NWSDB on 0777356643 regarding the sewerage lines under NWSDB.

Eng. T. W. S. Perera
Deputy General Manager (WC)

FROM :NWSDB RSC RAJAGIRIYA FAX NO. :2812672 20 Dec. 2017 9:07AM P1

ජාතික ජල සම්පාදන හා ජලාපවහන මණ්ඩලය
தேசிய நீர் வழங்கல் வடிகாலமைப்புச் சபை
National Water Supply & Drainage Board

සභාපති தலைவர் Chairman Tel : 2634488 Fax : 2611234
උප සභාපති உப தலைவர் Vice Chairman Tel : 2635883 Fax : 2610034
ප්‍රධාන කාර්යාලය தலைமை அலுவலகம் Head Office Tel : 2638246, 2638256, 2638259, 2638260, 2621621
තැ.පෙ. த.பெ.இல. P.O. Box 14, ගල්කිස්ස கல்கிசை Mt. Lavinia
සාමානාධිකාරී பொது முகாமையாளர் General Manager Tel/Fax 2636449
ක්‍රියාකාරී අධ්‍යක්ෂ தொழிற்பாட்டுப் பணிப்பாளர் Working Director Tel : 2636901 Fax : 2611590
Hunting No : 2638999
Fax : 2636449
E-mail : nwsdbch@sltnet.lk
ගාල්ල පාර காலி வீதி Galle Road
රත්මලාන இரத்மலானை Ratmalana, Sri Lanka.

මගේ අංකය எமது இல My No. Addl.GM/S/P/SJK

මබේ අංකය உமது இல Your No.

දිනය திகதி Date 03.04.2018

Eng. Chaminda Ariyadasa,
Project Director
Light Rail Transit Project_JICA
Ministry of Megapolis and Western Development
8th Floor, Suhurupaya, Battaramulla

Dear sir,

Request to Obtain Information of the Proposed Sewer Network in Sri Jayawardanapura Kotte and Kaduwela Municipal Council Area

Reference is made to your letter number LRT-J/07/ENV/2018/07 dated 20th March 2018 and the subsequent discussion we had with your staff along with JICA Consultants appointed to carryout Feasibility Study for Sri Jayawardanepura Kotte Sewerage Project (SJPKSP) on 29th March 2018 we would like to inform you that NWSDB could accept sewage emanation from Light Rail project upon implementation of the SJPKSP as follows;

- Direct sewer connection to the Light Rail Stations proposed at Walikada, Rajagiriya, Sethsiripaya, Battaramulla, Palamthuna and Robert Gunawardane as they are situated within the sewerage reticulation system of proposed SJKSP. Therefore direct sewer connection could be provided for the 6 stations. Final connection point will be decided during detailed design stage.

- Other stations situated outside sewer network area towards depot direction can be dispose in one of the following ways
  - Single pumping main supported on light rail elevated supporting structure with synchronized pumping from 4 stations and the depot located outside SJKSP
  - Implementing Jhokasou or any other independent treatment and disposal system at each train station
  - Keeping holding tank at each rail station and utilize gully sucker to collect and transport to proposed sewage treatment plant or or as a interim measure to existing septage disposal facility operated by NWSDB. This will create traffic congestion ,overflow situation if not managed properly.

- **NWSDB accept only wastewater of domestic nature**. Therefore waste oil and grease from the depot should be separated in concentrated form and dispose appropriately

- Light rail project should incorporate capital cost of the sewer connection/independent treatment based on the preferred option as SJPKSP will not be accommodating these disposal arrangements in the project cost.

- O&M cost when connected to sewer system will be charged based on wastewater flow as per the National Sewerage Tariff

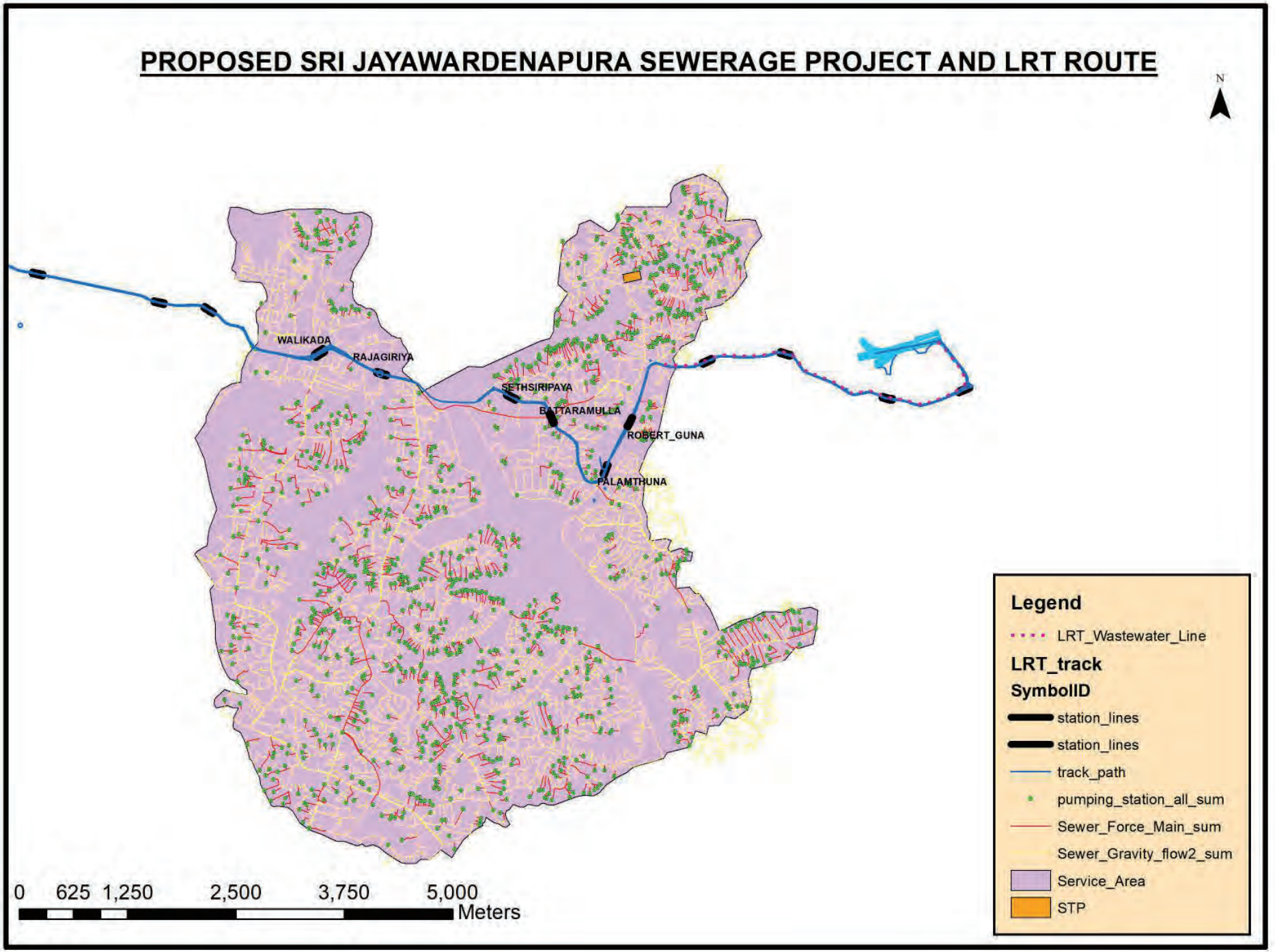
- Light rail stations situated towards CMC area should be connected in consultation with CMC

Yours faithfully,

Addl.GM (Sewerage)

Encl: LRT Track and reticulation area map

CC : Secretary , Ministry of Megapolis – f.y.i.pl
Team leader , JET – f.y.i.&.n.a.pl


PROPOSED SRI JAYAWARDENAPURA SEWERAGE PROJECT AND LRT ROUTE
N
WALIKADA
RAJAGIRIYA
SETHSIRIPAYA
BATTARAMULLA
ROBERT_GUNA
PALAMTHUNA
0 625 1,250 2,500 3,750 5,000
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Legend
LRT_Wastewater_Line
LRT_track
SymbolID
station_lines
station_lines
track_path
pumping_station_all_sum
Sewer_Force_Main_sum
Sewer_Gravity_flow2_sum
Service_Area
STP

Attention :- Mr. Ravi RD/PROJ/35

මහානගර හා බස්නාහිර සංවර්ධන අමාත්‍යාංශය
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மாநகர மற்றும் மேல் மாகாண அபிவிருத்தி அமைச்சு
இலங்கை காணி மீட்பு மற்றும் அபிவிருத்திக் கூட்டுத்தாபனம்

MINISTRY OF MEGAPOLIS & WESTERN DEVELOPMENT
SRI LANKA LAND RECLAMATION AND DEVELOPMENT CORPORATION

த.பெ.56, இல.03, ஸ்ரீ ஜயவர்த்தனபுர மாவத்தை, வெலிகட, ராஜகிரிய. | [illegible] | P.O. Box 56, No. 03, Sri Jayawardenapura Mawatha, Welikada, Rajagiriya.

Our Ref: RD/PROJ/35

18/12/2017

Eng. Nihal Rupasinghe,
Secretary,
Ministry of Megapolis and Western Development,
Suhurupaya,
17th Floor,
Battaramulla.

Clearance for the study route

Light Rail Transit Project – JICA

This has reference to your letter LRT/JIENV/08 dated 20/10/2017 regarding above.

Sri Lanka Land Reclamation & Development Corporation hereby grants clearance to the proposed LRT (Light Rail Transit), under the condition that a detailed drainage study to be carried out during the detailed design stage and final approval to be sought from the corporation.

Eng. Srimathi Senadheera
General Manager
Sri Lanka Land Reclamation & Development Corporation.

දුරකථන / தொலைபேசி: 2867369, 2889465 / 2863705, 2889466
සභාපති / தலைவர்: 2863696
ෆැක්ස් / பெக்ஸ்: 2862457 / 2868001
Website : www.landreclamation.lk
E-mail: slrdc@sltnet.lk

20/12 2017 3:53 PM FAX 0001

මහානගර හා බස්නාහිර සංවර්ධන අමාත්‍යාංශය
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மாநகர மற்றும் மேல் மாகாண
அபிவிருத்தி அமைச்சு
இலங்கை காணி மீட்பு மற்றும்
அபிவிருத்திக் கூட்டுத்தாபனம்

MINISTRY OF MEGAPOLIS &
WESTERN DEVELOPMENT
SRI LANKA LAND RECLAMATION
AND DEVELOPMENT CORPORATION

த.பொ.56, இல.03, ஸ்ரீ ஜயவர்தனபுர மாவத்தை, வெலிகட, ராஜகிரிய.
තැ.පෙ.56, අංක 03, ශ්‍රී ජයවර්ධනපුර මාවත, වැලිකඩ, රාජගිරිය.
P.O. Box 56, No. 03, Sri Jayawardenepura Mawatha, Welikada, Rajagiriya.

Ref: WM/WWPM/185/Gov16 2018-01-24

Eng. Nihal Rupasinghe,
Secretary,
Ministry of Megapolis and Western Development,
"Suhurupaya",
Battaramulla.

Dear Sir,

Approval for the Waste delivering to Waste Management Park at Kerawalapitiya

This has reference to the letter dated 8th January 2018 on above. The permission has been granted to deliver Construction and Demolition waste generated through the Light Rail Transit Project – JICA to the Waste Management Park development area at Kerawalapitiya.

It has to be noted that, the following conditions to be applied;

- Construction and Demolition waste and Excavated material will be accepted at Free of Charge and following conditions to be satisfied.
  - No contamination with the fresh Municipal Solid Waste (MSW), Hazardous wastes, wood or plant debris
  - Attention to maintain a better environment during the transportation and dumping operation (Specially in Dust Controlling)
- To be transported via approval vehicles only. It is necessary to take approval for the waste transporting vehicles in writing prior to the delivering.
- Name of the Authority and the Waste type need to be displayed at the front of the vehicles.
- Before the commencement of the project, this approval needs to be renewed.

Forwarded for our attention please.

Thank You.
Yours Sincerely,

Eng. K. Rajapakse
Actg. General Manager
Sri Land Reclamation and Development Corporation

දුරකථනය / தொலைபேசி / Telephone 2867369, 2889485, 2863705, 2889486, 2867533, 2889487
සභාපති / தலைவர் / Chairman 2863696
ෆැක්ස් / பெக்ஸ் / Fax 2862457, 2868001
Website : www.landreclamation.lk
E-mail: sllrdc@sltnet.lk

142

(16)

නාගරික කොමසාරිස්
வி. கே. ஏ. අනුර

மாநகர ஆணையாளர்
வி. கே. ஏ. அனுர

MUNICIPAL COMMISSIONER
V. K. A. ANURA

කොළඹ මහා නගර සභාව
நகர மண்டபம், கொழும்பு 07.

கொழும்பு மாநகர சபை
நகர மண்டபம், கொழும்பு 07.

Colombo Municipal Council,
Town Hall - Colombo 07.

දුරකථනය කාර්යාලය
தொலைபேசி காரியாலயம்
Telephone Office
011-2695121
011-2678425

ෆැක්ස්
தொலைநகல்
Fax
011-2694640

විද්‍යුත් තැපෑල / மின்னஞ்சல் / E.Mail : munici@slt.lk

RECEIVED
29 NOV 2017
Ministry of Megapolis & Western Development

මගේ අංකය / எனது இல. / My No.: ME/ME/ML/43/2017

ඔබේ අංකය / உமது இல. / Your No:

දිනය / திகதி / Date: 23/11/2017

මහානගර හා බස්නාහිර සංවර්ධන අමාත්‍යාංශය
R 6845
28 NOV 2017
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සුහුරුපාය, 17 වන මහල, සුවතිපුර පාර,
බත්තරමුල්ල.

Eng. Nihal Rupasinghe,
Secretary,
Ministry of Megapolis and Western Development,
Suhurupaya,
17th Floor,
Battaramulla.

Clearance for the study route

Light Rail Transit Project – JICA

This has reference to your letter dated 09.08.2017 regarding above.

Colombo Municipal Council hereby grants clearance to the proposed LRT (Light Rail Transit) route in the center median of the roads within the Colombo City subjected to the condition that the land acquisition has to be done by the Ministry of Megapolis in cases where the existing width of Thoroughfare is reduced due to the proposed structure.

.....
Municipal Commissioner

කොළඹ මහා නගර සභාව
கொழும்பு மாநகர சபை
COLOMBO MUNICIPAL COUNCIL

මගේ අංකය
எனது இல
My No.

දුරකථනය
தொலைபேசி
Telephone 2691191, 2693437

නාගරික ඉංජිනේරු දෙපාර්තමේන්තුව
புரவல. கொළඹ 07.
மாநகர பொறியியலாளர் திணைக்களம்
நகர மண்டபம், கொழும்பு 07.
MUNICIPAL ENGINEER'S DEPARTMENT
Town Hall, Colombo 07.

ඔබේ අංකය
உங்கள் இல
Your No.

02.04.2018

Eng. Nihal Rupasinghe,
Secretary,
Ministry of Megapolis and Western Development,
"Suhurupaya",
17th Floor,
Baththaramulla.

Disposing Solid Waste Water / Sewer Generated from Proposed Stations in LRT system from Fort to Malabe within Colombo City Limit.

This is response to your letter under reference LRT-J/07ENV/2018/04 dated 20.03.2018.

1. Colombo Municipal Council confirms that the sewerage connection can be facilitated provided that all related costs are met.

2. Colombo Municipal Council confirms that solid waste could be collected provided that the facilities are furnished at the road level for collection.

.....

Eng. K. A. D. N. Wickramaratne,
Actg. Deputy Municipal Commissioner,
Municipal Engineer's Department.
29th March 2018.

Eng. K.A.D.N. WICKRAMARATNE
Director Engineering
Traffic, Design & Road Safety Division
Colombo Municipal Council

නාගරික කොමසාරිස්
மாநகர ஆணையாளர்
MUNICIPAL COMMISSIONER

තැ.පෙ. අංක. 6, ශ්‍රී ජයවර්ධනපුර
த.பெ. இல. 6, ஸ்ரீ ஜயவர்தனபுர
P.O. BOX. NO.6, SRI JAYAWARDENAPURA

දුරකථන / தொலைபேசி / Telephone: 2877518, 2862941
ෆැක්ස් / தொலை நகல் / Fax: 2874703
කාර්යාලය / காரியாலயம் / Office: 2862555, 2874701, 2874702

ශ්‍රී ජයවර්ධනපුර කෝට්ටේ මහ නගර සභාව
ஸ்ரீ ஜயவர்த்தனபுர கோட்டை மாநகர சபை
SRI JAYAWARDENAPURA KOTTE MUNICIPAL COUNCIL

මගේ අංකය / எனது இல / My No.: JKMC/W6/සැ.ළු.සං.ව්‍යා./2017 | ඔබේ අංකය / உமது இல / Your No.: LRT-J/07/ENV/17/01 | දිනය / திகதி / Date: 2018.01.24

ලේකම්,

ව්‍යාපෘති කළමණාකරන ඒකකය,

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"සුහුරු පාය" ශ්‍රී සුහුනි පාර,

බත්තරමුල්ල.

සැහැල්ලු දුම්රිය සංක්‍රමණ ව්‍යාපෘතිය (JICA)

උක්ත කාරණය සම්බන්ධයෙන් ඔබගේ සමාංක හා 2017/11/30 දිනැති ලිපිය හා බැඳේ,

02. මාලබේ සිට කොළඹ කොටුව දක්වා දිවෙන සැහැල්ලු දුම්රිය සංක්‍රමණ ව්‍යාපෘතිය යටතේ අප මහ නගර සභා සීමාවේ මෙම ව්‍යාපෘතියට යොදා ගැනෙන ඉඩම් හා ගොඩනැගිලි සම්බන්ධයෙන් රජයේ තක්සේරුව මත අදාල පාර්ශවයන්ට වන්දි ගෙවීමේ එකඟතාවය මත ව්‍යාපෘතිය ක්‍රියාත්මක කිරීමට 2018.01.11 දින පැවති කළමණාකරන කමිටුවේ අනුමැතිය ලබා දී ඇති බව කරුණිකව දන්වා සිටිමි.

නාගරික ඉංජිනේරු,
ශ්‍රී ජයවර්ධනපුර කෝට්ටේ මහ නගර සභාව.

ජේ. තිලකරත්න
නාගරික ඉංජිනේරු
ශ්‍රී ජයවර්ධනපුර කෝට්ටේ මහ නගර සභාව

නාගරික ලේකම්
සහකාර නාගරික ලේකම්
ප්‍රධාන නාගරික ගණකාධිකාරි
ප්‍රධාන නාගරික ඉංජිනේරු
සෞඛ්‍ය වෛද්‍ය නිලධාරි
නාගරික පශු වෛද්‍ය නිලධාරි
ගිනි නිවීමේ ඒකකය

மாநகர செயலாளர்
பிரதி மாநகர செயலாளர்
மாநகர பிரதம கணக்காளர்
மாநகர பிரதம பொறியியலாளர்
ககாதார மருத்துவ அதிகாரி
மாநகர மிருக வைத்திய நிபுணர்
தீயணைப்புப் படை நிலையம்

Municipal Secretary : 2888098
Assistant Municipal Secretary : 2862615
Chief Municipal Accountant : 2862839
Chief Municipal Engineer : 2862173
Medical Officer of Health : 2888097
Municipal Veterinary Surgeon : 2876012
Fire Brigade Center : 2879444

නාගරික කොමසාරිස්
மாநகர ஆணையாளர்
MUNICIPAL COMMISSIONER

තැ.පෙ. අංක. 6, ශ්‍රී ජයවර්ධනපුර
த.பெ. இல. 6, ஸ்ரீ ஜயவர்தனபுர
P.O. BOX. NO.6, SRI JAYAWARDENAPURA

දුරකථන / தொலைபேசி / Telephone: 2877518, 2862941
ෆැක්ස් / தொலை நகல் / Fax: 2874703
කාර්යාලය / காரியாலயம் / Office: 2862555, 2874701, 2874702

ශ්‍රී ජයවර්ධනපුර කෝට්ටේ මහ නගර සභාව
ஸ்ரீ ஜயவர்த்தனபுர கோட்டை மாநகர சபை
SRI JAYAWARDENAPURA KOTTE MUNICIPAL COUNCIL

මගේ අංකය / எனது இல / My No.	ඔබේ අංකය / உமது இல / Your No. LRT-J/07/ENV/2018/05	දිනය / திகதி / Date 2018.03.29

ලේකම්,
මහානගර හා බස්නාහිර සංවර්ධන අමාත්‍යාංශය,
17 වන මහල,
'සුහුරුපාය',
බත්තරමුල්ල.

<u>ඝන අපද්‍රව්‍ය කළමනාකරණය සහ මල අපද්‍රව්‍ය බැහැර කිරීම සඳහා එකඟතාවය ලබා දීම සැහැල්ලු දුම්රිය සංක්‍රමණ ව්‍යාපෘතිය (ජයිකා)</u>

උක්ත කාරණය සම්බන්ධයෙන් ඔබගේ සමාංක 2018.03.20 දිනැති ලිපිය හා බැඳේ.

උක්ත යෝජිත ව්‍යාපෘතියෙහි වැලිකඩ හා රාජගිරිය ප්‍රදේශවල ඉදි කිරීමට යෝජිත දුම්රිය නැවතුම් ස්ථානවලින් දුම්රිය ක්‍රියාත්මක වීම ආරම්භයත් සමඟ ජනනය වන ඝන අපද්‍රව්‍ය (ආහාර කොටස්, ප්ලාස්ටික් සහ කඩදාසි) අප මහනගර සභාව මඟින් ඉවත් කිරීමට එකඟතාවය පල කරන බව කාරුණිකව දැනුම් දෙමු.

තව ද උක්ත දුම්රිය ස්ථානවලින් ජනනය වන මල අපද්‍රව්‍ය ඉවත් කිරීම සඳහා මල අපද්‍රව්‍ය බැහැරලීමේ පද්ධතියක් අප බල ප්‍රදේශ තුල නොමැති අතර, ජාතික ජල සම්පාදන හා ජලාපවහන මණ්ඩලය මඟින් JICA ආධාර සහිතව මල අපද්‍රව්‍ය බැහැරලීම් පද්ධතියක් ඉදිකිරීමට යෝජිත ය. එබැවින් ඒ පිළිබඳව ජාතික ජල සම්පාදන හා ජලාපවහන මණ්ඩලය සමඟ සාකච්ඡා කොට එකඟතාවය ලබා ගන්නා මෙන් කාරුණිකව ඉල්ලා සිටිමි.

නාගරික ඉංජිනේරු,
ශ්‍රී ජයවර්ධනපුර - කෝට්ටේ මහනගර සභාව

[illegible] එච්. සී. ජේ. වත්තිනායක
[illegible] සෞඛ්‍ය වෛද්‍ය නිලධාරී
[illegible] කෝට්ටේ මහ නගර සභාව
රාජගිරිය.

දේශයේ ප්‍රතාපවත් පුරවරය/ நாட்டின் உன்னதமான நகரம் / Dignified City of the Nation

කඩුවෙල මහා නගර සභාව
கடுவெல மாநகர சபை
KADUWELA MUNICIPAL COUNCIL

මගේ අංකය / எனது இலக்கம் / My Number: KMC/05/E1	ඔබේ අංකය / உங்கள் இலக்கம் / Your Number:	දිනය / திகதி / Date: 2018. 01. 02

Light Rail Transit Project-JICA RECEIVED 03 JAN 2017 Ministry of Megapolis & Western Development

Eng. Nihal Rupasinghe,
Secretary,
Ministry of Megapolis and Western Development,
8th Floor,
Suhurupaya,
Battaramulla.

CONCURRENCE OF PROJECT IMPLEMENTION
LIGHT RAIL TRANSIT (LRT) PROJECT - JICA

This has reference to your letter no. LRT-J/07/ENV/17/01 and dated 30.11.2017 Regrading above.

Kaduwela Municipal Council hereby gives consent on the proposed LRT (Light Rail Transits) route in the center median of the roads within the Kaduwela Municipal Council area subjected to grants necessary recommendation / approval from relevant institution.

S.M.M. Vijitha Mayadunne
Municipal Commissioner

S. M. M. Wijitha Mayadunna
Municipal Commissioner
Kaduwela Municipal Council

	Mayor	Commissioner	Secretary	Head Office
	නගරාධිපති / மாநகர முதல்வர்	නාගරික කොමසාරිස් / மாநகர ஆணையாளர்	නාගරික ලේකම් / மாநகர செயலாளர்	ප්‍රධාන කාර්යාලය / பிரதான அலுவலகம்
දුරකථන / தொலைபேசி / Telephone	0112 539 832	0112 548 491	0112 539 831	0112 571200
ෆැක්ස් / தொலைநகல் / Fax	0112 548 493	0112 548 492	0112 539 831/011 2548996	0112 539839
	mayourkmc@sltnet.lk	mcomkadu@sltnet.lk	ms.kadumc@gmail.com	kadumc@sltnet.lk

දේශයේ ප්‍රතාපවත් පුරවරය/ நாட்டின் உன்னதமான நகரம் / Dignified City of the Nation

කඩුවෙල මහා නගර සභාව
கடுவெல மாநகர சபை
KADUWELA MUNICIPAL COUNCIL

මගේ අංකය / எனது இலக்கம் / My Number: KMC/05/05/E15/03/02

ඔබේ අංකය / உங்கள் இலக்கம் / Your Number: .....

දිනය / திகதி / Date: 2018. 04. 02

මහානගර හා බස්නාහිර සංවර්ධන අමාත්‍යාංශය
03 APR 2018
ලේකම් කාර්යාලය
සුහුරුපාය, 17 වන මහල, සුභූතිපුර මාවත, බත්තරමුල්ල.

Eng. Nihal Rupasinghe,
Secretary,
Ministry of Megapolis and Western Development,
8th Floor,
Suhurupaya,
Battaramulla.

CONCURRENCE FOR SOLID WASTE AND SEWER DISPOSAL
LIGHT RAIL TRANSIT PROJECT – JICA

This has reference to your letter no. LRT-J/07/2018/06 and dated 20.03.2018 regarding above.

Kaduwela Municipal Council hereby gives consent for the collection of solid waste with condition and charges stipulated by the council, which will be generated from the stations and depot under our jurisdiction coverage. Further, currently we have no public sewer facility, however some area would be covered by the proposed piped sewer project under National Water Supply and Drainage Board.

S.M.M. Vijitha Mayadunne
Municipal Commissioner

	නගරාධිපති / மாநகர முதல்வர் / Mayor	නාගරික කොමසාරිස් / மாநகர ஆணையாளர் / Commissioner	නාගරික ලේකම් / மாநகர செயலாளர் / Secretary	ප්‍රධාන කාර්යාලය / பிரதான அலுவலகம் / Head Office
දුරකථන தொலைபேசி Telephone	0112 539 832	0112 548 491	0112 539 831	0112 571200
ෆැක්ස් தொலைநகல் Fax	0112 548 493	0112 548 492	0112 539 831/011 2548996	0112 539839
	mayourkmc@sltnet.lk	mcomkadu@sltnet.lk	ms.kadumc@gmail.com	kadumc@sltnet.lk

30/11 2017 1:05 PM FAX +94 11 2696250 DEPT. OF ARCHAEOLOGY 0001

Attention: Eng Chaminda Ariyadasa

144

අධ්‍යක්ෂ ජනරාල්
பணிப்பாளர் நாயகம்
Director-General

දුරකථන අංක
தொலைபேசி இல.
Telephone Nos. 011-2695255

ෆැක්ස්
பெக்ஸ்
Fax 011-2696250

E mail : info@archaeology.gov.lk
Web site : www.archaeology.gov.lk

විදුලි පණිවුඩ
தந்தி
Telegrams

පුරාවිද්.
புராவித்
Puravid.

පුරාවිද්‍යා දෙපාර්තමේන්තුව
தொல்லியல் திணைக்களம்
DEPARTMENT OF ARCHAEOLOGY

ශ්‍රී ලංකා ප්‍රජාතාන්ත්‍රික සමාජවාදී ජනරජය
இலங்கை சனநாயக சோசலிசக் குடியரசு
Government of the Democratic Socialist Republic

මගේ අංකය
எனது இல.
My No. H/ExcP/ADA/WP/2017

ඔබේ අංකය
உமது இல.
Your No.

ශ්‍රීමත් මාකස් ප්‍රනාන්දු මාවත, කොළඹ 7.
சேர் மாக்கஸ் பர்ணாந்து மாவத்தை, கொழும்பு 7.
Sir Marcus Fernando Mawatha,
Colombo 7.

දිනය 2017.11.30

Light Rail Transit Project-JICA
RECEIVED
30 NOV 2017
Ministry of Megapolis & Western Development

Eng. Chaminda Ariyadasa
Project Director
Light Rail Transit Project-JICA
Ministry of Megapolis and western Development

Concurrence of Project implementation light Rail Transit (LRT) Project

This is in response to your application dated 02.11.2017 and letter numbered LRT-J/07/ENV and dated 23.11.2017.

02 I wish to inform you that your new project plan avoiding the two buildings mentioned in our previous report is approved and it should be carried out under following conditions. The two buildings are, Railway Museum and peoples Bank.

Conditions

1. If any antiquity is found during the construction, should report to the Director General of Archaeology or Assistant Director of Archaeology (Western Province)

2. This permission is granted considering only the Archaeological aspects that related to the project area and the Department of Archaeology is not responsible for the environmental impact and public protests if any.

Prassana B Rathnayake
Actg. Additional Director General (Academic)
For Director General of Archaeology

Archt. PRASANNA BANDARA RATNAYAKE
Chartered Architect
Additional Director General (Arch)
Director Architectural Conservation
Sri Lanka Architects' Service II
Department of Archaeology
Colombo 07.

Copy

Secretary, Ministry of Education -For kind Attention
Divisional Secretariat (Colombo)- For kind Attention
Divisional Secretariat (Thimbirigasyaya)- For kind Attention
Divisional Secretariat (Sri Jayawardanapura Kotte) - For kind Attention
Divisional Secretariat (Kaduwela) - For kind Attention
Assistant Director (western Province) - For kind Attention

Ravi - Pls inform relevant officials accordingly.
30/11

ප්‍රධාන කාර්යාලය – පොදු අංක
தலைமை அலுவலகம் – பொது இல.
Head Office – General Numbers 011-2692840 011-2692841

පුරාවස්තු විනාශය වැළැක්වීමේ පොලිස් ඒකකය
தொல் பொருள் அழிவை தடுக்கும் பொலிஸ் அலகு
Police Unit – Prevention of Destruction and Theft of Antiquities

General 011-2694727
Hot Line 011-7 222 333

ගොවිජන සංවර්ධන දෙපාර්තමේන්තුව
கமநல அபிவிருத்தித் திணைக்களம்
DEPARTMENT OF AGRARIAN DEVELOPMENT

මගේ අංකය / எனது இல. / My No. 7/1/17/CO/Dev-94

ඔබේ අංකය / உமது இல. / Your No.

දිනය / திகதி / Date 2018.01.17

ලේකම්,
මහානගර හා බස්නාහිර සංවර්ධන අමාත්‍යාංශය,
සුහුරුපාය, 08 වන මහළ,
බත්තරමුල්ල.

2011 අංක 46 දරණ ගොවිජන සංවර්ධන (සංශෝධන) පනතින් සංශෝධිත 2000 අංක 46 දරණ ගොවිජන සංවර්ධන පනත - කුඹුරු ඉඩම් ප්‍රමාණයක් වී වගා කිරීමක් හැර වෙනත් කාර්යයක් සඳහා භාවිතා කිරීමට අවසර ලබාදීම.

උක්ත කරුණ සම්බන්ධයෙන් ඔබගේ අංකLRT/J/ENV/08 සහ 2017.10.20 දිනමින් ඉදිරිපත් කර ඇති ඉල්ලීම් ලිපිය හා බැඳේ.එකී ලිපියට අදාලව මාළඹේ ගොවිජන සේවා බල ප්‍රදේශයේ ක්‍රියාත්මක කිරීමට සැලසුම් කර ඇති බස්නාහිර කලාපීය සැහැල්ලු දුම්රිය සංක්‍රමණික පද්ධති ව්‍යාපෘතියේ ප්‍රධාන මෙහෙයුම් ඒකකය ඉදි කිරීම සඳහා කුඹුරු ඉඩම් යොදා ගැනීම සම්බන්ධයෙන් ගොවිජන සංවර්ධන දෙපාර්තමේන්තුවේ විරෝධතාවයක් නොමැති බව කාරුණිකව දන්වා සිටිමි.

ඩී. වී. බන්දුලසේන
ගොවිජන සංවර්ධන කොමසාරිස් ජනරාල් (වැ.බ.)
ගොවිජන සංවර්ධන දෙපාර්තමේන්තුව
අංක. 42, ශ්‍රීමත් මාකස් ප්‍රනාන්දු මාවත
කොළඹ 07.

ඩී.වී.බන්දුලසේන
ගොවිජන සංවර්ධන කොමසාරිස් ජනරාල්(වැ.බ)

පිටපත් : දැන ගැනීම හා අවශ්‍ය කටයුතු සඳහා

1. දිස්ත්‍රික් ලේකම්,ඉහළඹ — කාරුණික දැන ගැනීම් සඳහා
2. ප්‍රාදේශීය ලේකම්,කඩුවෙල — කාරුණික දැන ගැනීම් සඳහා
3. ගොවිජන සංවර්ධන සහකාර කොමසාරිස්,ඉහළඹ — කාරුණික දැන ගැනීම් සඳහා
4. සාමාන්‍යාධිකාරී, ශ්‍රී ලංකා ඉඩම් ගොඩකිරීමේ හා සංවර්ධනය කිරීමේ සංස්ථාව කාරුණික දැන ගැනීම් සඳහා
5. අධ්‍යක්ෂ(බස්නාහිර පළාත), නාගරික සංවර්ධන අධිකාරිය — කාරුණික දැන ගැනීම් සඳහා
6. නාගරික කොමසාරිස්,මහ නගර සභාව,කඩුවෙල — කාරුණික දැන ගැනීම් සඳහා
7. අධ්‍යක්ෂ, මධ්‍යම පරිසර අධිකාරිය(බස්නාහිර පළාත) — කාරුණික දැන ගැනීම් සඳහා
8. ගොවිජන සංවර්ධන ප්‍රාදේශීය නිලධාරි,මාළඹේ — කාරුණික දැන ගැනීම් සඳහා
9. පොලිස් ස්ථානාධිපති, අතුරුගිරිය — කාරුණික දැන ගැනීම් සඳහා
10. කෘෂිකර්ම පර්යේෂණ නිෂ්පාදන සහකාර — කාරුණික දැන ගැනීම් සඳහා

ගොවිජන සංවර්ධන දෙපාර්තමේන්තුව, අංක 42, ශ්‍රීමත් මාර්කස් ප්‍රනාන්දු මාවත, තැ. පෙ. 537, කොළඹ 07.
கமநல அபிவிருத்தித் திணைக்களம், இல. 42, சேர் மார்கஸ் பெர்னாந்து மாவத்தை, அ. பெ. 537, கொழும்பு 07.
DEPARTMENT OF AGRARIAN DEVELOPMENT, NO. 42, SIR MARCUS FERNANDO MAWATHA, P. O. BOX 537, COLOMBO 07.
දුරකථන/தொலைபேசிகள்/Telephones :
පොදු කාර්යාලය / பொது அலுவலகம் / General Office 2694231, 2694232, 2694233, 2694234
ගොවිජන සංවර්ධන කොමසාරිස් ජනරාල් / கமநல அபிவிருத்தி ஆணையாளர் நாயகம் / Commissioner General of Agrarian Development 2691060
ෆැක්ස් / தொலைநகல் / Fax 2693572, 2691843, 2674481
E-mail : commissionerdad@yahoo.com
විදුලි පණිවුඩ / தந்தி / Telegram ගොවිජනසේවා / கொவிசேவா / Agraservis

වනජීවී සංරක්ෂණ දෙපාර්තමේන්තුව
வனசீவராசிகள் பாதுகாப்புத் திணைக்களம்
DEPARTMENT OF WILDLIFE CONSERVATION
ප්‍රධාන කාර්යාලය - අංක 811/ඒ, ජයන්තිපුර පාර, බත්තරමුල්ල
பிரதான அலுவலகம், இல. 811/ஏ, ஜயந்திபுர வீதி, பத்தரமுல்லை
Head Office - No. 811/A, Jayanthipura Road, Battaramulla

මගේ අංකය / எனது இல. / My No.: WL/6/1/1/298

ඔබේ අංකය / உமது இல. / Your No.:

දිනය / திகதி / Date: 15 .01.2018

Light Rail Transit Project-JICA
RECEIVED
16 JAN 2018
Ministry of Megapolis & Western Development

Through
Secretary,
Ministry of Sustainable Development and Wildlife

Secretary,
Ministry of Megapolis and Western Development,
Battaramulla.

Dear Sir,

Concurrence for Project Implementation Light Rail Transit (LRT) –JICA Project

This refers to your letter numbered LRT-J/07/ENV/2017/1 and dated 23.11.2018 regarding the above subject.

02. According to the map that you have submitted to this department, proposed light rail transit (LRT) project falls outside of the Sri Jayawardhanapura Sanctuary declared under the Fauna and Flora Protection Ordinance. LRT goes through the sanctuary buffer zone (100 m) in two locations.

03. Therefore we have no objection to carry out this project under the stipulated conditions recommended by Environmental Impact Assessment (EIA)/Initial Environmental Examination (IEE) and the provisions of Flora and Fauna Protection Ordinance.

04. Please be kind enough to nominate Department of Wildlife Conservation (DWC) as a TEC member for the TEC committee.

Yours Faithfully,

Manjula Amararathne
Director (Operations)

Sgd/M.G.C.Sooriyabandara
Director General

Copy: Secretary,
Ministry of Megapolis and Western Development, - For Your Kind Information
Battaramulla.

Assistant Director (Western) - -do-

දුරකථන / தொலைபேசி / Telephone
අධ්‍යක්ෂ ජනරාල් - 011 2888581
අධ්‍යක්ෂ (පාලන) - 011 2888583
අධ්‍යක්ෂ (මෙහෙයුම්) - 011 2888582
අධ්‍යක්ෂ (මුදල්) - 011 2888584
ප්‍රධාන කාර්යාලය / அலுவலகம் / Head Office: 011 2888585
ෆැක්ස් / தொலைநகல் / Fax: 011 2883355
ඊ-මේල් / மின்னஞ்சல் / E-mail: director@dwc.gov.lk
වෙබ් අඩවිය / வலைப்பின்னல் / Website: www.dwc.gov.lk

(169)

කාර්යාලය/ அலுவலகம் / Office

දුරකථනය
Telephone
தொலைபேசி
011-2887421

ෆැක්ස්
தொலை நகல
Fax
011-2887481

තිරසර සංවර්ධන හා වනජීවී අමාත්‍යාංශය
வலுவாதார அபிவிருத்தி மற்றும் வன ஜீவரசிகள் அமைச்சு
Ministry of Sustainable Development and Wildlife

9 වන මහල, පළමු අදියර, "සෙත්සිරිපාය", බත්තරමුල්ල.
9 ஆம் மாடி, முதலாம் கட்டம், "செத்சிறிபாய", பத்தரமுல்லை.
9th Floor, Stage I, "Sethsiripaya", Battaramulla.

ලේකම්/ செயலாளர்/ Secretary

★ දුරකථනය
தொலைபேசி
Telephone
011-2885841

ෆැක්ස්
தொலை நகல
Fax
011-2885492

30 JAN 2018
තැපැල් දෙපාර්තමේන්තුව

RECEIVED
02 FEB 2018
Ministry of Megapolis & Western Development

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எனது இல
My No
SDW/5/4

ඔබේ අංකය
உமது இல
Your No

දිනය
திகதி
Date
30.01.2018

Secretary
Ministry of Megapolis and Western Development
Batteramulla

Concurrence for Project Implementation Light Rail Transit (LRT) –JICA project

Herewith I am forwarding the letter dated 15th January 2018 sent by the Director General of Department of Wildlife Conservation regarding the above subject for your necessary action please.

A.K.K.M.R.W. Kumaragama
Additional Secretary (Development)
For Secretary
Ministry of Sustainable Development and Wildlife

Copy:
Director General, Department of Wildlife Conservation - i.f.pl.

(52)

ලංකා විදුලිබල මණ්ඩලය
இலங்கை மின்சார சபை
CEYLON ELECTRICITY BOARD

Your Ref: PMU/JICA/ULT/04 My Ref: LRT –Project/Gen.Correspondance Date: 08th November 2017

Project Director,
Light rail Transit Project (JICA),
Ministry of Megapolis and Western Development.

Dear Sir,

Consent for the Re-Routing of All Affected Transmission & Distribution Lines – JICA funded Light Rail Transit Project

This refers to your letter no PMU/JICA/ULT/04 dated 31.10.2017 regarding above.

As requested therein, the consent is hereby granted subject to the re-routing of all affected Transmission & Distribution Lines designed by CEB for the proposed LRT route.

This shall be carried out according to the system procedures and guidelines of Ceylon Electricity Board.

General Manager
Ceylon Electricity Board.

Copy to:

1. Addl.GM (DD1) – f.i.p.l.
2. Addl.GM (Tr) - f.i.pl
3. Addl.GM (DD3) – f.i.p.l.

OFFICE OF THE GENERAL MANAGER
3rd Floor, Chittampalam A Gardiner Mawatha, Colombo 00200, Sri Lanka
Tel: +94 11 23 20 953 / 23 25 340 | Fax: +94 11 23 23 935 | e-mail: gm@ceb.lk | www.ceb.lk |

117

(110)

My No DIAM/AM/W/CMB/General
Assets Management Branch
Irrigation Department
Colombo07
18.12.2017

Light Rail Transit Project JICA
RECEIVED
21 DEC 2017
Ministry of Megapolis & Western Development

Eng. Nihal Rupasinghe
Secretary
Ministry of Megapolis and Western Development

DPD — collect all these ... letters in view of sending to JICA.

Concurrence for Project Implementation
Light Rail Transit (LRT) Project.

Mr. Rav.
Pl take action to collect all clearance letters from respective organizations.
26/12

(109)

This refers to your letter no LRT/J/ENV/08 dated 19.10.2017

This proposal was inspected at the site by Colombo Division Irrigation Engineer and found that 100 m^3 of water to be discharged daily to the canal along the Chandrika Kumarathunga Mawatha in Malabe and convey to Kalani river through Malabe Minor Flood protection scheme belong to Irrigation Department.

Eventhough Irrigation Department has no objection for this proposal you may need the approval of SLRDC and Enviornment Authority due to reason mentioned in the above para.

Eng H.M.Junaid
Director of Irrigation (Assets Management)
O/C

Copy

1. Director of Irrigation (Colombo) - f.i. & n.a pl

KUMARASINGHE SIRISENA
Chairman
Sri Lanka Telecom PLC
1st Floor, CTO Building
Lotus Road, Colombo 01, Sri Lanka.
Company Reg. No. PQ7
Voice : +94- 11-2323434 / +94-11-2433337
Fax : +94-11-2449999
E-mail : sltchairman@slt.com.lk
Website : www.slt.lk

Sri Lanka Telecom

CH-L/GCEWO-LRT/04/01/2018

4th January, 2018

The Secretary
Ministry of Megapolis & Western Development
17th & 18th Floors
Suhurupaya, Subhuthipura Road,
Battaramulla

Dear Secretary

CONCURRENCE OF PROJECT IMPLEMENTATION
LIGHT RAIL TRANSIT (LRT) PROJECT – JICA

With reference to your letter LRT-J/16/UTI/07/SLT dated 15/12/2017 on the above subject, we wish to inform you that Sri Lanka Telecom PLC (SLT) has no objection in principle for your proposed trace to construct LRT structures on the center median of existing roads that may require to adjust/divert existing SLT owned Outside Plant network, if any, subject to the following:

1. Before commissioning the work, Ministry of Megapolis and Western Development and/or LRT Project-JICA shall make arrangements for joint site inspections with SLT with the relevant authorities/organizations to identify the existing SLT plants along the proposed trace and plan for appropriate diversions/relocations of SLT Out Side Plant network, where applicable. This will enable SLT to prepare the required removal and relocation plan and submit a cost estimate to your office.

2. Ministry of Megapolis and Western Development and/or LRT Project-JICA shall agree to bear the total cost of such diversions/relocations and service cut-overs based on the estimates made by SLT for such requirement. Upon the receipt of payment SLT will carry out necessary shifting work.

Thank you.

Yours sincerely

Kumarasinghe Sirisena
Chairman

Copy: Actg. CCO

December 27, 2017

Mr. Nihal Rupasinghe,
Secretary,
Ministry of Megapolis and Western Development.

Dear Sir,

CONCURANCE OF PROJECT IMPLEMENTATION
LIGHT RAIL TRANSIT (LRT) PROJECT- JICA

Reference is made to your letter LRT-J/16/UTI/11/DLG dated 15th December 2017 on above captioned matter.

Whilst thanking you for being concerned about the safety of our existing fiber optic cable paths, We have highlighted the existing road segments where our fiber cables are laid in the reference maps provided .

Further we would be much grateful if a JICA representative could participate for a joint inspection along with our Optical Fiber maintenance team to exactly locate the overlapping sections. This will help us on providing you with precise details which will ease your work as well as ensure the safety of our cables.

Please kindly inform us a date and time convenient to you to arrange this join inspection

Should you need further clarifications, please do not hesitate to contact Dilan. D. Perera Manager – Transmission Operations on 773331169.

Thank you very much for your kind cooperation in this regard.

Yours faithfully,

DIALOG BROADBAND NETWORKS (PVT) LIMITED

Pradeep De Almeida
Group Chief Technology Officer

Dialog Broadband Networks (Pvt) Ltd (PV 261)
475, Union Place, Colombo 02, Sri Lanka. Tel: +94 (0) 11 7 100 700 Fax: +94 (0) 11 7 100 701 www.dialog.lk
an axiata company

INSEE ECOCYCLE

3rd April 2018

Eng. Chaminda Ariyadasa
Project Director,
Light Rail Transit Project - JICA,
Ministry of Megapolis and Western Development

Dear Sir,

Re: Request to Obtain Consent/Concurrence for the Acceptance of Wastes – Light Rail Transit Project from Fort to Malabe

With reference to your letter dated 22nd March 2018 on the above request, it is highly appreciated that you have select us as the preferred waste management partner for LRT project.

INSEE Ecocycle, the waste management unit of Siam City Cement (Lanka) Limited (SCCL) which was previously named as Geocycle under the former Holcim (Lanka) Limited, has been in the waste management industry since 2003 and had served to the nation in eliminating more than 600,000 MT of waste through its cement kiln, which would have otherwise ended up at the open dumping. We are pleased to covey our initial interest on secure disposal of material as per the waste profile provided with regards to the above project. We will have to separately analysis the waste generation and the disposal solution when the actual requirement arises after completion of the LRT project on 2025.

Looking forward to continuing strong relationship with LRT project.

Yours faithfully,

Siam City Cement (Lanka) Limited

Sanjeewa Chulakumara
General Manager - Ecocycle

Sanjeewa Chulakumara
General Manager
INSEE Ecocycle
Siam City Cement (Lanka) Limited
No. 41, R. A. De Mel Mawatha,
Colombo 03

Siam City Cement (Lanka) Limited
Reg No. PB 888
41, R A De Mel Mawatha, Colombo 3, Sri Lanka.
Tel: +94 11 5900 600
Website: www.siamcitycement.com/lk

Annex C

Traffic Impact Study

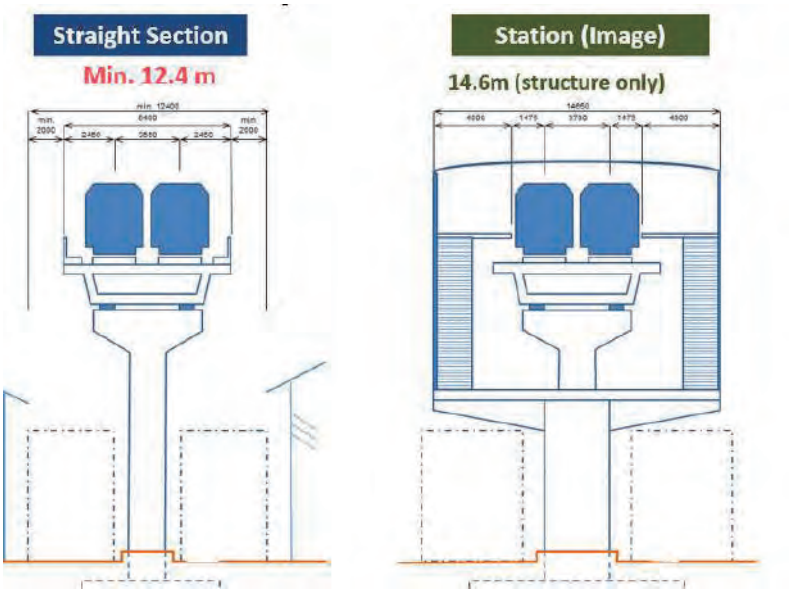
1 TRAFFIC IMPACT ANALYSIS FOR THE PROPOSED LRT LINE – RTS 1 (NORTHERN PART) AND RTS 4

1.1 Introduction

The Ministry of Megapolis and Western Region Development has proposed an Light Rapid Transit (LRT) network for the Western Region as one of their key developments in the transport master plan. The proposed LRT lines are the first phase of the LRT network. The total length of the LRT line is 16 km. The route of the proposed LRT lines and stations considered in the study are given in Figure 02 below.

1.2 Characteristics of the LRT Infrastructure

The infrastructure characteristics of the LRT line is an important consideration in assessment of its impact during the construction stage. The typical cross section of an elevated LRT line is given in Figure . The Right of Way (ROW) is 12.4m (8.4m for track and 2m gap on each side) on straight sections and 14.6 near stations. It is assumed that during construction minimum of 10m wide area will be allocated for construction works on straight sections and 15m at stations. 10m wide is equivalent to 2 lanes including the width of the centre median on roads with a centre medians.



Source: JICA

Figure 1. Typical cross sections of LRT line

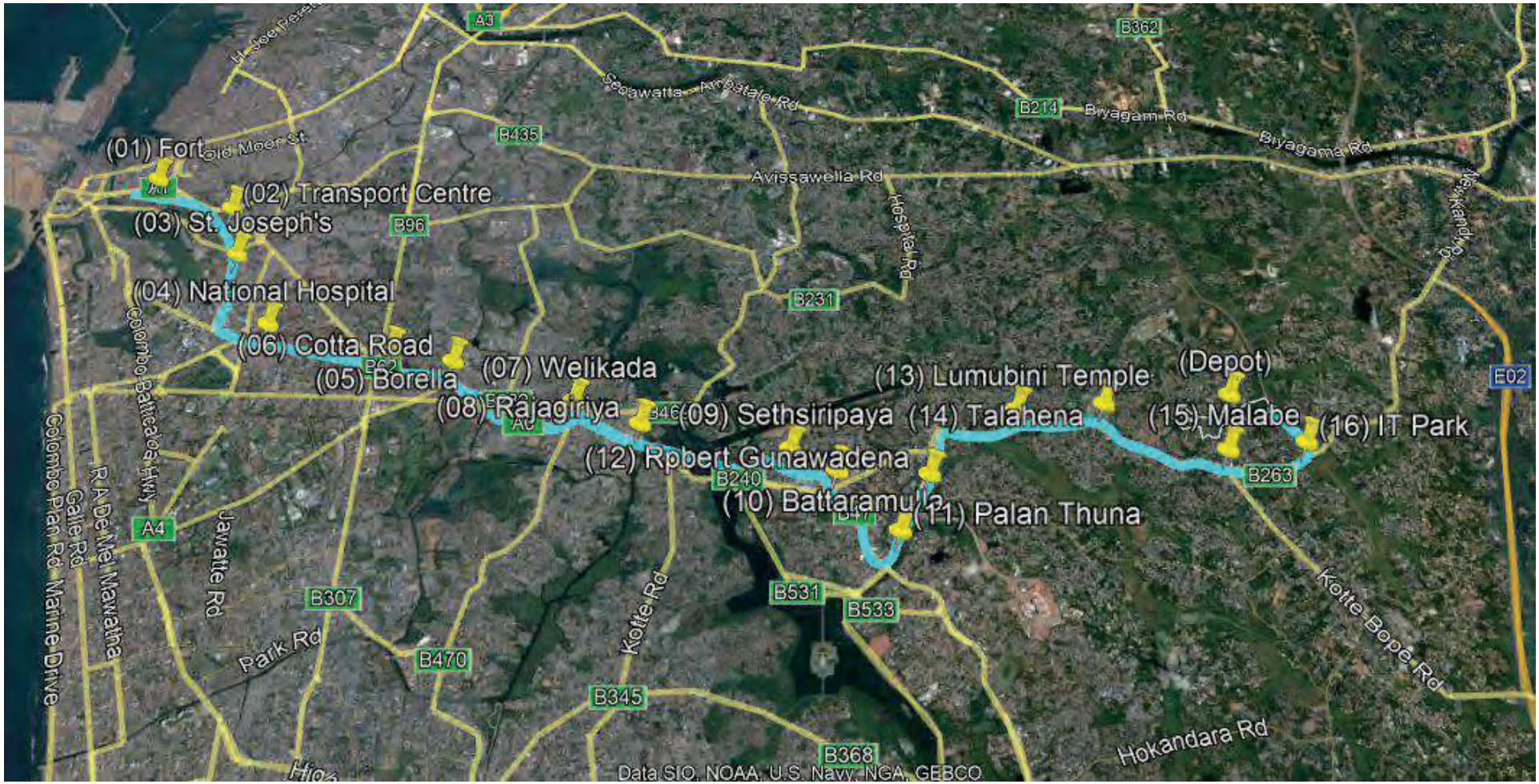


Figure 2: Proposed LRT route and stations

1.3 Road Network and Traffic Characteristics in the Project Impact Area

The LRT line is to constructed parallel to the existing roads for majority of its route except for section near Sethsiripaya Station and near Kotte-Bope Road. Therefore, it is expected that there will be significant impact on the road network during the construction phase.

The characteristics of the roads along which the LRT lines is proposed to be constructed and other roads affected at key intersections are listed in Table 1 below.

Table 1. Characteristics of Roads affected by the LRT Construction

No.	Road Name	Class	Start node (a)	End node (b)	Node Type (a)	(b)	Road type	No. of lanes	Carriageway width (m)	Sidewalk width (m)
1	W E Bastian Mawatha		1	2	3	4S	One way	2	10	2.0-4.0m
2	Olcott Mawatha	A01	2	3	4S	3	Divided	5	21	> 4.0m
3	Trace Ln		3	4	3	3	Undivided			
4	T B Jayah Mawatha		4	5	3	3S	Divided	4	18	> 4.0m
5	Dr Colvin R de Silva Mawatha		5	6	3S	RS	Median Seperated	4	13	2.0-4.0m
6	Ward Place		6	7	RS	5S	Divided	4	13	2.0-4.0m
7	Cotta Rd	B62	7	8	5S	4S	Median Seperated	4	15	2.0-4.0m
8	Sri Jayawardenepura Mawatha	B240	8	9	4S	5	Median Seperated	6	24	2.0-4.0m
9	Sri Jayawardenepura Mawatha	B240	9	10	5	-	Median Seperated	6	21	> 4.0m
10	Sri Jayawardenepura Mawatha		10	11	-	3	-		-	-
11			11	12	3	3S	-	-	-	-
12	Battaramulla Rd	B47	12	13	3S	4S	Median Seperated	4	14	2.0-4.0m
13	Denzil Kobbekaduwa mawatha		13	14	4S	-	Undivided	4	12	> 4.0m
15	Kaduwela Rd	B240	14	15	-	3	Undivided	2	10	2.0-4.0m
16	Kaduwela Rd	B240	15	16	3	3	Undivided	2	10	<2m
17	Kaduwela Rd	B240	16	17	3	3	Undivided	2	10	<2m
18	Chandrika Kumaratunga Mwa		17	18	3	-	-	2	-	2.0-4.0m

Note: The junction type (at the node) and the traffic control mechanism is indicated as follows,

3 3 way (Y/T junction)

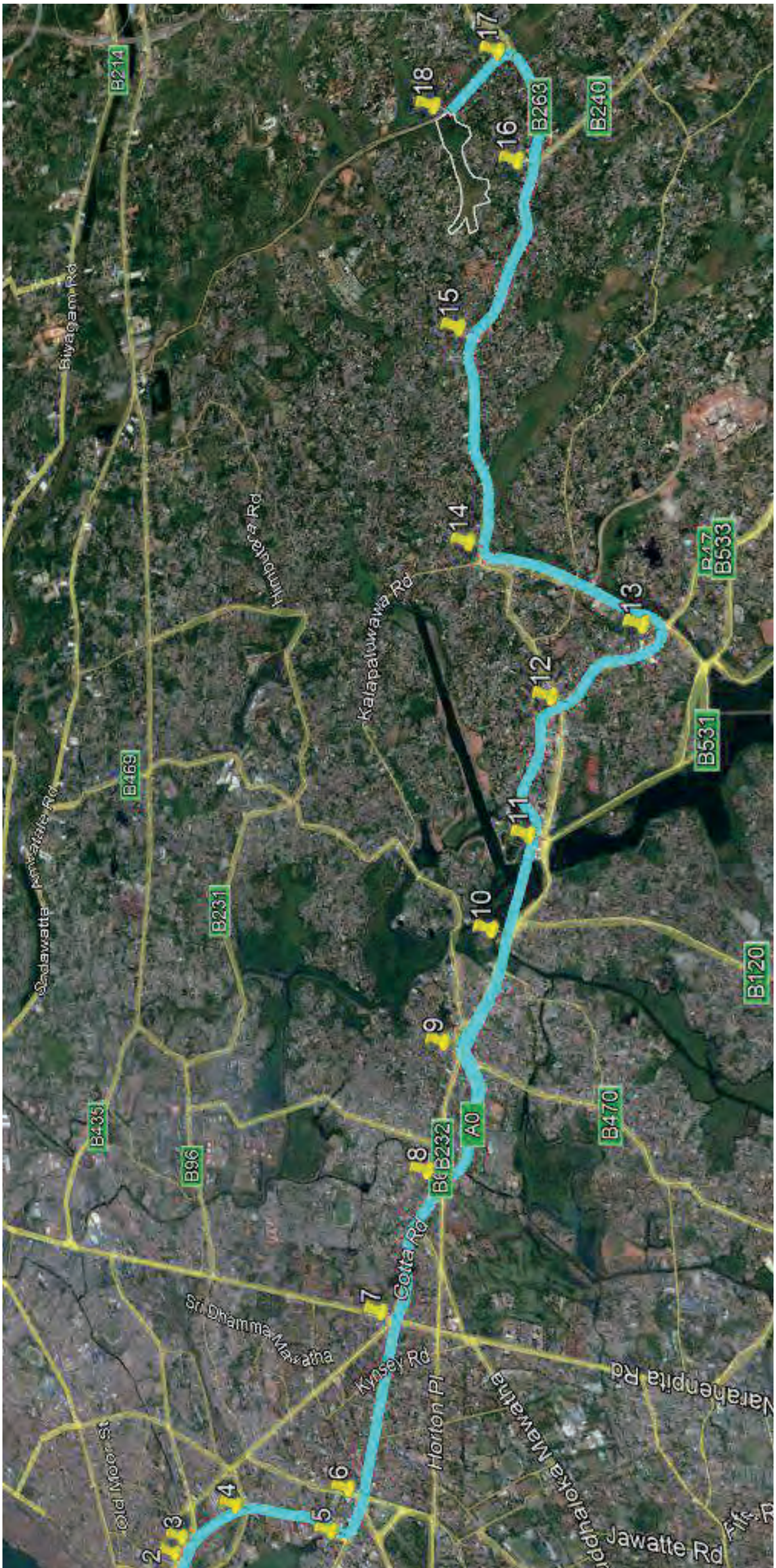
4 4 way

R Roundabout

*S Signalized

Midblock nodes are indicated as empty

Sections that are not constructed over existing major road links are highlighted in grey.



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B214
Biyagama Rd
B263
B240
Kalapaluwawa Rd
B47
B533
B531
B469
B231
B120
B435
B96
B232
A0
B470
Cotta Rd
Sri Dhamma Mawatha
Kynsey Rd
Horton Pl
Narahenpita Rd
Jawatte Rd
Old Moor St
A4

1.3.1 Bastian Mawatha (Node 1-2)

Bastian Mawatha operates as a one-way two-lane road with a 12 hr traffic volume of 18,230 vehicles and a peak flow of 1710 veh/hr. Traffic flow is fairly uniform during the day and reduces significantly after 6.00PM. The vehicle composition is predominantly buses and three-wheelers with 31% and 43% respectively, motorcycles are 13% and 6% cars/van/jeep category.

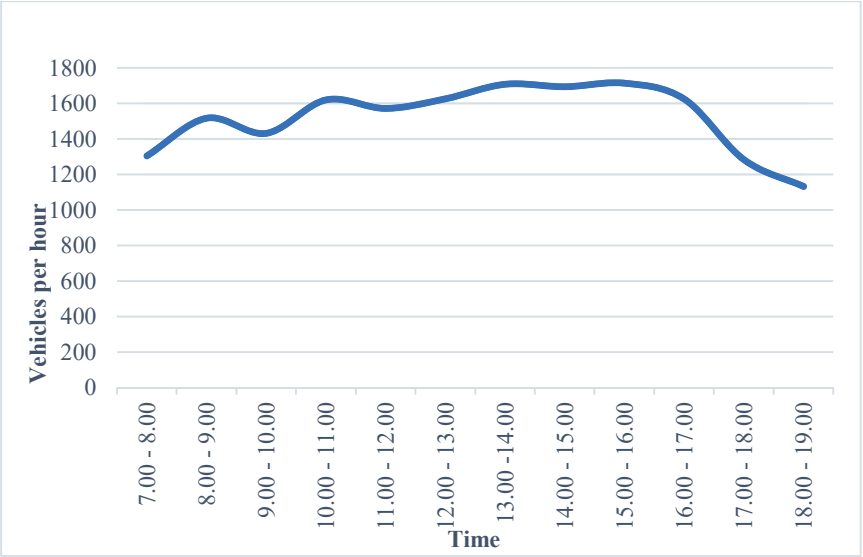

Figure 4. Hourly traffic flow on Bastian Mawatha

1.3.2 Olcott Mawatha (Node 2-3)

Olcott Mawatha section where the LRT is proposed to be constructed include several key intersections in the Fort area and is used to access the Pettah market, main bus and railway terminals in the city. The Lotus Road and York Street intersections are one of the busiest intersections in the city. As shown in Figure , there is significant congestion and queue build up from the York Street and Lotus Road intersections and towards Pettah on Olcott Mawatha during the peak hours.

Figure 5. Traffic condition near Olcott Mawatha/Lotus Road/York Street intersections

A4/Olcott Mawatha/Lotus Road junction has a 12 hr traffic flow of over 72000 vehicles with peak hour flow in the range of 7300 veh/hr. Olcott Mawatha/York Street junction has nearly 63,500 vehicles during a 12 hour period, with peak flows in range of 6000 veh/hr. Traffic flow at the intersection (Node 8) on Olcott Mawatha is around 41,000. The average traffic flow during a 12 hr period along Olcott Mawatha is in the range of 35,000, with peak flow of 3199 veh/hr occurring during the mid-day period, hourly flows fairly even during the day (see Figure).

Olcott Mawatha has a very high pedestrian flow as well mainly due to, a) the public transport users from the Fort Railway Station and interprovincial and intra provincial bus terminals and b) the pettah market area.

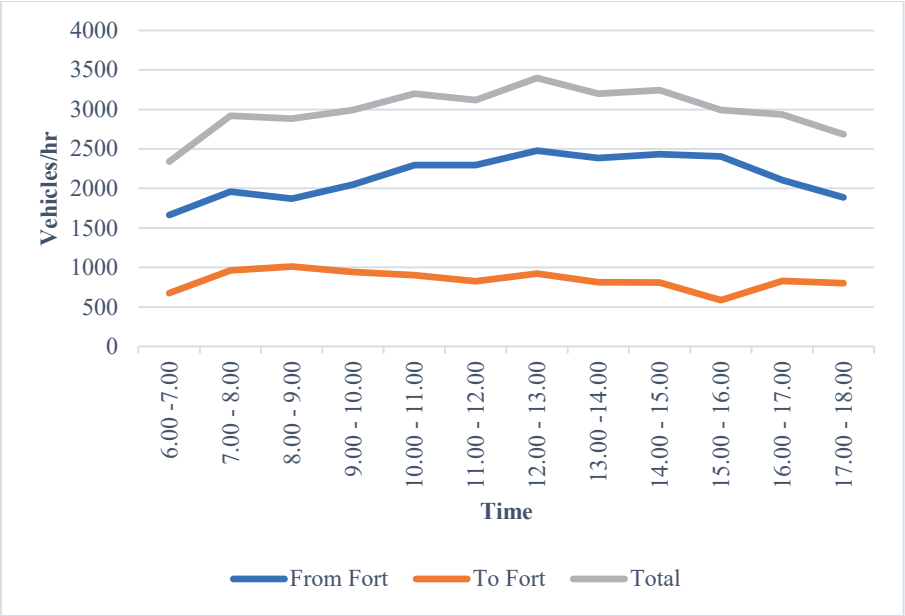

Figure 6. Hourly traffic flow on Olcott Mawatha (near Bastian Mawatha terminal)

1.3.3 T.B. Jayah Mawatha (Node 4-5)

T.B.Jayah Mawatha is a 4-lane road connecting D.R. Wijewardene Mawatha and Union Place. The 12 hr traffic volume is 30,180 vehicle and peak flow of 3175 veh/hr. There is a significant peak in traffic movement during the mid day period, due to the presence of a school and the afternoon period is especially congested due to traffic flow towards Union Place.

D.R. Wijewardene Mw./T.B.Jaya Mawatha intersection has a total traffic movement of 41,043 during the day time 12 hr period with a peak 15 min flow rate of 1250 vehicles occurring during the mid-day.

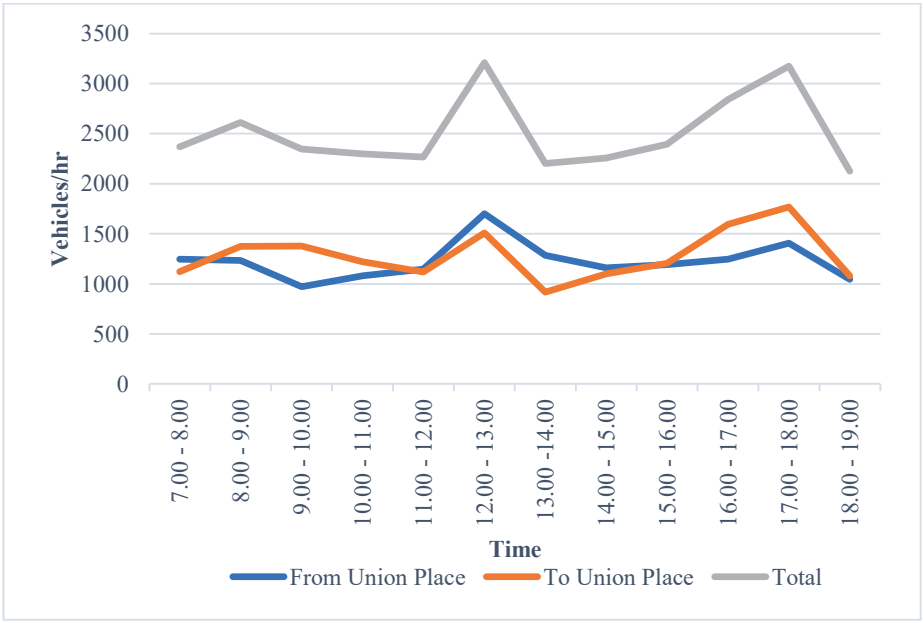

Figure 7. Hourly traffic flow on T.B. Jayah Mawatha

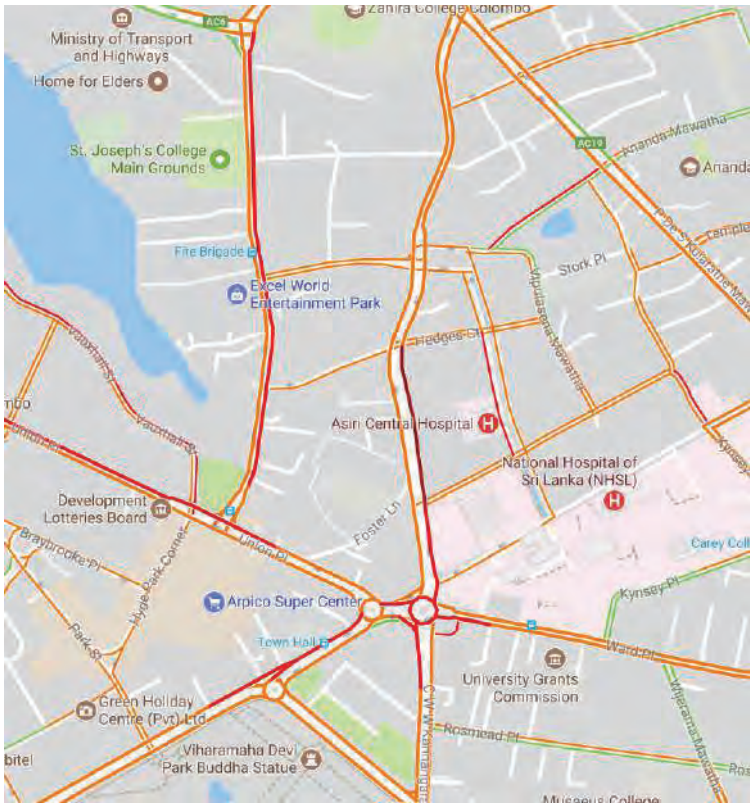

Figure 8. Traffic flow condition in the network near nodes 13-15 (PM peak period)

1.3.4 Union Place – Town Hall- Ward Place (Node 5-7)

The road section from Ibbanwala junction to Borella via Town Hall is a high traffic volume corridors with significant congestion oberserved at Ibbanwala junction, De Soysa Circus as well the Borella Junction (see Figure . Ibbanwala junction has 12 hr day time traffic demand of 63,604 vehicles with peak hour demand of 6139 veh/hr. Union Place road segment from Ibbanwala junction to Town Hall has a 12hr traffic volume of 44,202 vehicles, with peak flow of 4101 veh/hr and heavy traffic flows and congestion is observed towards Town Hall in the evening peak period.

Ward Place operates as a 4-lane road with a 12 hr traffic flow of 31,391 vehicles. Peak flow rate is 2981 veh/hr (see. Traffic flow speeds are relatively satisfactory compared to similar roads in the network and delays are near the two ends of the road. The vehicle composition is as follows, cars/van/jeep -26%, motorcycles -19%, three-wheelers-33%, goods vehicle -3%, buses- 4%. The road segment beyond Borella Cross Roads has less traffic since traffic toward Borella turn left from Ward Place on to Borella Cross Road.

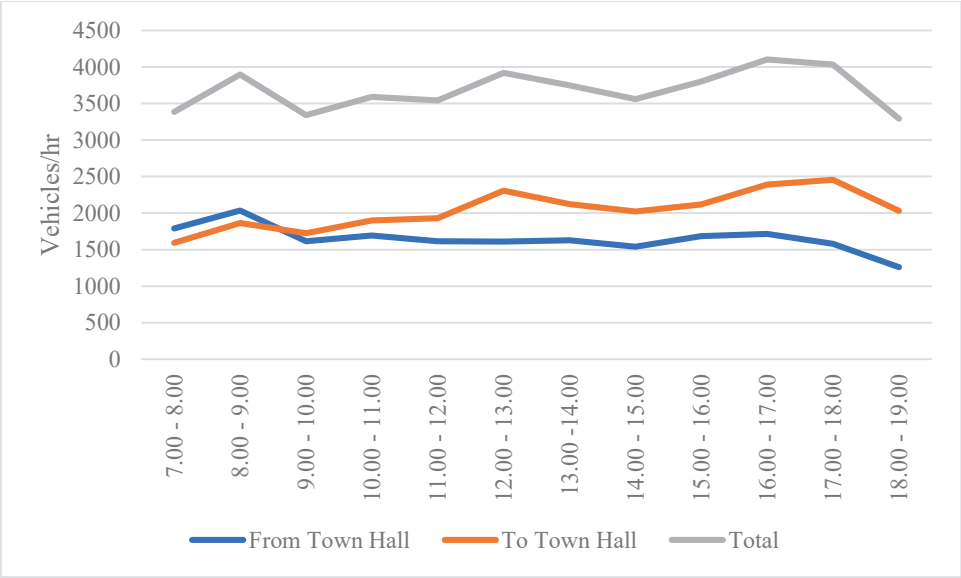

Figure 9. Hourly traffic flow on Union Place near Ibbanwala junction

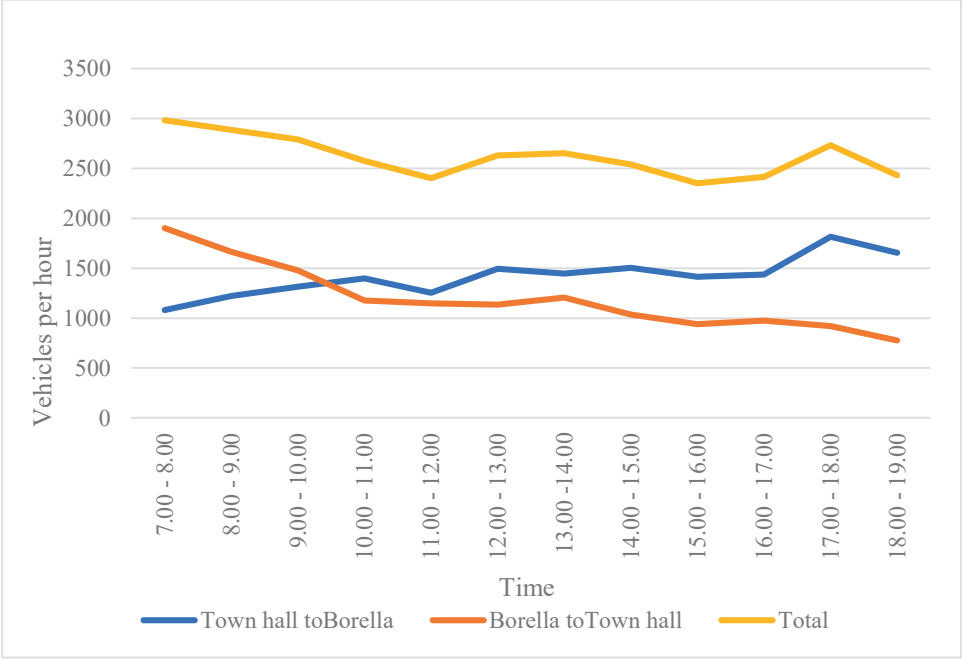

Figure 10. Hourly traffic flow on Ward Place

1.3.5 Cotta Road (Node 7-8)

Cotta Road operates as a 4-lane median divided road with a 12hr traffic flow of 44181 vehicles and a peak flow of 4012 veh/hr. The vehicle composition is as follows, cars/van/jeep -38%, motorcycles - 25%, three-wheelers-29%, goods vehicle -4%, buses- 4%. The Kelani Valley railway line crossing is located along this segment, and delays are typically observed near the crossing during closure period. In addition, as shown

in Figure , there is heavy congestion towards Rajagiriya during the evening peak, especially near the Ayurveda and Rajagiriya junctions.

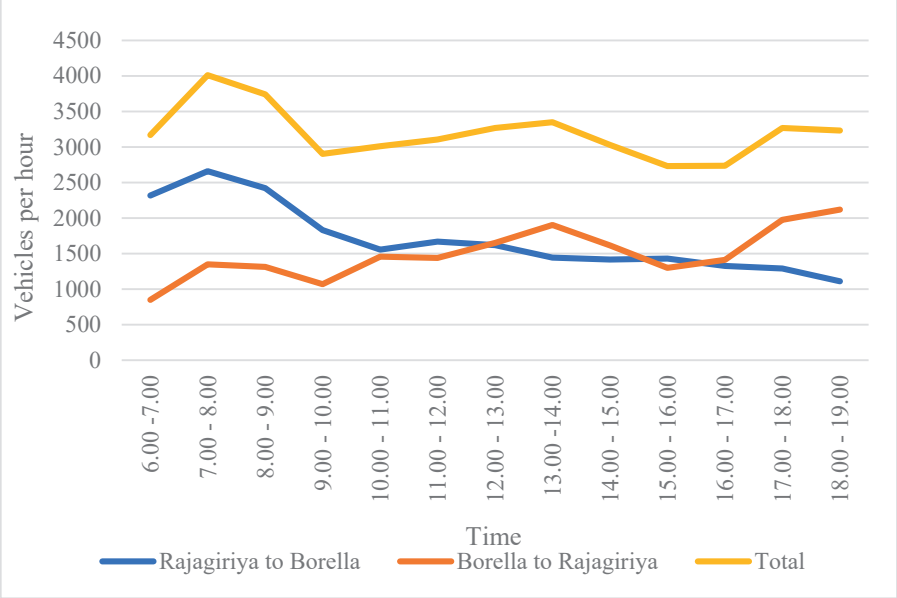

Figure 11. Hourly traffic flow on Cotta Road

Figure 12. Traffic condition on Cotta Road (PM Peak)

1.3.6 Sri Jayawardenepura Mawatha (Node 8-9)

Sri Jayawardenepura Mawatha, at presently one of the most congested roads in Colombo. It serves a large population in Rajagiriya and Malabe corridors who make car oriented trips and several key intersections are located which that connects this to Cotta Road, Angoda, Nawala etc. which adds to the delays observed on the road segment. It operates as six lane median separated highway. Sri Jayawardenepura Mawatha has a 12 hr traffic volume of approximately 51,000 vehicles with two distinguishable peaks during the morning

and the evening periods. The peak hour traffic flows are in the range of 4000-5000 vehicles/hr, with morning peak flow of nearly 4000 vehicles/hr towards Borella and evening peak flow of nearly 3000-4000 vehicles/hr towards Battaramulla. The vehicle composition is as follows, cars/van/jeep -41%, motorcycles - 23%, three-wheelers-26%, goods vehicle -4%, buses- 5%.

At present, a bus priority lane is in operation on section of this road in the morning and a flyover is under construction at Rajagiriya intersection.

1.3.7 Battaramulla Road – Denzil Kobbekaduwa Mw (Node -12-13-14)

Battaramulla road section between Palan thuna junction and Sri Jayawardenepura Road is 4 lane road which has a 12 hr traffic volume of 18410 vehicles and a peak flow rate of 1890 veh/hr. The traffic congestion is low on this link compared to other roads in the network. The vehicle composition is as follows, cars/van/jeep -42%, motorcycles - 22%, three-wheelers-30%, goods vehicle -3%, buses- 3%.

Denzil Kobbekaduwa Mawatha is a 4-lane road which has a 12 hr traffic volume of 36,858 vehicles and a peak flow rate of 3610 veh/hr. This section attracts high traffic volumes due to the numerous government institutions being established along the road.

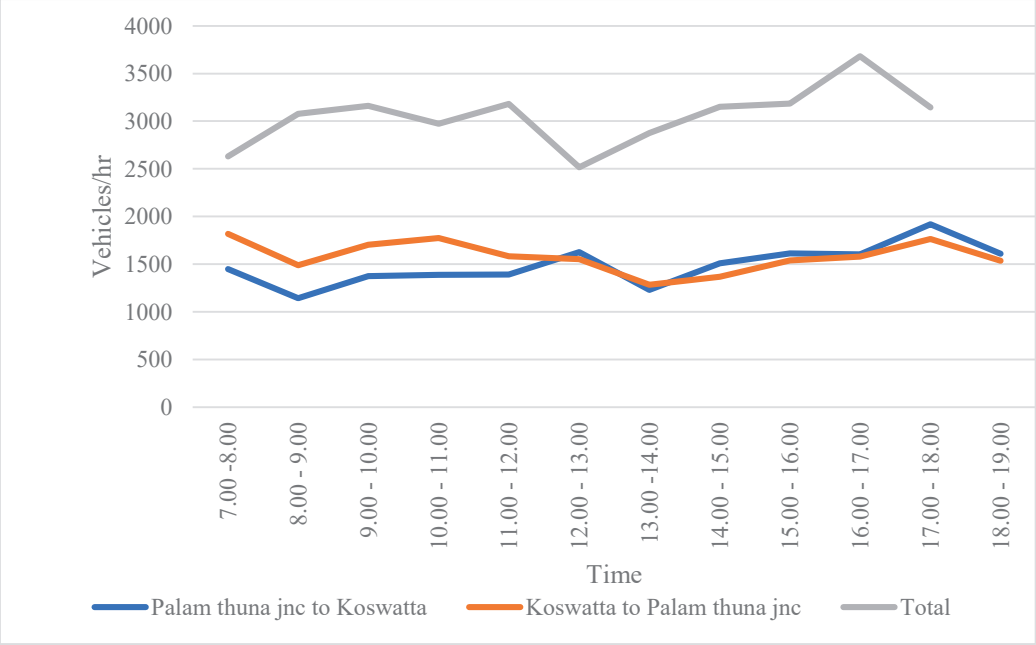

Figure 13. Hourly traffic flow on Denzil Kobbekaduwa Mawatha

1.3.8 Kotte-Bope Road (Node 14-15-16-17)

Kotte-Bope road (Between Malabe junction and IT park) serves as the main arterial road that connects the Malabe corridor to Rajagiriya, Battaramulla and Colombo. It is a 2-lane road with 31885 vehicles per day observed during a 12hr period. Peak flow rate is 3708 veh/hr and distinct peak periods are observed flow the hourly flow variation.

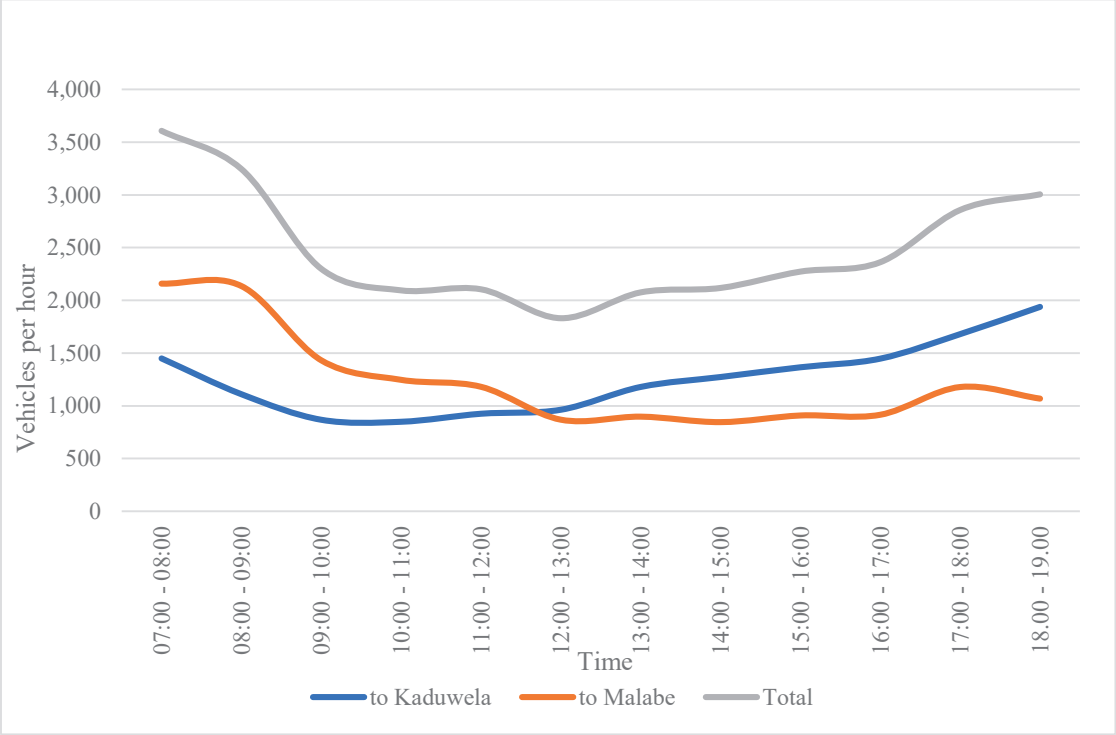

Figure 14. Hourly traffic flow on Kotte-Bope Road

1.3.9 Summary of the Link Traffic Flows

The volume to capacity analysis was carried to gauge the existing condition of road capacity for the road links where the LRT line will be constructed. The following assumptions were made,

Lane capacity – 1400 veh/hr/lane

Peak hour factor = 10% of daily traffic

Road capacity = Hourly capacity/Peak hour factor

Estimated ADT = 1.25 x 12 hr traffic volume

As evident from results in Table 2, most road links operate at or near capacity levels when you consider the total capacity of the road.

Table 2. Capacity Analysis for the Road Links

Link ID	Road Name	Class	Road type	No. of lanes	Link hourly Capacity (veh/h)	Estimated ADT	Total 12hr	V/C
1	Olcott Mawatha	A01	Divided	5	7000	45000	36000	0.64
2	W E Bastian Mawatha		One way	2	2800	22788	18230	0.81
3	T B Jayah Mawatha		Divided	4	5600	37635	30108	0.67
4	Dr Colvin R de Silva Mawatha		Median Seperated	4	5600	55253	44202	0.99
5	Ward Place		Divided	4	5600	39239	31391	0.70
6	Cotta Rd	B62	Median Seperated	4	5600	55226	44181	0.99
7	Sri Jayawardenepura Mawatha	B240	Median Seperated	6	8400	72554	58043	0.86
8	Battaramulla Rd	B47	Median Seperated	4	5600	12139	9711	0.22
9	Denzil Kobbekaduwa mawatha		Divided	4	5600	23319	18655	0.42
10	Kaduwela Rd	B240	Divided	2	2800	37356	29885	1.33

This suggests that flow rate increases that occur during peak periods where flow rate increases there is likely to be extended periods of congestion. This was also evident from the traffic condition observations.

1.4 Traffic Impact Analysis and Mitigatory Measures

The proposed LRT line is to be constructed on the major arterial roads in Colombo. More than 50% of these roads have a daily vehicle traffic demand in excess of 50,000 vehicles. There are several critical intersections that will be affected during the construction activities that may have network wide impacts in addition to the roads directly affected by the construction work.

1. T.B.Jaya Mw – D.R.Wijewardene Mw intersection
2. Ibbanwala junction
3. De Soysa Circus / Lipton Cicus
4. Borella junction
5. Ayurveda junction
6. Rajagiriya junction
7. Koswatta junction

In addition, there are roads with high pedestrian movement and links to key public transport services.

1.4.1 Road Link Capacity Reduction

A minimum of 10m wide work-zone is required for the LRT construction. Therefore, most road links will lose 2-3 lanes as per standard lane width allocation. Assuming, temporary lane widths of 2.7m given and 1-2m of sidewalks allocated for temporary roadways during the construction stages, the number of temporary lanes that can be provided on the affected roads during construction phase is estimated and given in Table 3. This would require removal of the existing center medians, if any and relocation of road side utility facilities. The temporary lane allocation would result in a capacity reduction of 30%-50% on most roads. However, it is recommended to provided minimum of 3m especially for the lanes utilized by buses.

Table 3. Temporary lane number estimation

Link	Road Name	Road type	No. lanes	Carriageway (m)	Sidewalk (m)	Width avail. During construc	Temp. lanes
1	Olcott Mawatha	Divided	5	21	> 4.0m	13	4
2	W E Bastian Mawatha	One way	2	12	2.0-4.0m	3	1
3	T B Jayah Mawatha	Divided	4	18	> 4.0m	10	3
4	Dr Colvin R de Silva Mawatha	Median Seperated	4	13	2.0-4.0m	5	1
5	Ward Place	Divided	4	13	2.0-4.0m	5	1
6	Cotta Rd	Median Seperated	4	15	2.0-4.0m	6	2
7	Sri Jayawardenepura Mawatha	Median Seperated	6	24	2.0-4.0m	16	5
8	Battaramulla Rd	Median Seperated	4	14	2.0-4.0m	6	2
9	Denzil Kobbekaduwa mawatha[1]	Undivided	4	12	> 4.0m	9	3
10	Kaduwela Rd[1]	Divided	2	10	2.0-4.0m	7	2

Note: 1. Assume LRT line will be constructed on the edge of the carriageway and 5m on the existing roadway will be utilized for construction work zone.

1.4.2 Traffic Diversion

As a result of the reduced capacity of the links due to construction activity, it would be required to divert traffic especially during the peak periods during the construction phase. It is evident that similar to these roads affected, most of the links in the alternative routes have also reached their capacity. Diversion requirement may be in the order of 5000-10,000 veh/day for the affected roads. Therefore, it is required to clearly identify the stages of construction and the timeline to identify the alternative routes available and the phases when the diversion will take pace. Traffic diversion will be even more challenging if turning movements at intersections are obstructed during the construction activity.

1.5 Pedestrians

Pedestrian movement will be severely hindered during construction work, therefore it is recommended to ensure walkable paths maintained for pedestrian movement especially where high density of pedestrian flow is expected such as at Olcott Mawatha, Liberty Roundabout,Borella junction area.

1.6 Bus operations

Bus operations are likely to be severely affected during the project work. This includes the recently established bus lane operation in some corridors. It would be required to change the operational path of some bus routes and to relocate bus stops etc. The most critical segment would be that of Olcott Mawatha and Bastian Mawatha where the bus and rail terminals are located.

1.7 Safety

Ensuring safety during the construction period is of high importance. The consultants are required to adhere to the work zone management guidelines given by RDA for the required standards.

1.8 Recommendations

A comprehensive traffic study should be carried out to assess the different scenarios of stage-wise construction, traffic diversion options for each construction phase and its impact on the network traffic flow for the study period. This study should be accompanied by a micro-simulation traffic model for the study area to assess possible changes that will be made in the future. A separate intersection wise analysis is also recommended for the key intersections affected by the study. It is also recommended to update the model with any changes made to the traffic management schemes in the area, such as bus lane implementation, traffic signal installation etc.

Appoint a stake holder committee with the participation of project consultants, Colombo Municipal Council and the other relevant local government bodies, Road Development Authority and Traffic Police to give guidance on the developed traffic management plan as well as to continuously monitor its implementation during construction stage. The traffic management plan should be made available to the public and adequate time to be allowed for familiarization of the new routes.

Based on the above, the consultant is required to propose a traffic management scheme for each stage of construction for the work zone area and mechanism to be set up to monitor the traffic flow characteristics during the construction stage.

Annex D

Noise measurement survey

Monitoring of Background Noise Levels
And Existing Noise Levels
Report No. SS – 1708661

Report to :
Consulting Engineers & Architects Associated (Pvt) Ltd.
No. 500/5, ThalapathpitiyaRoad,
Madiwela,
Kotte.

Issued By:
Noise & Vibration Group
Electro Technology Laboratory

2017, September 08

Monitoring of Background Noise Levels
And Existing Noise Levels
Report No. SS – 1708661

1. Customer :
Consulting Engineers & Architects Associated (Pvt) Ltd.
No. 500/5, Thalapathpitiya Road,
Madiwela,
Kotte.

2. Scope of the Project:
To determine the background noise levels and existing noise levels at specified selected locations that are most affected (or that will be most affecting) by noise from the proposed project for Establishment of New Light Rail Transit System under the Western Region Megapolis Development.

3. Location of Project :
The proposed New Light Rail Transit System in Colombo, Light train travel through Kollupitiya, Gangaramaya temple, Fort, General hospital, Borella, Diyatha uyana, Thalangama and Malabe.

4. Definitions

4.1 Background Noise Level
The background noise level is defined as the underlying level of noise present on ambient noise where all unusual extraneous noise is removed. Sounds contributing to background noise can include, sound from nearby traffic, industries, machinery, birds, insects, animals and similar sources including human activities are the normal features of the location. The background noise level is measured using $L_{A90,\ 15min}$ descriptor.

4.2 Assessment Background Level (ABL)
The single figure background level representing each assessment period, day, evening and night (three assessment background levels are determined for each 24-hour monitoring period.) The **tenth percentile method** is used to determine the assessment background level.

4.3 Rating Background Level (RBL)
The overall single figure background level representing each assessment period day, evening and night over the whole monitoring period. Rating background level is determined by the **median value** of day time period.

4.4 Existing Noise Level (ENL)
The existing noise levels is determined as the logarithmic average of individual $L_{Aeq,\ 15min}$ levels of each day time period.

4.5 Equivalent Continuous Sound Pressure Level ($L_{Aeq,T}$)

The equivalent steady sound level in dB containing the same acoustic energy as the actual fluctuating sound level over the given period, T

5. Assessment Period

5.1 Twenty four hour background and existing noise level measurements

The background noise level measurements were carried out 24 hours continuously at the eight locations (weekday & weekend) including, day, evening and night. The period for a day where the assessments are made is given below.

Day - 0600h to 1800h
Evening - 1800h to 2200h
Night - 2200h to 0600h

6. Instrumentation Details

The following instruments and software used to determine the background noise levels

6.1 Noise data logger : Modular precision Level Analyzer, Bruel and Keajer Type 2270, 2260, 2250& 2250L Enhanced sound analysis software BZ 7202 versions 2, Bruel and Keajer

Field calibrator : Bruel and Keajer type 4231 acoustic calibrator traceable to primary standard maintained at Brüel & Kjær, The Calibration Laboratory, Denmark. Certificate No. CDK 1601194.

6.2 Anemometer : Novalynx Model:200-WS-25

6.3 Digital Thermo Hygrometer : Commet Logger S3121

7. Measurement Procedure

7.1 Noise level

The noise level measurements were carried out in accordance with the test method MM /SL/ 04- Monitoring of background noise level and existing noise level. The following steps involved in background noise level monitoring.

Calibrated the sound level analyser using acoustic calibrator at the site before measurements.

Measurements carried out at least 3.5 m away from any reflecting structure other than the ground to minimize the influence of reflections. Measurement height of the microphone 1.5 m above the ground. Monitoring of background noise levels ($L_{A90,\ 15min}$ and $L_{Aeq,\ 15min}$)

7.2 The Team Involved in Noiseand Vibration Monitoring Programme

Names of the ITI staff who carried out the measurement:

Mr. C.M. Kalansuriya	Research Scientist
Mr. D.C. Jayaratne	Research Technologist
Mr. K.K.N. Darshana	Assistant Research Technologist
Mr. P.N. Alagiyawanna	Assistant Research Technologist

Representatives from the following organization/person was present on the day of measurement.

Mr. H.K.S.P. Perera Instrument Operator- Industrial Technology Institute

8. Result

The results of the measurements carried out by ITI are given in the tables below;

Summary of noise level measurement data for eight measurement locations (weekday & weekend) are presented in table 1 to table 4. (day, evening and night. - 24 hour locations)

8.1 Summary of Noise level data

Summary of measurement data for eight measurement locations (weekday & weekend) are presented on table-1 totable-4 (day, evening and night - 24 hour locations)

Table 1: Noise Level Results – 24 hour Measurement Locations - N1 to N4

Weekday measurement

Date	*Measurement Location*		*Assessment time period-Day*			*Assessment time period-Evening*			*Assessment time period-Night*		
			ABL **dB(A)**	***RBL*** **dB(A)**	***ENL*** **dB(A)**	***ABL*** **dB(A)**	***RBL*** **dB(A)**	***ENL*** **dB(A)**	***ABL*** **dB(A)**	***RBL*** **dB(A)**	***ENL*** **dB(A)**
2017 July 06 & 2017 July 07	N1	6°54'31.98"N 79°57'26.93"E	61	67	72	64	67	72	51	53	67
2017 July 12 & 2017 July 13	N2	6°54'13.22"N 79°57'25.36"E	61	62	73	56	60	69	49	50	65
2017 July 06 & 2017 July 07	N3	6°54'2.12"N 79°55'37.11"E	41	45	57	43	47	57	41	43	54
2017 July 06 & 2017 July 07	N4	6°54'14.17"N 79°54'41.83"E	56	57	63	54	56	65	46	49	56

ABL -Assessment background level ($L_{A90,15min}$) RBL - Rating background level ($L_{A90,15min}$) ENL -Existing noise level ($L_{Aeq,h}$) h-hour

Table 2: Noise Level Results – 24 hour Measurement Locations – N5 to N8
Weekday measurement

Date	*Measurement Location*		*Assessment time period- Day*			*Assessment time period- Evening*			*Assessment time period- Night*		
			ABL **dB(A)**	***RBL*** **dB(A)**	***ENL*** **dB(A)**	***ABL*** **dB(A)**	***RBL*** **dB(A)**	***ENL*** **dB(A)**	***ABL*** **dB(A)**	***RBL*** **dB(A)**	***ENL*** **dB(A)**
2017 July 06 & 2017 July 07	N5	6°54'41.80"N 79°53'15.69"E	55	61	67	53	56	62	44	49	56
2017 July 12 & 2017 July 13	N6	6°54'56.22"N 79°52'23.66"E	58	66	75	61	64	75	45	46	68
2017 July 12 & 2017 July 13	N7	6°55'1.83"N 79°51'57.45"E	64	66	72	59	62	69	43	45	63
2017 July 12 & 2017 July 13	N8	6°54'55.41"N 79°51'21.83"E	66	68	72	61	64	70	47	51	63

ABL -Assessment background level ($L_{A90,15min}$) RBL - Rating background level ($L_{A90,15min}$) ENL -Existing noise level ($L_{Aeq,h}$) h-hour

Table 3: Noise Level Results – 24 hour Measurement Locations - N1 to N4
Weekend measurement

Date	Measurement Location		Assessment time period- Day			Assessment time period- Evening			Assessment time period- Night		
			ABL dB(A)	RBL dB(A)	ENL dB(A)	ABL dB(A)	RBL dB(A)	ENL dB(A)	ABL dB(A)	RBL dB(A)	ENL dB(A)
2017 July 01 & 2017 July 02	N1	6°54'31.98"N 79°57'26.93"E	44	47	61	45	45	57	48	54	59
2017 July 15 & 2017 July 16	N2	6°54'13.22"N 79°57'25.36"E	57	60	66	56	59	65	48	49	61
2017 July 01 & 2017 July 02	N3	6°54'2.12"N 79°55'37.11"E	55	60	66	55	58	64	41	45	59
2017 July 01 & 2017 July 02	N4	6°54'14.17"N 79°54'41.83"E	54	57	63	54	57	64	48	52	61

ABL -Assessment background level ($L_{A90,15min}$) RBL - Rating background level ($L_{A90,15min}$) ENL -Existing noise level ($L_{Aeq,h}$) h-hour

Table 4: Noise Level Results – 24 hour Measurement Locations – N5 to N8
Weekend measurement

Date	Measurement Location		Assessment time period- Day			Assessment time period- Evening			Assessment time period- Night		
			ABL dB(A)	RBL dB(A)	ENL dB(A)	ABL dB(A)	RBL dB(A)	ENL dB(A)	ABL dB(A)	RBL dB(A)	ENL dB(A)
2017 July 01 & 2017 July 02	N5	6°54'41.80"N 79°53'15.69"E	62	64	70	60	62	68	50	53	67
2017 July 15 & 2017 July 16	N6	6°54'56.22"N 79°52'23.66"E	53	66	77	61	62	73	48	49	69
2017 July 15 & 2017 July 16	N7	6°55'1.83"N 79°51'57.45"E	63	65	73	58	61	68	44	47	63
2017 July 15 & 2017 July 16	N8	6°54'55.41"N 79°51'21.83"E	59	66	70	61	64	69	50	53	65

ABL -Assessment background level ($L_{A90,15min}$) RBL - Rating background level ($L_{A90,15min}$) ENL -Existing noise level ($L_{Aeq,h}$) h-hour

8.2 Measurement data

Annexure 1	: Noise level measurements locations (GPS co-ordinates)
Annexure 2	: Map of the Noise level measurements locations
Annexure 3	: Method for determining the tenth percentile value
Annexure 4	: Definitions of terms
Annexure 05 to 20	: Noise Measurement data of 24 hour
Annexure 21 & 24	: Environment conditions (Ambient temperature, Ambient Humidity and Wind speed)
Annexure 25	: Noise Measurement location

9. Reference Documents

- NSW Industrial Noise Policy 2000 - Environmental Protection Authority, Australia.

- IEC 61672-1: (2002-05) – Electroacoustic - Sound Level Meters-Specification

- ISO 1996, International Organization for Standardization, Geneva
  Acoustics – D*escription, measurement and assessment of environmental noise*
  Part 1. Basic quantities and assessment procedures (second edition 2003-08-01)
  Part 2. Determination of environmental noise levels (second edition 2007-03-15)

- BS 4142:1997 *Method for rating industrial noise affecting mixed residential and industrial areas*, British Standards Institution (BSI), London 1997.

Authorized by

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Performed by

……
D. C. Jayaratne
Research Technologist

2017, September 08

Industrial Technology Institute
Noise level measurements locations

Measurement Location	G.P.S. Point	Location
N1	6°54'31.98"N 79°57'26.93"E	No. 852/71, Asokarama Road, Malabe
N2	6°54'13.22"N 79°57'25.36"E	Malabe Boys' School, Malabe
N3	6°54'2.12"N 79°55'37.11"E	Central Environmental Authority 104, Denzil Kobbekaduwa Mawatha, Battaramulla
N4	6°54'14.17"N79° 54'41.83"E	DiyathaUyana (Park in Sri Jayawardenepura Kotte) Kaduwela Road, Sri Jayawardenepura Kotte.
N5	6°54'41.80"N 79°53'15.69"E	Jayawardanaramaya Temple, Dr. N.M. PereraMawatha, Colombo 08
N6	6°54'56.22"N79° 52'23.66"E	Windsor Tower Ward place, Colombo 08
N7	6°55'1.83"N 79°51'57.45"E	National Hospital Colombo 10
N8	6°54'55.41"N 79°51'21.83"E	Sri Jinarathana Vocational Technical Training Center Sir James Peiris Mawatha, Colombo 02

Industrial Technology Institute

Proposed light rail transit system project

Noise level measurement locations

1. Method for determining the tenth percentile value

Step 1	Sort the $L_{A90,\ 15\ minutes}$ data in each assessment period in **ascending** order.
Step 2	Work out the tenth per cent **position** of the number of samples in the assessment period. This can be calculated by multiplying the number of $L_{A90,\ 15\ minutes}$ values in the assessment period by 0.1
Step 3	Determine the tenth percentile (essentially the lowest tenth per cent value). If the tenth per cent position (from Step 2) is an integer, then the tenth percentile is determined by taking the arithmetic average of the value of the $L_{A90,\ 15\ minutes}$ at the tenth per cent position and the next highest value. If the tenth per cent position (from step 2) is not an integer, then the tenth percentile is the next highest $L_{A90,\ 15\ minutes}$ value above the value at the tenth per cent position. Examples : 1. For a data set of size 40, the tenth per cent position is 4 (i.e. 0.1 x 40). As this is an integer, the tenth percentile is the average of the values at the 4^{th} position and the 5^{th} position, counting from the lowest value of the sorted data (from Step 1) 2. For a data set of size 44, the tenth per cent position is 4.4 (i.e. 0.1 x 44). As this value is not an integer, the tenth percentile is the value at the 5^{th} position counting from the lowest value of the sorted data (from Step 1)

2. Method for determining Median Test

Median' is the middle value in a number of values. For an odd number of values, the value of the median is simply the middle value in a number of values ranked in ascending or descending order. For an even number of values, the median is the arithmetic average of the two middle values.

3. Method for determining the existing L_{Aeq} noise levels

Risk of noise impact	Measurement period[1]	Definition of existing level
Low risk	One day-covering the defined day/evening/night periods relevant to the periods the proposed development would operate.	The Logarithmic average[2] of individual $L_{Aeq,\ 15\ minutes}$ levels for each day/evening/night assessment period over the measurement period.

Notes :

1. It is recommended that the L_{Aeq} *be measured on a 15 - minute basis.*

2. Logarithmic average = $10\log_{10}\left(\left(\sum_{i=1}^{n} 10^{\left(L_{Aeq,15\ min,\frac{i}{10}}\right)}\right)/n\right)$

where n = number of $L_{Aeq,\ 15\ min}$ values in each assessment period over the measurement period.

Definitions of terms

Adverse weather :
Weather effects that enhance noise (that is, wind and temperature invertions) that occur at a site for a significant period of time (that is, wind occuring more than 30% of the time in any assessment period in any season and/or temperature inversions occuring more than 30% of the nights in winter),

Ambient noise :
The all-encompassing noise associated within a given environment. It is the composite of sounds from many sources, both near and far.

Assessment period :
The period in a day over which assessment are made:day (0700h to 1800h), evening (1800h to 2200h) or night (2200h to 0700h).

Assessment background level (ABL)
The single figure background level representing each assessment period-day, evening and night (that is three assessment background levels are determined for each 24h period of the monitoring period). Its determination is by the tenth percentile method described in Appendix A.

Background noise :
The underlying level of noise present in the ambient noise, excluding the noise source under investigation, when extraneous noise is removed. This is described using the L_{A90} descriptor.

C-weighted :
C-weighting is an adjustment made to sound level measurements which takes account of low-frequency components of noise within the audibility range of humans.

Construction activities :
Activities that are related to the establishment phase of a development and that will occur on a site for only a limited period of time.

Cumulative noise level :
The total level of noise from all sources.

dB :
Abbreviation for decibel - a unit of sound measurement. It is equivalent to 10 times the logarithm (to base 10) of the ratio of a given sound pressure to a reference pressure.

dB(A) :
Unit used to measure 'A-weighted' sound pressure levels. A-weighting is an adjustment made to sound level measurement to approximate the response of the human ear.

Default parameters :
In assessing meteorological enhancement of noise, refers to set values for weather parameters, such as wind speeds and temperature gradients. to be used in predicting source noise levels.

Equivalent continuous noise level:
The level of noise equivalent to the energy average of noise levels occurring over a measurement period.

Extraneous noise :
Noises resulting from activities that are not typical of the area. Atypical activities may include construction, and traffic generated by holiday periods and by special events such as concerts or sporting events. Normal daily traffic is not considered to be extraneous.

L_{A90} :
The A-weighted sound pressure level that is exceeded for 90 per cent of the time over which a given sound is measured. This is considered to represent the background noise.

L_{Aeq}:
The equivalent continuous noise level - the level of noise equivalent to the energy, average of noise levels occuring over a measurement period.

Low frequency :
Noise containing major components in the low-frequency range (20Hz to 250 Hz) of the frequency spectrum.

Median :
The middle value in a number of values sorted in ascending or descending order. Hence, for an odd number of values, the value of the median is simply the middle value.

If there is an even number of values the median is the arithmetic average of the two middle values.

Meteorological conditions :
Wind and temperature inversion conditions.

Most affected location(s) :
Locations that experience (or well experience) the greatest noise impact from the noise source under consideration. In determining these locations, one needs to consider existing background levels, exact noise source location(s), distance from source (or proposed source) to receiver, and any shielding between source and receiver.

Receiver :
The noise-sensitive land use at which noise from a development can be heard.

Measurement Data of 24 hours - Measurement Locations

Industrial Technology Institute

Proposed light rail transit system project ***Annexure – 05***

Measurement Point :N1 – Weekday measurement

Date of measurement :06th July 2017 & 07th July 2017

Day : (0600h to 1800h) *Evening : (1800h to 2200h)* *Night : (2200h to 0600h)*

Start time	Time Interval (15 min)	Measured Noise Level (dBA)	
		LAeq	LA90,15min
0600h	1	68	49
0615h	2	66	49
0630h	3	68	54
0645h	4	70	59
0700h	5	70	61
0715h	6	71	64
0730h	7	72	65
0745h	8	72	66
0800h	9	72	67
0815h	10	72	67
0830h	11	72	67
0845h	12	73	67
0900h	13	73	68
0915h	14	74	69
0930h	15	72	67
0945h	16	74	68
1000h	17	73	68
1015h	18	71	67
1030h	19	72	66
1045h	20	74	67
1100h	21	74	67
1115h	22	72	67
1130h	23	72	67
1145h	24	71	66
1200h	25	72	66
1215h	26	72	67
1230h	27	71	66
1245h	28	72	67
1300h	29	72	67
1315h	30	73	68
1330h	31	73	67
1345h	32	73	67
1400h	33	72	67
1415h	34	73	67
1430h	35	73	67
1445h	36	73	68
1500h	37	75	67
1515h	38	74	68
1530h	39	73	67
1545h	40	71	66
1600h	41	72	67
1615h	42	72	67
1630h	43	72	66
1645h	44	72	66
1700h	45	72	67
1715h	46	72	67
1730h	47	72	67
1745h	48	73	68

Start time	Time Interval (15 min)	Measured Noise Level (dBA)	
		LAeq	LA90,15min
1800h	49	73	68
1815h	50	72	67
1830h	51	72	67
1845h	52	73	68
1900h	53	72	67
1915h	54	72	67
1930h	55	73	67
1945h	56	72	67
2000h	57	72	67
2015h	58	71	66
2030h	59	73	66
2045h	60	73	65
2100h	61	71	65
2115h	62	70	64
2130h	63	70	64
2145h	64	70	64
2200h	65	69	64
2215h	66	69	62
2230h	67	69	63
2245h	68	69	61
2300h	69	69	60
2315h	70	68	60
2330h	71	68	59
2345h	72	68	58
0000h	73	68	57
0015h	74	68	56
0030h	75	68	54
0045h	76	67	54
0100h	77	66	53
0115h	78	66	52
0130h	79	65	53
0145h	80	65	50
0200h	81	64	52
0215h	82	64	52
0230h	83	66	52
0245h	84	65	52
0300h	85	63	51
0315h	86	64	51
0330h	87	61	51
0345h	88	64	52
0400h	89	64	52
0415h	90	67	51
0430h	91	64	46
0445h	92	67	46
0500h	93	64	52
0515h	94	66	53
0530h	95	65	53
0545h	96	67	53

Measurement Data of 24 hours - Measurement Locations

Industrial Technology Institute

Proposed light rail transit system project ***Annexure – 06***

Measurement Point :N1 – Weekend measurement

Date of measurement :01st July 2017 & 02nd July 2017

Day : (0600h to 1800h) *Evening : (1800h to 2200h)* *Night : (2200h to 0600h)*

Start time	Time Interval (15 min)	Measured Noise Level (dBA)	
		LAeq	LA90,15min
0600h	1	52	44
0615h	2	51	44
0630h	3	55	45
0645h	4	58	47
0700h	5	64	49
0715h	6	63	50
0730h	7	61	50
0745h	8	61	49
0800h	9	62	46
0815h	10	61	44
0830h	11	57	43
0845h	12	58	44
0900h	13	59	44
0915h	14	60	45
0930h	15	62	47
0945h	16	64	49
1000h	17	61	53
1015h	18	62	53
1030h	19	58	46
1045h	20	60	50
1100h	21	62	50
1115h	22	60	48
1130h	23	57	46
1145h	24	59	48
1200h	25	62	54
1215h	26	66	56
1230h	27	66	50
1245h	28	60	47
1300h	29	61	54
1315h	30	67	54
1330h	31	67	50
1345h	32	58	48
1400h	33	55	47
1415h	34	57	45
1430h	35	59	45
1445h	36	56	45
1500h	37	58	44
1515h	38	59	47
1530h	39	59	46
1545h	40	63	46
1600h	41	61	47
1615h	42	58	45
1630h	43	63	46
1645h	44	57	45
1700h	45	56	44
1715h	46	62	47
1730h	47	60	47
1745h	48	57	45

Start time	Time Interval (15 min)	Measured Noise Level (dBA)	
		LAeq	LA90,15min
1800h	49	57	45
1815h	50	60	46
1830h	51	56	45
1845h	52	58	45
1900h	53	57	43
1915h	54	58	45
1930h	55	58	45
1945h	56	60	45
2000h	57	56	45
2015h	58	56	45
2030h	59	52	47
2045h	60	55	47
2100h	61	56	48
2115h	62	53	48
2130h	63	52	47
2145h	64	58	47
2200h	65	56	54
2215h	66	58	55
2230h	67	56	52
2245h	68	54	48
2300h	69	51	48
2315h	70	52	47
2330h	71	52	48
2345h	72	53	48
0000h	73	52	49
0015h	74	54	51
0030h	75	57	52
0045h	76	55	53
0100h	77	57	55
0115h	78	66	56
0130h	79	62	59
0145h	80	61	61
0200h	81	62	61
0215h	82	62	62
0230h	83	62	62
0245h	84	62	62
0300h	85	61	61
0315h	86	61	60
0330h	87	61	60
0345h	88	59	58
0400h	89	57	56
0415h	90	57	56
0430h	91	55	54
0445h	92	54	52
0500h	93	53	51
0515h	94	60	48
0530h	95	55	44
0545h	96	58	44

Measurement Data of 24 hours - Measurement Locations

Industrial Technology Institute

Proposed light rail transit system project

Annexure – 07

Measurement Point :N2 – Weekday measurement

Date of measurement :12th July 2017 & 13th July 2017

Day : (0600h to 1800h) *Evening : (1800h to 2200h)* *Night : (2200h to 0600h)*

Start time	Time Interval (15 min)	Measured Noise Level (dBA)	
		LAeq	LA90,15min
0600h	1	70	60
0615h	2	71	61
0630h	3	70	61
0645h	4	74	63
0700h	5	73	65
0715h	6	74	64
0730h	7	79	65
0745h	8	73	64
0800h	9	71	62
0815h	10	73	63
0830h	11	74	63
0845h	12	72	64
0900h	13	74	63
0915h	14	73	63
0930h	15	72	62
0945h	16	70	61
1000h	17	72	61
1015h	18	72	63
1030h	19	72	63
1045h	20	71	62
1100h	21	73	62
1115h	22	74	61
1130h	23	72	62
1145h	24	74	61
1200h	25	74	62
1215h	26	75	62
1230h	27	72	62
1245h	28	73	62
1300h	29	70	62
1315h	30	74	63
1330h	31	73	65
1345h	32	75	64
1400h	33	70	61
1415h	34	74	63
1430h	35	71	63
1445h	36	71	62
1500h	37	74	62
1515h	38	74	63
1530h	39	74	63
1545h	40	71	62
1600h	41	71	62
1615h	42	71	63
1630h	43	74	63
1645h	44	74	63
1700h	45	73	63
1715h	46	77	63
1730h	47	70	62
1745h	48	69	61

Start time	Time Interval (15 min)	Measured Noise Level (dBA)	
		LAeq	LA90,15min
1800h	49	69	61
1815h	50	70	60
1830h	51	70	60
1845h	52	70	61
1900h	53	67	61
1915h	54	68	61
1930h	55	68	60
1945h	56	73	60
2000h	57	66	60
2015h	58	67	60
2030h	59	66	58
2045h	60	66	58
2100h	61	67	58
2115h	62	68	56
2130h	63	67	57
2145h	64	65	56
2200h	65	66	55
2215h	66	64	54
2230h	67	65	56
2245h	68	65	53
2300h	69	64	53
2315h	70	64	52
2330h	71	64	52
2345h	72	64	51
0000h	73	65	51
0015h	74	64	50
0030h	75	63	50
0045h	76	65	50
0100h	77	63	49
0115h	78	63	50
0130h	79	63	50
0145h	80	64	49
0200h	81	62	49
0215h	82	61	49
0230h	83	66	48
0245h	84	62	49
0300h	85	63	49
0315h	86	62	49
0330h	87	62	49
0345h	88	61	48
0400h	89	63	49
0415h	90	63	50
0430h	91	63	50
0445h	92	65	50
0500h	93	66	51
0515h	94	66	52
0530h	95	69	55
0545h	96	69	58

Measurement Data of 24 hours - Measurement Locations

Industrial Technology Institute

Proposed light rail transit system project

Annexure – 08

Measurement Point :N2 – Weekend measurement

Date of measurement :15th July 2017 & 16th July 2017

Day : (0600h to 1800h) *Evening : (1800h to 2200h)* *Night : (2200h to 0600h)*

Start time	Time Interval (15 min)	Measured Noise Level (dBA)	
		LAeq	LA90,15min
0600h	1	64	54
0615h	2	64	53
0630h	3	64	55
0645h	4	65	57
0700h	5	65	57
0715h	6	64	56
0730h	7	65	58
0745h	8	66	59
0800h	9	67	60
0815h	10	66	60
0830h	11	67	59
0845h	12	68	61
0900h	13	66	61
0915h	14	66	61
0930h	15	66	61
0945h	16	67	61
1000h	17	65	60
1015h	18	67	61
1030h	19	67	61
1045h	20	67	60
1100h	21	67	61
1115h	22	66	61
1130h	23	67	61
1145h	24	66	60
1200h	25	66	60
1215h	26	66	60
1230h	27	66	60
1245h	28	65	60
1300h	29	66	60
1315h	30	66	60
1330h	31	66	60
1345h	32	65	59
1400h	33	66	60
1415h	34	65	59
1430h	35	66	60
1445h	36	66	59
1500h	37	66	60
1515h	38	66	60
1530h	39	66	61
1545h	40	65	60
1600h	41	65	59
1615h	42	66	60
1630h	43	66	60
1645h	44	66	60
1700h	45	66	60
1715h	46	66	60
1730h	47	66	61
1745h	48	66	60

Start time	Time Interval (15 min)	Measured Noise Level (dBA)	
		LAeq	LA90,15min
1800h	49	65	60
1815h	50	66	61
1830h	51	66	60
1845h	52	65	59
1900h	53	66	59
1915h	54	67	60
1930h	55	64	59
1945h	56	67	59
2000h	57	67	59
2015h	58	64	59
2030h	59	64	57
2045h	60	65	57
2100h	61	64	58
2115h	62	64	55
2130h	63	63	56
2145h	64	63	56
2200h	65	63	55
2215h	66	63	56
2230h	67	63	56
2245h	68	62	53
2300h	69	63	52
2315h	70	61	51
2330h	71	62	51
2345h	72	61	50
0000h	73	62	51
0015h	74	60	50
0030h	75	61	49
0045h	76	59	49
0100h	77	60	50
0115h	78	60	49
0130h	79	60	49
0145h	80	57	48
0200h	81	59	48
0215h	82	58	48
0230h	83	58	48
0245h	84	60	49
0300h	85	58	49
0315h	86	58	48
0330h	87	58	48
0345h	88	59	48
0400h	89	59	49
0415h	90	61	49
0430h	91	63	49
0445h	92	61	50
0500h	93	60	49
0515h	94	62	50
0530h	95	64	51
0545h	96	63	52

Measurement Data of 24 hours - Measurement Locations

Industrial Technology Institute

Proposed light rail transit system project

Annexure – 09

Measurement Point :N3 – Weekday measurement

Date of measurement :06th July 2017 & 07th July 2017

Day : (0600h to 1800h) *Evening : (1800h to 2200h)* *Night : (2200h to 0600h)*

Start time	Time Interval (15 min)	Measured Noise Level (dBA)	
		LAeq	LA90,15min
0600h	1	52	41
0615h	2	54	41
0630h	3	57	43
0645h	4	59	47
0700h	5	60	47
0715h	6	62	49
0730h	7	63	46
0745h	8	60	45
0800h	9	59	46
0815h	10	57	46
0830h	11	57	46
0845h	12	59	47
0900h	13	57	46
0915h	14	58	50
0930h	15	56	46
0945h	16	58	46
1000h	17	59	47
1015h	18	57	48
1030h	19	53	40
1045h	20	53	40
1100h	21	53	42
1115h	22	53	51
1130h	23	54	43
1145h	24	54	41
1200h	25	54	41
1215h	26	55	45
1230h	27	58	46
1245h	28	57	47
1300h	29	58	45
1315h	30	55	45
1330h	31	56	46
1345h	32	57	46
1400h	33	56	45
1415h	34	55	44
1430h	35	55	42
1445h	36	57	50
1500h	37	59	50
1515h	38	57	45
1530h	39	54	44
1545h	40	55	50
1600h	41	56	50
1615h	42	52	43
1630h	43	53	42
1645h	44	55	44
1700h	45	55	43
1715h	46	58	41
1730h	47	54	40
1745h	48	54	41

Start time	Time Interval (15 min)	Measured Noise Level (dBA)	
		LAeq	LA90,15min
1800h	49	55	43
1815h	50	60	45
1830h	51	56	45
1845h	52	57	47
1900h	53	57	47
1915h	54	58	46
1930h	55	62	48
1945h	56	58	48
2000h	57	57	48
2015h	58	54	48
2030h	59	57	51
2045h	60	55	52
2100h	61	55	52
2115h	62	58	47
2130h	63	58	46
2145h	64	52	43
2200h	65	51	41
2215h	66	49	41
2230h	67	53	41
2245h	68	50	41
2300h	69	50	41
2315h	70	46	41
2330h	71	46	41
2345h	72	45	41
0000h	73	45	41
0015h	74	61	41
0030h	75	56	41
0045h	76	56	42
0100h	77	55	42
0115h	78	45	43
0130h	79	56	44
0145h	80	47	44
0200h	81	47	45
0215h	82	55	47
0230h	83	54	52
0245h	84	52	48
0300h	85	51	48
0315h	86	51	47
0330h	87	48	47
0345h	88	48	47
0400h	89	47	46
0415h	90	57	46
0430h	91	48	44
0445h	92	54	43
0500h	93	45	43
0515h	94	60	44
0530h	95	63	42
0545h	96	52	40

Measurement Data of 24 hours - Measurement Locations

Industrial Technology Institute

Proposed light rail transit system project

Annexure – 10

Measurement Point :N3 – Weekend measurement

Date of measurement :01st July 2017 & 02nd July 2017

Day : (0600h to 1800h) *Evening : (1800h to 2200h)* *Night : (2200h to 0600h)*

Start time	Time Interval (15 min)	Measured Noise Level (dBA)	
		LAeq	LA90,15min
0600h	1	63	49
0615h	2	62	50
0630h	3	63	52
0645h	4	64	54
0700h	5	65	55
0715h	6	64	57
0730h	7	64	58
0745h	8	65	58
0800h	9	65	59
0815h	10	65	58
0830h	11	66	58
0845h	12	65	59
0900h	13	66	60
0915h	14	67	61
0930h	15	65	61
0945h	16	65	61
1000h	17	66	61
1015h	18	65	60
1030h	19	65	60
1045h	20	66	60
1100h	21	65	60
1115h	22	65	60
1130h	23	65	60
1145h	24	65	60
1200h	25	66	60
1215h	26	65	60
1230h	27	65	60
1245h	28	65	60
1300h	29	64	59
1315h	30	65	60
1330h	31	66	60
1345h	32	65	60
1400h	33	65	59
1415h	34	65	60
1430h	35	64	59
1445h	36	65	59
1500h	37	66	59
1515h	38	65	59
1530h	39	65	60
1545h	40	71	63
1600h	41	66	61
1615h	42	65	61
1630h	43	68	62
1645h	44	66	61
1700h	45	66	61
1715h	46	66	60
1730h	47	65	60
1745h	48	65	60

Start time	Time Interval (15 min)	Measured Noise Level (dBA)	
		LAeq	LA90,15min
1800h	49	65	60
1815h	50	65	61
1830h	51	64	60
1845h	52	65	60
1900h	53	64	59
1915h	54	64	59
1930h	55	64	59
1945h	56	65	58
2000h	57	63	58
2015h	58	64	57
2030h	59	64	58
2045h	60	64	56
2100h	61	62	55
2115h	62	63	55
2130h	63	62	55
2145h	64	63	55
2200h	65	61	54
2215h	66	62	52
2230h	67	61	50
2245h	68	61	51
2300h	69	62	53
2315h	70	61	51
2330h	71	60	48
2345h	72	59	47
0000h	73	60	46
0015h	74	60	45
0030h	75	60	47
0045h	76	57	46
0100h	77	58	43
0115h	78	63	50
0130h	79	59	47
0145h	80	58	46
0200h	81	57	45
0215h	82	58	45
0230h	83	56	41
0245h	84	55	42
0300h	85	56	42
0315h	86	57	43
0330h	87	58	43
0345h	88	57	41
0400h	89	55	41
0415h	90	56	41
0430h	91	56	41
0445h	92	58	44
0500h	93	57	43
0515h	94	60	44
0530h	95	61	45
0545h	96	61	48

Measurement Data of 24 hours - Measurement Locations

Industrial Technology Institute

Proposed light rail transit system project

Annexure – 11

Measurement Point :N4 – Weekday measurement

Date of measurement :06th July 2017 & 07th July 2017

Day : (0600h to 1800h) *Evening : (1800h to 2200h)* *Night : (2200h to 0600h)*

Start time	Time Interval (15 min)	Measured Noise Level (dBA)	
		LAeq	LA90,15min
0600h	1	60	55
0615h	2	62	56
0630h	3	61	56
0645h	4	61	56
0700h	5	62	56
0715h	6	60	56
0730h	7	62	57
0745h	8	61	57
0800h	9	60	56
0815h	10	62	56
0830h	11	62	57
0845h	12	63	57
0900h	13	61	58
0915h	14	63	57
0930h	15	63	56
0945h	16	62	56
1000h	17	63	58
1015h	18	63	58
1030h	19	62	57
1045h	20	63	58
1100h	21	63	58
1115h	22	62	58
1130h	23	62	58
1145h	24	63	58
1200h	25	62	57
1215h	26	62	57
1230h	27	62	57
1245h	28	63	57
1300h	29	62	57
1315h	30	63	57
1330h	31	62	57
1345h	32	62	57
1400h	33	63	58
1415h	34	62	57
1430h	35	63	58
1445h	36	65	59
1500h	37	63	59
1515h	38	64	57
1530h	39	63	57
1545h	40	62	57
1600h	41	63	58
1615h	42	67	60
1630h	43	63	57
1645h	44	64	57
1700h	45	62	57
1715h	46	62	57
1730h	47	61	56
1745h	48	62	57

Start time	Time Interval (15 min)	Measured Noise Level (dBA)	
		LAeq	LA90,15min
1800h	49	62	57
1815h	50	63	56
1830h	51	62	56
1845h	52	61	56
1900h	53	61	55
1915h	54	70	56
1930h	55	61	56
1945h	56	62	57
2000h	57	62	57
2015h	58	61	56
2030h	59	72	57
2045h	60	61	55
2100h	61	60	55
2115h	62	64	55
2130h	63	59	54
2145h	64	59	54
2200h	65	59	54
2215h	66	60	54
2230h	67	60	54
2245h	68	59	53
2300h	69	58	53
2315h	70	58	53
2330h	71	56	51
2345h	72	56	51
0000h	73	56	50
0015h	74	55	50
0030h	75	57	50
0045h	76	53	49
0100h	77	54	49
0115h	78	53	48
0130h	79	53	48
0145h	80	54	47
0200h	81	51	47
0215h	82	54	46
0230h	83	51	45
0245h	84	55	46
0300h	85	51	44
0315h	86	52	46
0330h	87	53	46
0345h	88	53	45
0400h	89	56	47
0415h	90	57	48
0430h	91	55	48
0445h	92	55	47
0500h	93	55	49
0515h	94	55	50
0530h	95	58	52
0545h	96	59	53

Measurement Data of 24 hours - Measurement Locations

Industrial Technology Institute

Proposed light rail transit system project

Annexure – 12

Measurement Point :N4 – Weekend measurement

Date of measurement :01st July 2017 & 02nd July 2017

Day : (0600h to 1800h) *Evening : (1800h to 2200h)* *Night : (2200h to 0600h)*

Start time	Time Interval (15 min)	Measured Noise Level (dBA)	
		LAeq	LA90,15min
0600h	1	57	51
0615h	2	57	51
0630h	3	59	53
0645h	4	58	53
0700h	5	60	54
0715h	6	59	54
0730h	7	59	54
0745h	8	60	56
0800h	9	61	56
0815h	10	59	54
0830h	11	61	56
0845h	12	61	56
0900h	13	62	55
0915h	14	62	55
0930h	15	64	55
0945h	16	63	57
1000h	17	62	58
1015h	18	63	60
1030h	19	62	57
1045h	20	67	59
1100h	21	64	58
1115h	22	63	58
1130h	23	62	58
1145h	24	63	58
1200h	25	65	58
1215h	26	62	58
1230h	27	62	57
1245h	28	64	58
1300h	29	63	57
1315h	30	63	58
1330h	31	63	58
1345h	32	62	57
1400h	33	63	58
1415h	34	61	57
1430h	35	62	57
1445h	36	63	57
1500h	37	62	57
1515h	38	61	57
1530h	39	68	59
1545h	40	63	56
1600h	41	61	57
1615h	42	60	57
1630h	43	60	57
1645h	44	60	57
1700h	45	59	57
1715h	46	63	58
1730h	47	66	60
1745h	48	66	60

Start time	Time Interval (15 min)	Measured Noise Level (dBA)	
		LAeq	LA90,15min
1800h	49	67	60
1815h	50	66	60
1830h	51	65	60
1845h	52	63	59
1900h	53	64	59
1915h	54	63	59
1930h	55	63	59
1945h	56	64	59
2000h	57	62	57
2015h	58	65	56
2030h	59	63	57
2045h	60	62	56
2100h	61	61	55
2115h	62	63	56
2130h	63	62	54
2145h	64	60	53
2200h	65	59	53
2215h	66	58	53
2230h	67	59	53
2245h	68	61	53
2300h	69	60	54
2315h	70	63	57
2330h	71	63	57
2345h	72	62	57
0000h	73	63	58
0015h	74	61	54
0030h	75	58	52
0045h	76	59	52
0100h	77	69	50
0115h	78	59	52
0130h	79	58	50
0145h	80	58	50
0200h	81	57	52
0215h	82	57	52
0230h	83	57	50
0245h	84	56	48
0300h	85	60	47
0315h	86	55	48
0330h	87	56	47
0345h	88	54	48
0400h	89	57	50
0415h	90	57	49
0430h	91	57	49
0445h	92	57	48
0500h	93	57	49
0515h	94	59	51
0530h	95	60	54
0545h	96	63	55

Measurement Data of 24 hours - Measurement Locations

Industrial Technology Institute

Proposed light rail transit system project

Annexure – 13

Measurement Point :N5 – Weekday measurement

Date of measurement :06th July 2017 & 07th July 2017

Day : (0600h to 1800h) *Evening : (1800h to 2200h)* *Night : (2200h to 0600h)*

Start time	Time Interval (15 min)	Measured Noise Level (dBA)	
		LAeq	LA90,15min
0600h	1	58	53
0615h	2	58	54
0630h	3	59	55
0645h	4	58	54
0700h	5	59	54
0715h	6	68	58
0730h	7	69	63
0745h	8	70	64
0800h	9	69	64
0815h	10	70	64
0830h	11	70	64
0845h	12	68	63
0900h	13	68	62
0915h	14	69	62
0930h	15	67	64
0945h	16	67	64
1000h	17	66	61
1015h	18	66	62
1030h	19	69	64
1045h	20	68	64
1100h	21	68	63
1115h	22	68	62
1130h	23	67	61
1145h	24	67	62
1200h	25	66	62
1215h	26	68	62
1230h	27	69	62
1245h	28	66	62
1300h	29	67	61
1315h	30	66	61
1330h	31	66	61
1345h	32	65	61
1400h	33	66	61
1415h	34	66	61
1430h	35	66	61
1445h	36	66	61
1500h	37	66	61
1515h	38	67	62
1530h	39	66	61
1545h	40	66	61
1600h	41	69	62
1615h	42	66	61
1630h	43	66	61
1645h	44	67	61
1700h	45	68	62
1715h	46	65	60
1730h	47	66	61
1745h	48	67	61

Start time	Time Interval (15 min)	Measured Noise Level (dBA)	
		LAeq	LA90,15min
1800h	49	66	61
1815h	50	65	60
1830h	51	66	61
1845h	52	65	60
1900h	53	64	59
1915h	54	62	56
1930h	55	59	56
1945h	56	60	56
2000h	57	61	56
2015h	58	63	58
2030h	59	60	55
2045h	60	59	55
2100h	61	59	55
2115h	62	58	54
2130h	63	58	53
2145h	64	59	53
2200h	65	57	54
2215h	66	58	54
2230h	67	56	52
2245h	68	57	53
2300h	69	56	52
2315h	70	56	51
2330h	71	55	49
2345h	72	54	50
0000h	73	54	47
0015h	74	54	49
0030h	75	54	49
0045h	76	54	49
0100h	77	54	48
0115h	78	53	44
0130h	79	50	43
0145h	80	53	45
0200h	81	51	45
0215h	82	52	46
0230h	83	52	44
0245h	84	53	44
0300h	85	52	44
0315h	86	53	45
0330h	87	55	47
0345h	88	55	47
0400h	89	55	47
0415h	90	56	48
0430h	91	57	50
0445h	92	57	50
0500h	93	57	50
0515h	94	58	51
0530h	95	59	53
0545h	96	62	54

Measurement Data of 24 hours - Measurement Locations

Industrial Technology Institute

Proposed light rail transit system project

Annexure – 14

Measurement Point :N5 – Weekend measurement

Date of measurement :01st July 2017 & 02nd July 2017

Day : (0600h to 1800h) *Evening : (1800h to 2200h)* *Night : (2200h to 0600h)*

Start time	Time Interval (15 min)	Measured Noise Level (dBA)	
		LAeq	LA90,15min
0600h	1	67	59
0615h	2	67	61
0630h	3	67	59
0645h	4	67	61
0700h	5	68	62
0715h	6	69	65
0730h	7	68	64
0745h	8	69	65
0800h	9	69	63
0815h	10	70	64
0830h	11	69	67
0845h	12	72	66
0900h	13	70	66
0915h	14	72	67
0930h	15	70	67
0945h	16	72	67
1000h	17	73	68
1015h	18	71	67
1030h	19	71	66
1045h	20	72	66
1100h	21	71	67
1115h	22	71	66
1130h	23	71	66
1145h	24	71	66
1200h	25	69	65
1215h	26	72	66
1230h	27	72	67
1245h	28	72	66
1300h	29	73	65
1315h	30	69	64
1330h	31	71	65
1345h	32	70	64
1400h	33	69	64
1415h	34	69	65
1430h	35	70	64
1445h	36	70	64
1500h	37	69	65
1515h	38	69	64
1530h	39	72	64
1545h	40	67	62
1600h	41	69	64
1615h	42	70	64
1630h	43	69	63
1645h	44	68	64
1700h	45	69	64
1715h	46	69	64
1730h	47	69	64
1745h	48	69	64

Start time	Time Interval (15 min)	Measured Noise Level (dBA)	
		LAeq	LA90,15min
1800h	49	72	64
1815h	50	68	63
1830h	51	69	63
1845h	52	71	62
1900h	53	69	64
1915h	54	69	63
1930h	55	67	63
1945h	56	68	63
2000h	57	67	62
2015h	58	67	62
2030h	59	67	62
2045h	60	67	62
2100h	61	67	61
2115h	62	67	60
2130h	63	65	60
2145h	64	67	59
2200h	65	64	59
2215h	66	65	58
2230h	67	65	58
2245h	68	66	59
2300h	69	64	57
2315h	70	63	56
2330h	71	62	56
2345h	72	61	56
0000h	73	61	54
0015h	74	62	52
0030h	75	61	53
0045h	76	60	52
0100h	77	72	53
0115h	78	79	59
0130h	79	60	51
0145h	80	60	52
0200h	81	61	52
0215h	82	60	54
0230h	83	61	55
0245h	84	61	53
0300h	85	59	51
0315h	86	60	48
0330h	87	59	47
0345h	88	59	48
0400h	89	61	51
0415h	90	62	51
0430h	91	62	52
0445h	92	63	51
0500h	93	62	50
0515h	94	62	53
0530h	95	73	55
0545h	96	68	58

Measurement Data of 24 hours - Measurement Locations

Industrial Technology Institute

Proposed light rail transit system project

Annexure – 15

Measurement Point :N6 – Weekday measurement

Date of measurement :12th July 2017 & 13th July 2017

Day : (0600h to 1800h) *Evening : (1800h to 2200h)* *Night : (2200h to 0600h)*

Start time	Time Interval (15 min)	Measured Noise Level (dBA)	
		LAeq	LA90,15min
0600h	1	67	48
0615h	2	71	51
0630h	3	69	53
0645h	4	74	56
0700h	5	71	58
0715h	6	74	61
0730h	7	75	63
0745h	8	75	66
0800h	9	76	66
0815h	10	75	68
0830h	11	73	68
0845h	12	74	68
0900h	13	77	68
0915h	14	77	69
0930h	15	77	65
0945h	16	77	66
1000h	17	75	66
1015h	18	74	66
1030h	19	76	64
1045h	20	74	64
1100h	21	76	65
1115h	22	76	65
1130h	23	75	65
1145h	24	75	65
1200h	25	77	66
1215h	26	74	65
1230h	27	76	66
1245h	28	75	66
1300h	29	77	68
1315h	30	75	65
1330h	31	75	66
1345h	32	77	68
1400h	33	78	68
1415h	34	75	68
1430h	35	76	67
1445h	36	74	67
1500h	37	75	66
1515h	38	77	63
1530h	39	74	64
1545h	40	74	65
1600h	41	74	64
1615h	42	75	64
1630h	43	75	66
1645h	44	74	66
1700h	45	75	66
1715h	46	75	65
1730h	47	74	65
1745h	48	75	68

Start time	Time Interval (15 min)	Measured Noise Level (dBA)	
		LAeq	LA90,15min
1800h	49	80	67
1815h	50	75	67
1830h	51	75	67
1845h	52	74	66
1900h	53	74	66
1915h	54	73	64
1930h	55	75	66
1945h	56	73	64
2000h	57	73	64
2015h	58	72	64
2030h	59	73	62
2045h	60	72	62
2100h	61	73	62
2115h	62	75	62
2130h	63	73	61
2145h	64	72	59
2200h	65	71	61
2215h	66	72	58
2230h	67	72	60
2245h	68	71	59
2300h	69	71	59
2315h	70	70	56
2330h	71	69	55
2345h	72	70	54
0000h	73	69	54
0015h	74	68	53
0030h	75	69	50
0045h	76	68	49
0100h	77	68	47
0115h	78	68	48
0130h	79	66	45
0145h	80	65	45
0200h	81	66	45
0215h	82	65	46
0230h	83	64	45
0245h	84	65	45
0300h	85	63	45
0315h	86	64	45
0330h	87	64	45
0345h	88	64	45
0400h	89	59	44
0415h	90	62	44
0430h	91	62	44
0445h	92	65	45
0500h	93	64	45
0515h	94	68	46
0530h	95	66	45
0545h	96	66	47

Measurement Data of 24 hours - Measurement Locations

Industrial Technology Institute

Proposed light rail transit system project

Annexure – 16

Measurement Point :N6 – Weekend measurement

Date of measurement :15th July 2017 & 16th July 2017

Day : (0600h to 1800h) *Evening : (1800h to 2200h)* *Night : (2200h to 0600h)*

Start time	Time Interval (15 min)	Measured Noise Level (dBA)	
		LAeq	LA90,15min
0600h	1	67	49
0615h	2	68	50
0630h	3	70	52
0645h	4	70	53
0700h	5	69	53
0715h	6	72	58
0730h	7	71	54
0745h	8	72	54
0800h	9	71	56
0815h	10	72	64
0830h	11	74	63
0845h	12	75	65
0900h	13	75	66
0915h	14	75	65
0930h	15	74	66
0945h	16	75	65
1000h	17	76	67
1015h	18	74	66
1030h	19	75	65
1045h	20	74	64
1100h	21	75	66
1115h	22	75	67
1130h	23	74	66
1145h	24	75	64
1200h	25	74	65
1215h	26	74	64
1230h	27	75	66
1245h	28	75	66
1300h	29	76	66
1315h	30	76	66
1330h	31	76	66
1345h	32	74	66
1400h	33	74	66
1415h	34	74	67
1430h	35	76	67
1445h	36	76	67
1500h	37	77	66
1515h	38	75	66
1530h	39	74	64
1545h	40	76	66
1600h	41	74	66
1615h	42	77	70
1630h	43	82	76
1645h	44	87	76
1700h	45	86	73
1715h	46	79	69
1730h	47	75	65
1745h	48	74	64

Start time	Time Interval (15 min)	Measured Noise Level (dBA)	
		LAeq	LA90,15min
1800h	49	74	64
1815h	50	76	65
1830h	51	73	62
1845h	52	75	64
1900h	53	73	64
1915h	54	73	63
1930h	55	73	62
1945h	56	73	65
2000h	57	73	62
2015h	58	72	62
2030h	59	74	64
2045h	60	73	61
2100h	61	73	62
2115h	62	73	62
2130h	63	72	61
2145h	64	71	61
2200h	65	73	61
2215h	66	72	58
2230h	67	72	59
2245h	68	71	57
2300h	69	70	59
2315h	70	70	57
2330h	71	71	58
2345h	72	69	55
0000h	73	70	54
0015h	74	71	54
0030h	75	72	54
0045h	76	71	55
0100h	77	70	53
0115h	78	69	52
0130h	79	69	52
0145h	80	68	49
0200h	81	68	48
0215h	82	69	50
0230h	83	67	49
0245h	84	67	48
0300h	85	67	48
0315h	86	66	49
0330h	87	67	48
0345h	88	66	48
0400h	89	67	48
0415h	90	63	47
0430h	91	65	46
0445h	92	65	48
0500h	93	66	48
0515h	94	65	49
0530h	95	68	48
0545h	96	65	47

Measurement Data of 24 hours - Measurement Locations

Industrial Technology Institute

Proposed light rail transit system project

Annexure – 17

Measurement Point :N7 – Weekday measurement

Date of measurement :12th July 2017 & 13th July 2017

Day : (0600h to 1800h) *Evening : (1800h to 2200h)* *Night : (2200h to 0600h)*

Start time	Time Interval (15 min)	Measured Noise Level (dBA)	
		LAeq	LA90,15min
0600h	1	68	61
0615h	2	70	62
0630h	3	71	63
0645h	4	71	64
0700h	5	71	64
0715h	6	71	64
0730h	7	71	64
0745h	8	72	65
0800h	9	72	64
0815h	10	71	64
0830h	11	71	65
0845h	12	72	65
0900h	13	72	65
0915h	14	71	66
0930h	15	72	66
0945h	16	72	66
1000h	17	72	66
1015h	18	72	66
1030h	19	73	66
1045h	20	73	66
1100h	21	71	66
1115h	22	72	66
1130h	23	74	66
1145h	24	72	66
1200h	25	74	67
1215h	26	73	67
1230h	27	72	66
1245h	28	73	66
1300h	29	74	67
1315h	30	73	66
1330h	31	74	66
1345h	32	73	66
1400h	33	74	66
1415h	34	70	65
1430h	35	71	65
1445h	36	71	64
1500h	37	72	65
1515h	38	71	65
1530h	39	72	66
1545h	40	72	65
1600h	41	71	66
1615h	42	76	67
1630h	43	72	66
1645h	44	74	66
1700h	45	71	65
1715h	46	73	65
1730h	47	73	66
1745h	48	72	66

Start time	Time Interval (15 min)	Measured Noise Level (dBA)	
		LAeq	LA90,15min
1800h	49	70	65
1815h	50	70	65
1830h	51	70	63
1845h	52	70	65
1900h	53	69	63
1915h	54	69	62
1930h	55	68	62
1945h	56	70	62
2000h	57	68	63
2015h	58	68	62
2030h	59	68	62
2045h	60	67	62
2100h	61	67	60
2115h	62	67	59
2130h	63	67	60
2145h	64	66	58
2200h	65	66	59
2215h	66	65	56
2230h	67	66	56
2245h	68	64	53
2300h	69	65	54
2315h	70	64	52
2330h	71	63	49
2345h	72	63	51
0000h	73	64	52
0015h	74	62	45
0030h	75	62	47
0045h	76	60	44
0100h	77	62	44
0115h	78	59	43
0130h	79	59	43
0145h	80	59	42
0200h	81	59	44
0215h	82	59	41
0230h	83	57	41
0245h	84	60	43
0300h	85	57	43
0315h	86	57	43
0330h	87	59	44
0345h	88	60	44
0400h	89	61	44
0415h	90	59	43
0430h	91	63	49
0445h	92	64	50
0500h	93	64	50
0515h	94	65	54
0530h	95	65	58
0545h	96	67	59

Measurement Data of 24 hours - Measurement Locations

Industrial Technology Institute

Proposed light rail transit system project

Annexure – 18

Measurement Point :N7 – Weekend measurement

Date of measurement :15th July 2017 & 16th July 2017

Day : (0600h to 1800h) *Evening : (1800h to 2200h)* *Night : (2200h to 0600h)*

Start time	Time Interval (15 min)	Measured Noise Level (dBA)	
		LAeq	LA90,15min
0600h	1	66	58
0615h	2	67	60
0630h	3	72	62
0645h	4	70	63
0700h	5	71	63
0715h	6	71	65
0730h	7	70	64
0745h	8	72	64
0800h	9	70	64
0815h	10	71	64
0830h	11	71	65
0845h	12	70	64
0900h	13	70	64
0915h	14	72	64
0930h	15	71	64
0945h	16	72	65
1000h	17	72	64
1015h	18	70	64
1030h	19	74	65
1045h	20	70	65
1100h	21	72	66
1115h	22	70	65
1130h	23	71	65
1145h	24	73	66
1200h	25	71	65
1215h	26	72	66
1230h	27	72	65
1245h	28	71	66
1300h	29	72	66
1315h	30	74	66
1330h	31	73	67
1345h	32	71	65
1400h	33	72	65
1415h	34	71	65
1430h	35	71	64
1445h	36	70	64
1500h	37	71	64
1515h	38	71	64
1530h	39	75	66
1545h	40	82	75
1600h	41	83	70
1615h	42	78	71
1630h	43	72	65
1645h	44	71	64
1700h	45	71	65
1715h	46	70	64
1730h	47	70	65
1745h	48	70	64

Start time	Time Interval (15 min)	Measured Noise Level (dBA)	
		LAeq	LA90,15min
1800h	49	71	65
1815h	50	70	64
1830h	51	69	64
1845h	52	69	62
1900h	53	69	62
1915h	54	69	62
1930h	55	69	61
1945h	56	68	63
2000h	57	68	62
2015h	58	68	61
2030h	59	68	61
2045h	60	66	58
2100h	61	67	60
2115h	62	66	58
2130h	63	66	59
2145h	64	66	59
2200h	65	65	57
2215h	66	66	59
2230h	67	64	57
2245h	68	65	55
2300h	69	65	55
2315h	70	65	53
2330h	71	64	55
2345h	72	65	53
0000h	73	63	52
0015h	74	63	49
0030h	75	61	48
0045h	76	62	46
0100h	77	62	47
0115h	78	62	46
0130h	79	60	46
0145h	80	62	45
0200h	81	60	46
0215h	82	59	45
0230h	83	61	46
0245h	84	60	44
0300h	85	57	44
0315h	86	59	43
0330h	87	57	43
0345h	88	60	44
0400h	89	60	46
0415h	90	59	46
0430h	91	59	47
0445h	92	63	49
0500h	93	63	52
0515h	94	65	54
0530h	95	65	58
0545h	96	66	58

Measurement Data of 24 hours - Measurement Locations

Industrial Technology Institute

Proposed light rail transit system project

Annexure – 19

Measurement Point :N8 – Weekday measurement

Date of measurement :12th July 2017 & 13th July 2017

Day : (0600h to 1800h) *Evening : (1800h to 2200h)* *Night : (2200h to 0600h)*

Start time	Time Interval (15 min)	Measured Noise Level (dBA)	
		LAeq	LA90,15min
0600h	1	67	61
0615h	2	67	61
0630h	3	69	63
0645h	4	70	65
0700h	5	70	66
0715h	6	70	66
0730h	7	71	67
0745h	8	71	67
0800h	9	71	67
0815h	10	72	67
0830h	11	71	67
0845h	12	73	68
0900h	13	72	69
0915h	14	71	68
0930h	15	72	68
0945h	16	71	69
1000h	17	72	69
1015h	18	73	69
1030h	19	72	69
1045h	20	72	69
1100h	21	73	69
1115h	22	73	69
1130h	23	73	69
1145h	24	73	69
1200h	25	72	69
1215h	26	73	68
1230h	27	74	68
1245h	28	73	69
1300h	29	74	69
1315h	30	73	69
1330h	31	72	68
1345h	32	73	69
1400h	33	77	69
1415h	34	73	69
1430h	35	74	69
1445h	36	73	70
1500h	37	72	68
1515h	38	73	69
1530h	39	76	68
1545h	40	72	68
1600h	41	72	68
1615h	42	72	68
1630h	43	72	68
1645h	44	72	68
1700h	45	71	68
1715h	46	70	67
1730h	47	73	67
1745h	48	71	67

Start time	Time Interval (15 min)	Measured Noise Level (dBA)	
		LAeq	LA90,15min
1800h	49	72	68
1815h	50	71	68
1830h	51	72	67
1845h	52	70	67
1900h	53	70	67
1915h	54	69	66
1930h	55	70	66
1945h	56	70	65
2000h	57	68	64
2015h	58	69	64
2030h	59	69	64
2045h	60	69	63
2100h	61	68	62
2115h	62	67	62
2130h	63	66	60
2145h	64	67	61
2200h	65	66	59
2215h	66	65	58
2230h	67	64	57
2245h	68	66	58
2300h	69	64	54
2315h	70	65	55
2330h	71	64	53
2345h	72	64	54
0000h	73	62	54
0015h	74	62	51
0030h	75	62	50
0045h	76	61	48
0100h	77	60	48
0115h	78	60	48
0130h	79	58	47
0145h	80	58	47
0200h	81	59	47
0215h	82	59	46
0230h	83	60	46
0245h	84	59	46
0300h	85	58	47
0315h	86	59	47
0330h	87	57	47
0345h	88	57	47
0400h	89	61	50
0415h	90	62	52
0430h	91	61	52
0445h	92	62	52
0500h	93	63	55
0515h	94	63	55
0530h	95	65	58
0545h	96	66	60

Measurement Data of 24 hours - Measurement Locations

Industrial Technology Institute

Proposed light rail transit system project

Annexure – 20

Measurement Point :N8 – Weekend measurement

Date of measurement :15th July 2017 & 16th July 2017

Day : (0600h to 1800h) *Evening : (1800h to 2200h)* *Night : (2200h to 0600h)*

Start time	Time Interval (15 min)	Measured Noise Level (dBA)	
		LAeq	LA90,15min
0600h	1	67	58
0615h	2	66	58
0630h	3	66	58
0645h	4	67	59
0700h	5	67	59
0715h	6	66	59
0730h	7	68	61
0745h	8	70	66
0800h	9	71	66
0815h	10	70	65
0830h	11	71	65
0845h	12	70	66
0900h	13	72	67
0915h	14	71	66
0930h	15	71	67
0945h	16	72	66
1000h	17	70	67
1015h	18	70	67
1030h	19	71	66
1045h	20	71	66
1100h	21	71	67
1115h	22	71	66
1130h	23	71	66
1145h	24	71	67
1200h	25	70	67
1215h	26	71	67
1230h	27	71	66
1245h	28	71	67
1300h	29	71	67
1315h	30	71	66
1330h	31	70	66
1345h	32	71	66
1400h	33	70	66
1415h	34	71	66
1430h	35	71	66
1445h	36	70	66
1500h	37	71	67
1515h	38	70	66
1530h	39	70	66
1545h	40	70	65
1600h	41	72	66
1615h	42	70	66
1630h	43	70	65
1645h	44	69	65
1700h	45	70	66
1715h	46	70	65
1730h	47	69	65
1745h	48	70	65

Start time	Time Interval (15 min)	Measured Noise Level (dBA)	
		LAeq	LA90,15min
1800h	49	70	66
1815h	50	70	66
1830h	51	70	64
1845h	52	69	65
1900h	53	69	65
1915h	54	70	65
1930h	55	68	64
1945h	56	68	64
2000h	57	70	64
2015h	58	69	64
2030h	59	69	63
2045h	60	69	63
2100h	61	68	64
2115h	62	69	63
2130h	63	67	61
2145h	64	67	61
2200h	65	67	60
2215h	66	67	59
2230h	67	68	60
2245h	68	68	59
2300h	69	66	58
2315h	70	65	56
2330h	71	65	57
2345h	72	68	56
0000h	73	64	54
0015h	74	65	56
0030h	75	65	53
0045h	76	65	54
0100h	77	63	52
0115h	78	64	54
0130h	79	63	51
0145h	80	64	52
0200h	81	68	52
0215h	82	63	51
0230h	83	63	51
0245h	84	61	50
0300h	85	63	50
0315h	86	61	50
0330h	87	60	49
0345h	88	61	51
0400h	89	61	51
0415h	90	63	53
0430h	91	62	53
0445h	92	66	52
0500h	93	61	53
0515h	94	64	55
0530h	95	64	58
0545h	96	66	58

Environmental Condition – 24 hour

Industrial Technology Institute

Annexure – 21

Proposed light rail transit system project

Measurement Point :N7 – Weekday measurement

Date of measurement :12th July 2017 & 13th July 2017

Start time	Temp.	R.H.	Wind speed	
			Max	Avg.
06.00 - 06.15	23.5	80	0.0	0.0
06.15 - 06.30	23.5	80	0.0	0.0
06.30 - 06.45	23.5	80	0.0	0.0
06.45 - 07.00	24.0	80	0.0	0.0
07.00 - 07.15	24.0	80	0.0	0.0
07.15 - 07.30	24.0	80	0.0	0.0
07.30 - 07.45	24.0	80	0.0	0.0
07.45 - 08.00	24.0	79	0.0	0.0
08.00 - 08.15	24.5	78	0.0	0.0
08.15 - 08.30	24.5	76	0.0	0.0
08.30 - 08.45	25.5	75	0.0	0.0
08.45 - 09.00	25.5	73	0.0	0.0
09.00 - 09.15	26.5	70	0.4	0.0
09.15 - 09.30	26.5	69	0.0	0.0
09.30 - 09.45	26.5	68	0.6	0.0
09.45 - 10.00	27.0	67	0.7	0.0
10.00 - 10.15	27.0	67	0.0	0.0
10.15 - 10.30	27.5	67	0.5	0.0
10.30 - 10.45	28.5	65	0.9	0.0
10.45 - 11.00	28.5	62	0.7	0.0
11.00 - 11.15	28.5	59	1.2	0.4
11.15 - 11.30	28.5	57	0.6	0.0
11.30 - 11.45	28.0	55	0.7	0.0
11.45 - 12.00	28.0	54	0.9	0.4
12.00 - 12.15	28.0	53	1.2	0.3
12.15 - 12.30	28.5	53	1.9	0.8
12.30 - 12.45	28.5	53	1.3	0.4
12.45 - 13.00	28.5	53	0.8	0.3
13.00 - 13.15	29.0	54	1.2	0.4
13.15 - 13.30	29.0	55	0.7	0.3
13.30 - 13.45	28.5	57	1.2	0.6
13.45 - 14.00	28.5	58	0.9	0.3
14.00 - 14.15	28.0	59	0.6	0.0
14.15 - 14.30	28.0	61	0.0	0.0
14.30 - 14.45	28.0	62	0.7	0.0
14.45 - 15.00	28.0	64	1.2	0.4
15.00 - 15.15	28.0	66	0.8	0.0
15.15 - 15.30	27.5	67	0.5	0.0
15.30 - 15.45	27.5	70	0.8	0.3
15.45 - 16.00	27.5	72	1.1	0.4
16.00 - 16.15	27.0	74	0.9	0.0
16.15 - 16.30	26.5	76	1.6	0.7
16.30 - 16.45	26.5	78	0.8	0.0
16.45 - 17.00	26.5	80	0.5	0.0
17.00 - 17.15	26.5	81	0.0	0.0
17.15 - 17.30	26.5	82	0.0	0.0
17.30 - 17.45	26.5	82	0.6	0.0
17.45 - 18.00	26.0	81	0.6	0.0

Start time	Temp.	R.H.	Wind speed	
			Max	Avg.
18.00 - 18.15	26.0	81	0.4	0.0
18.15 - 18.30	26.0	81	0.0	0.0
18.30 - 18.45	26.0	81	0.0	0.0
18.45 - 19.00	26.0	81	0.4	0.0
19.00 - 19.15	26.0	81	0.0	0.0
19.15 - 19.30	26.0	81	0.0	0.0
19.30 - 19.45	26.0	81	0.0	0.0
19.45 - 20.00	26.0	81	0.0	0.0
20.00 - 20.15	26.0	81	0.0	0.0
20.15 - 20.30	26.0	81	0.0	0.0
20.30 - 20.45	26.0	81	0.0	0.0
20.45 - 21.00	26.0	80	0.0	0.0
21.00 - 21.15	26.0	80	0.0	0.0
21.15 - 21.30	26.0	80	0.0	0.0
21.30 - 21.45	25.5	80	0.0	0.0
21.45 - 22.00	25.5	80	0.0	0.0
22.00 - 22.15	25.5	80	0.0	0.0
22.15 - 22.30	25.5	80	0.0	0.0
22.30 - 22.45	25.5	80	0.0	0.0
22.45 - 23.00	25.5	80	0.0	0.0
23.00 - 23.15	25.5	80	0.0	0.0
23.15 - 23.30	25.5	80	0.0	0.0
23.30 - 23.45	25.5	80	0.0	0.0
23.45 - 24.00	25.5	80	0.0	0.0
00.00 - 00.15	25.0	80	0.0	0.0
00.15 - 00.30	25.0	80	0.0	0.0
00.30 - 00.45	25.0	80	0.0	0.0
00.45 - 01.00	25.0	80	0.0	0.0
01.00 - 01.15	25.0	80	0.0	0.0
01.15 - 01.30	25.0	80	0.0	0.0
01.30 - 01.45	25.0	80	0.0	0.0
01.45 - 02.00	25.0	80	0.0	0.0
02.00 - 02.15	25.0	80	0.0	0.0
02.15 - 02.30	25.0	80	0.0	0.0
02.30 - 02.45	25.0	80	0.0	0.0
02.45 - 03.00	25.0	80	0.0	0.0
03.00 - 03.15	25.0	80	0.0	0.0
03.15 - 03.30	25.0	80	0.0	0.0
03.30 - 03.45	25.0	80	0.0	0.0
03.45 - 04.00	25.0	80	0.0	0.0
04.00 - 04.15	25.0	80	0.0	0.0
04.15 - 04.30	25.0	80	0.0	0.0
04.30 - 04.45	24.5	80	0.0	0.0
04.45 - 05.00	24.5	80	0.0	0.0
05.00 - 05.15	24.5	80	0.0	0.0
05.15 - 05.30	24.5	80	0.0	0.0
05.30 - 05.45	24.0	80	0.0	0.0
05.45 - 06.00	24.0	80	0.0	0.0

Environmental Condition – 24 hour

Industrial Technology Institute

Annexure – 22

Proposed light rail transit system project

Measurement Point :N4 – Weekday measurement

Date of measurement :06th July 2017 & 07th July 2017

Start time	Temp.	R.H.	Wind speed	
			Max	Avg.
06.00 - 06.15	22.3	80	0.0	0.0
06.15 - 06.30	22.3	80	0.0	0.0
06.30 - 06.45	22.3	79	0.0	0.0
06.45 - 07.00	22.4	79	0.0	0.0
07.00 - 07.15	22.5	79	0.0	0.0
07.15 - 07.30	22.5	79	0.0	0.0
07.30 - 07.45	22.8	78	0.5	0.0
07.45 - 08.00	23.5	76	0.3	0.0
08.00 - 08.15	25.0	70	0.0	0.0
08.15 - 08.30	25.5	67	0.5	0.0
08.30 - 08.45	26.0	66	0.0	0.0
08.45 - 09.00	26.2	68	0.7	0.0
09.00 - 09.15	26.5	67	0.6	0.0
09.15 - 09.30	26.5	66	0.0	0.0
09.30 - 09.45	27.0	65	1.0	0.3
09.45 - 10.00	27.3	63	0.6	0.0
10.00 - 10.15	27.5	60	1.2	0.4
10.15 - 10.30	27.7	58	0.8	0.0
10.30 - 10.45	27.8	58	0.6	0.0
10.45 - 11.00	28.0	57	1.4	0.5
11.00 - 11.15	28.3	56	0.8	0.0
11.15 - 11.30	28.6	54	1.2	0.3
11.30 - 11.45	28.8	55	0.8	0.3
11.45 - 12.00	29.0	54	2.2	0.6
12.00 - 12.15	29.0	53	0.7	0.0
12.15 - 12.30	29.3	53	0.0	0.0
12.30 - 12.45	29.5	52	1.1	0.5
12.45 - 13.00	29.5	51	0.8	0.0
13.00 - 13.15	29.6	50	1.7	0.4
13.15 - 13.30	29.3	50	1.3	0.5
13.30 - 13.45	29.7	50	0.6	0.0
13.45 - 14.00	30.2	50	0.0	0.0
14.00 - 14.15	30.1	49	1.2	0.4
14.15 - 14.30	30.2	49	0.8	0.3
14.30 - 14.45	30.0	49	1.3	0.6
14.45 - 15.00	30.0	48	1.7	0.5
15.00 - 15.15	29.8	47	0.7	0.0
15.15 - 15.30	29.9	48	0.6	0.0
15.30 - 15.45	29.8	49	0.8	0.0
15.45 - 16.00	29.7	50	0.4	0.4
16.00 - 16.15	29.9	50	0.5	0.0
16.15 - 16.30	29.9	53	1.0	0.5
16.30 - 16.45	29.7	54	0.6	0.0
16.45 - 17.00	29.5	55	0.0	0.0
17.00 - 17.15	29.4	56	0.0	0.0
17.15 - 17.30	29.0	57	0.4	0.0
17.30 - 17.45	28.7	58	0.6	0.0
17.45 - 18.00	28.5	59	0.4	0.0

Start time	Temp.	R.H.	Wind speed	
			Max	Avg.
18.00 - 18.15	28.0	71	0.0	0.4
18.15 - 18.30	28.5	71	0.0	0.5
18.30 - 18.45	28.0	72	0.0	0.4
18.45 - 19.00	28.5	72	0.0	0.6
19.00 - 19.15	28.0	75	0.0	0.4
19.15 - 19.30	28.5	78	0.0	0.4
19.30 - 19.45	28.5	78	0.0	0.0
19.45 - 20.00	28.0	80	0.0	0.4
20.00 - 20.15	27.5	82	0.0	0.0
20.15 - 20.30	27.5	82	0.0	0.5
20.30 - 20.45	27.0	84	0.0	0.0
20.45 - 21.00	27.0	84	0.0	0.4
21.00 - 21.15	27.0	85	0.0	0.0
21.15 - 21.30	27.0	85	0.0	0.0
21.30 - 21.45	27.0	84	0.0	0.0
21.45 - 22.00	27.5	83	0.0	0.0
22.00 - 22.15	27.0	84	0.0	0.0
22.15 - 22.30	27.5	84	0.0	0.0
22.30 - 22.45	27.0	83	0.0	0.0
22.45 - 23.00	27.0	84	0.0	0.0
23.00 - 23.15	26.0	84	0.0	0.0
23.15 - 23.30	26.0	85	0.0	0.0
23.30 - 23.45	26.0	86	0.0	0.0
23.45 - 24.00	26.0	86	0.0	0.0
00.00 - 00.15	26.0	88	0.0	0.0
00.15 - 00.30	25.5	88	0.0	0.0
00.30 - 00.45	25.5	88	0.0	0.0
00.45 - 01.00	25.5	86	0.0	0.0
01.00 - 01.15	25.5	86	0.0	0.0
01.15 - 01.30	26.0	85	0.0	0.0
01.30 - 01.45	26.0	84	0.0	0.0
01.45 - 02.00	26.0	84	0.0	0.0
02.00 - 02.15	26.0	82	0.0	0.0
02.15 - 02.30	26.0	82	0.0	0.0
02.30 - 02.45	26.0	82	0.0	0.0
02.45 - 03.00	27.0	82	0.0	0.0
03.00 - 03.15	27.0	82	0.0	0.0
03.15 - 03.30	27.0	81	0.0	0.0
03.30 - 03.45	26.5	81	0.0	0.0
03.45 - 04.00	26.5	81	0.0	0.0
04.00 - 04.15	26.5	81	0.0	0.0
04.15 - 04.30	26.5	81	0.0	0.0
04.30 - 04.45	26.5	81	0.0	0.0
04.45 - 05.00	26.5	81	0.0	0.0
05.00 - 05.15	26.5	82	0.0	0.0
05.15 - 05.30	26.5	82	0.0	0.0
05.30 - 05.45	26.5	82	0.0	0.0
05.45 - 06.00	26.5	82	0.0	0.0

Environmental Condition – 24 hour

Industrial Technology Institute

Annexure – 23

Proposed light rail transit system project

Measurement Point :N5 – Weekend measurement

Date of measurement :01st July 2017 & 02nd July 2017

Start time	Temp.	R.H.	Wind speed	
			Max	Avg.
06.00 - 06.15	25.0	88	0.0	0.0
06.15 - 06.30	25.0	88	0.0	0.5
06.30 - 06.45	25.0	87	0.5	1.0
06.45 - 07.00	25.0	86	0.7	1.9
07.00 - 07.15	25.0	86	0.9	2.7
07.15 - 07.30	25.0	85	0.9	1.5
07.30 - 07.45	25.5	85	1.1	3.0
07.45 - 08.00	26.0	85	0.6	1.3
08.00 - 08.15	26.5	83	0.8	1.7
08.15 - 08.30	26.5	83	0.9	1.6
08.30 - 08.45	27.0	83	1.2	2.7
08.45 - 09.00	27.0	80	1.8	3.1
09.00 - 09.15	27.5	80	1.5	2.8
09.15 - 09.30	28.0	79	0.9	2.1
09.30 - 09.45	28.5	78	0.7	1.7
09.45 - 10.00	28.5	75	0.5	1.6
10.00 - 10.15	29.0	75	0.6	1.8
10.15 - 10.30	29.0	73	1.2	2.8
10.30 - 10.45	29.5	70	0.7	2.4
10.45 - 11.00	30.0	70	0.7	1.6
11.00 - 11.15	30.0	69	0.6	2.1
11.15 - 11.30	30.0	67	0.5	2.5
11.30 - 11.45	30.5	67	0.7	2.7
11.45 - 12.00	30.5	67	0.3	1.0
12.00 - 12.15	31.0	66	0.5	1.9
12.15 - 12.30	31.0	66	0.9	2.3
12.30 - 12.45	31.5	66	0.3	1.7
12.45 - 13.00	31.5	66	1.1	2.2
13.00 - 13.15	31.5	65	0.6	2.7
13.15 - 13.30	32.0	65	1.0	4.1
13.30 - 13.45	32.0	66	0.9	2.7
13.45 - 14.00	32.0	66	1.2	2.7
14.00 - 14.15	32.0	66	1.1	4.0
14.15 - 14.30	32.0	67	1.2	4.3
14.30 - 14.45	32.0	67	1.9	3.6
14.45 - 15.00	31.5	68	1.5	3.9
15.00 - 15.15	31.5	68	1.3	4.1
15.15 - 15.30	31.5	69	1.2	3.9
15.30 - 15.45	31.5	69	1.0	3.0
15.45 - 16.00	31.0	69	1.1	4.0
16.00 - 16.15	31.0	69	0.7	2.7
16.15 - 16.30	31.0	71	0.9	3.4
16.30 - 16.45	30.0	73	0.8	2.3
16.45 - 17.00	30.0	74	1.2	3.7
17.00 - 17.15	30.0	74	0.7	2.2
17.15 - 17.30	29.5	75	0.5	2.1
17.30 - 17.45	29.5	75	0.7	0.5
17.45 - 18.00	29.5	75	0.0	0.5

Start time	Temp.	R.H.	Wind speed	
			Max	Avg.
18.00 - 18.15	29.0	77	0.0	0.8
18.15 - 18.30	29.0	77	0.3	1.1
18.30 - 18.45	29.0	78	0.5	0.8
18.45 - 19.00	29.0	80	0.0	0.7
19.00 - 19.15	28.5	80	0.0	0.5
19.15 - 19.30	28.5	82	0.0	0.7
19.30 - 19.45	28.0	82	0.0	0.0
19.45 - 20.00	27.0	83	0.0	0.0
20.00 - 20.15	27.0	83	0.0	0.6
20.15 - 20.30	26.5	83	0.0	0.5
20.30 - 20.45	26.5	84	0.0	0.0
20.45 - 21.00	26.0	84	0.0	0.0
21.00 - 21.15	25.5	86	0.0	0.0
21.15 - 21.30	25.5	86	0.0	0.0
21.30 - 21.45	25.5	87	0.0	0.0
21.45 - 22.00	25.0	88	0.0	0.0
22.00 - 22.15	25.0	88	0.0	0.0
22.15 - 22.30	25.0	90	0.0	0.0
22.30 - 22.45	25.0	91	0.0	0.0
22.45 - 23.00	25.0	91	0.0	0.0
23.00 - 23.15	25.0	92	0.0	0.0
23.15 - 23.30	25.0	92	0.0	0.0
23.30 - 23.45	25.0	94	0.0	0.0
23.45 - 24.00	25.0	94	0.0	0.0
00.00 - 00.15	25.0	94	0.0	0.0
00.15 - 00.30	25.0	94	0.0	0.0
00.30 - 00.45	25.0	94	0.0	0.0
00.45 - 01.00	24.5	94	0.0	0.0
01.00 - 01.15	24.5	94	0.0	0.0
01.15 - 01.30	24.5	94	0.0	0.0
01.30 - 01.45	24.5	94	0.0	0.0
01.45 - 02.00	24.5	94	0.0	0.0
02.00 - 02.15	24.5	93	0.0	0.0
02.15 - 02.30	24.5	93	0.0	0.0
02.30 - 02.45	24.5	92	0.0	0.0
02.45 - 03.00	24.5	91	0.0	0.0
03.00 - 03.15	24.5	91	0.0	0.0
03.15 - 03.30	24.5	91	0.0	0.0
03.30 - 03.45	24.5	91	0.0	0.0
03.45 - 04.00	24.0	91	0.0	0.0
04.00 - 04.15	24.0	90	0.0	0.0
04.15 - 04.30	24.0	90	0.0	0.0
04.30 - 04.45	24.0	90	0.0	0.0
04.45 - 05.00	24.5	89	0.0	0.0
05.00 - 05.15	24.5	89	0.0	0.0
05.15 - 05.30	24.5	89	0.0	0.0
05.30 - 05.45	24.5	89	0.0	0.0
05.45 - 06.00	24.5	89	0.0	0.0

Environmental Condition – 24 hour

Industrial Technology Institute

Annexure – 24

Proposed light rail transit system project

Measurement Point :N7 – Weekend measurement

Date of measurement :15th July 2017 & 16th July 2017

Start time	Temp.	R.H.	Wind speed	
			Max	Avg.
06.00 - 06.15	24.0	85	0.7	1.6
06.15 - 06.30	24.0	85	0.7	1.5
06.30 - 06.45	24.0	85	0.4	1.7
06.45 - 07.00	24.0	85	0.8	1.9
07.00 - 07.15	24.0	85	0.5	1.6
07.15 - 07.30	24.5	84	0.0	0.6
07.30 - 07.45	25.0	83	0.0	0.5
07.45 - 08.00	25.0	82	0.0	0.5
08.00 - 08.15	26.5	82	0.0	0.4
08.15 - 08.30	26.5	81	0.0	1.0
08.30 - 08.45	27.0	81	0.0	0.7
08.45 - 09.00	27.0	81	0.0	1.0
09.00 - 09.15	27.0	81	0.0	1.0
09.15 - 09.30	27.0	81	0.0	0.6
09.30 - 09.45	27.0	80	0.0	1.9
09.45 - 10.00	27.5	79	0.0	1.1
10.00 - 10.15	27.5	78	0.0	0.6
10.15 - 10.30	27.5	78	0.0	0.5
10.30 - 10.45	27.5	78	0.0	0.7
10.45 - 11.00	27.5	77	0.6	1.6
11.00 - 11.15	28.0	77	0.0	0.0
11.15 - 11.30	28.0	77	0.0	0.0
11.30 - 11.45	28.5	76	0.0	0.0
11.45 - 12.00	28.5	76	0.0	2.2
12.00 - 12.15	28.5	77	0.0	0.7
12.15 - 12.30	29.0	76	0.0	0.6
12.30 - 12.45	29.5	76	0.8	1.9
12.45 - 13.00	29.5	75	0.0	0.6
13.00 - 13.15	30.5	75	0.0	0.5
13.15 - 13.30	31.0	75	0.0	0.7
13.30 - 13.45	31.0	74	0.0	0.7
13.45 - 14.00	31.0	74	0.7	1.6
14.00 - 14.15	31.0	74	0.7	1.1
14.15 - 14.30	31.0	74	0.4	1.1
14.30 - 14.45	31.0	73	0.8	1.7
14.45 - 15.00	31.5	73	0.5	1.4
15.00 - 15.15	31.5	73	0.0	0.0
15.15 - 15.30	31.5	73	0.0	1.4
15.30 - 15.45	31.5	73	0.0	0.6
15.45 - 16.00	31.5	74	0.0	0.7
16.00 - 16.15	31.5	74	0.0	0.4
16.15 - 16.30	31.5	73	0.0	0.3
16.30 - 16.45	31.0	74	0.0	0.8
16.45 - 17.00	31.0	74	0.0	0.6
17.00 - 17.15	31.0	74	0.0	0.0
17.15 - 17.30	30.5	75	0.0	0.0
17.30 - 17.45	30.5	75	0.0	0.0
17.45 - 18.00	30.0	75	0.0	0.0

Start time	Temp.	R.H.	Wind speed	
			Max	Avg.
18.00 - 18.15	29.0	74	0.0	1.1
18.15 - 18.30	29.0	74	0.6	1.5
18.30 - 18.45	29.0	70	0.0	1.0
18.45 - 19.00	28.5	74	0.0	0.8
19.00 - 19.15	27.0	76	0.0	0.6
19.15 - 19.30	27.0	76	0.6	2.4
19.30 - 19.45	26.5	77	0.4	0.8
19.45 - 20.00	26.5	77	0.6	0.0
20.00 - 20.15	26.5	77	0.0	0.0
20.15 - 20.30	26.5	78	0.4	1.7
20.30 - 20.45	26.5	78	0.5	0.9
20.45 - 21.00	26.5	78	0.0	0.4
21.00 - 21.15	26.5	80	0.0	0.0
21.15 - 21.30	26.0	80	0.0	0.0
21.30 - 21.45	26.0	80	0.0	0.0
21.45 - 22.00	26.0	80	0.0	0.0
22.00 - 22.15	26.0	81	0.0	0.0
22.15 - 22.30	26.0	83	0.0	0.0
22.30 - 22.45	26.0	83	0.0	0.0
22.45 - 23.00	26.0	83	0.0	0.0
23.00 - 23.15	26.0	83	0.0	0.0
23.15 - 23.30	26.0	83	0.0	0.0
23.30 - 23.45	26.0	83	0.0	0.0
23.45 - 24.00	25.5	83	0.0	0.0
00.00 - 00.15	25.5	82	0.0	0.0
00.15 - 00.30	25.5	82	0.0	0.0
00.30 - 00.45	25.5	82	0.0	0.0
00.45 - 01.00	25.5	83	0.0	0.0
01.00 - 01.15	25.5	83	0.0	0.0
01.15 - 01.30	25.5	83	0.0	0.0
01.30 - 01.45	25.5	83	0.0	0.0
01.45 - 02.00	25.5	83	0.0	0.0
02.00 - 02.15	25.5	84	0.0	0.0
02.15 - 02.30	25.5	84	0.0	0.0
02.30 - 02.45	25.5	84	0.0	0.0
02.45 - 03.00	25.5	85	0.0	0.0
03.00 - 03.15	25.5	85	0.0	0.0
03.15 - 03.30	25.0	85	0.0	0.0
03.30 - 03.45	25.0	85	0.0	0.0
03.45 - 04.00	25.0	85	0.0	0.0
04.00 - 04.15	25.0	85	0.0	0.0
04.15 - 04.30	25.0	85	0.0	0.0
04.30 - 04.45	25.0	85	0.0	0.0
04.45 - 05.00	25.0	85	0.0	0.0
05.00 - 05.15	24.0	85	0.0	0.0
05.15 - 05.30	24.0	85	0.0	0.0
05.30 - 05.45	24.0	85	0.0	0.0
05.45 - 06.00	24.0	86	0.0	0.0

SS – 1708661

24 hours - NoiseMeasurement Locations
Industrial Technology Institute

Annexure – 25

Noise Monitoring Programme for Proposed **light rail transit system project**

Location - N1

Location - N2

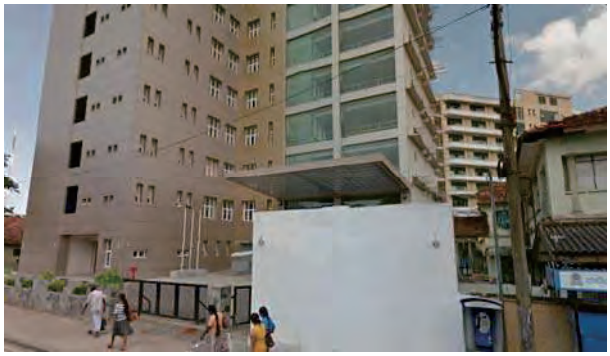
Location - N3

Location - N4

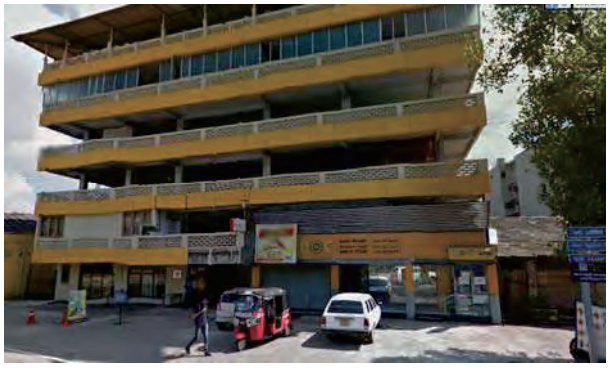
Location – N5

Location – N6

Location – N7



Location – N8



Annex E

Water Quality Survey

INDUSTRIAL TECHNOLOGY INSTITUTE (ITI)

P. O. Box, 787, 363, Bauddhaloka Mawatha, Colombo 7, Sri Lanka.
Telephone: 0094 011 2379800 Fax: 0094 011 2379850
120/4 A, Vidya Mawatha, Colombo 7, Sri Lanka.
Telephone: 0094 011 2379800 Fax: 0094 011 2379950

ilac-MRA SLAB ACCREDITED
ISO/ IEC 17025
TL 004 - 01

TEST REPORT

Reference No: SS 1708662

Report to :

Consulting Engineers & Architects Associated (Pvt) Ltd,
No. 500/5, Thalapathpitiya Road,
Madiwela,
Kotte.

Issued by :

Chemical and Microbiological Laboratory
Industrial Technology Institute

2017/09/02

2017/09/08 17/09/08

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SS 1708662

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QUERIES ON REPORT: Customer queries on reports will be entertained only up to a period of 01 year from the date of issue of the report.

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RETURN OF TEST ITEMS: Test items will be returned to the customer at the sole discretion of the ITI only on a written request by the customer.

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LITIGATION: All costs associated with litigation or dispute for oral or written testimony or preparation of same or for any other purpose related to work provided by the ITI shall be paid by the customer. Such costs include, but are not limited to hourly charges, travel and accommodation, mileage, counsel, legal fees and all other expenses associated with the said litigation and dispute.

CHANGE OF CONDITIONS: ITI may at its sole discretion add to or amend the conditions of this report at the time of issue of the report and such additions or amendments shall be binding on the customer.

2017/07/08 17/07/08

ISO/ IEC 17025
TL 004 - 01

TEST REPORT

Reference No. SS 1708662

CUSTOMER :	**Test Items : Water**
Consulting Engineers & Architects Associated (Pvt) Ltd, No. 500/5, Thalapathpitiya Road, Madiwela, Kotte.	**Service requested :** Sampling and Analysis for parameters requested by the customer's letter dated 2017/04/20

Collection Points :

Surface water
(1) Diyawannawa (2) Palamthuna Junction canal
(3) Bandaranayake canal (4) Beira lake

Ground water
(1) Well at Sri Parakumba Piriven Maha Viharaya.
(2) Well at P.W. Joachim, No. 487/11, Thalahena.
(3) Well at D.P.R. Dias, No. 146, Batalawatta, Thalahena.
(4) Well at Asokaramaya- Malabe.

Sampling Method : Grab sampling #

Description of test items at collection :

Surface Water
(1) Slightly turbid colourless water
(2) Turbid light brownish colour turbid water with particles
(3) Turbid brownish colour water with particles
(4) Turbid greenish colour water with particles

Ground Water
Clear colourless water (each item)

Quantity of test items collected :

Surface Water
Approximately 04 L of water collected into plastic container. (each test item)

Ground Water
Approximately 03 L of water collected into plastic container and 200 mL into a sterilized bottle (each test item)

2017/09/08

17/09/08

ISO/ IEC 17025
TL 004 - 01

SS 1708662

Sampling carried out by	:	Mr. Deshan Perera of ITI.
Witness	:	Mr. W.K.A. Madawa, Design Engineer from Consulting Engineers & Architects Associated (Pvt) Ltd,
Date & Time of sampling	:	**Surface water** (1) 2017/08/21 at 11.03 a.m (2) 2017/08/21 at 11.50 a.m (3) 2017/08/21 at 12.35 p.m (4) 2017/08/21 at 10.00 a.m **Ground water** (1) 2017/08/21 at 11.20 a.m (2) 2017/08/21 at 12.10 p.m (3) 2017/08/21 at 1.35 p.m (4) 2017/08/21 at 1.52 p.m
Temperature of test items at collection	:	**Surface water** – (1), (2) & (4) - 31 ^{0}C (3) – 30 ^{0}C **Ground water** – (1) - 28 ^{0}C (2), (3) & (4) – 29 ^{0}C
Date & time of reception of test items at ITI	:	2017/08/21 at 5.15 p.m
Temperature of test items at reception	:	**Surface water** – 26 ^{0}C (each item) **Ground water** – 24 ^{0}C (each item) } (stored in a cool box)
Condition of test items at reception	:	Satisfactory

SLAB Accredited

Test dates : 2017/08/21 – 2017/08/26

17/09/08

2017/09/08

ISO/ IEC 17025
TL 004 - 01

SS 1708662

TEST RESULTS : Surface water

Test	Unit	Method	Results				L.O.D	EU % (K=2)
			01	02	03	04		
# pH *	-	APHA 4500 – H^+ B	7.07 at 31 ^{0}C	6.63 at 31 ^{0}C	6.50 at 30 ^{0}C	8.6 at 31 ^{0}C	-	-
Temperature,* ^{0}C	-	APHA 2550 B	31	31	30	31	-	-
Dissolved Oxygen	mg/L	APHA 4500 O & G	4.0	2.4	3.4	6.5	-	-
# Turbidity	NTU	APHA 2130 B	2.9	12.0	619.5	154	-	20
BOD_3 at 30 ^{0}C	mg/L	APHA 5210 B	2	2.5	ND	6	2	-
Oil & Grease	mg/L	APHA 5520 B	ND	ND	ND	ND	2	-
# Total Suspended Solids at 103 – 105 ^{0}C mg/L	mg/L	APHA 2540 D	7	31	247	81	-	3

Ground water

Test	Unit	Method	Results				L.O.D	EU % (K=2)
			01	02	03	04		
# pH *	-	APHA 4500 – H^+ B	6.48 at 28 ^{0}C	5.31 at 29 ^{0}C	4.40 at 29 ^{0}C	3.95 at 29 ^{0}C	-	-
Temperature,* ^{0}C	-	APHA 2550 B	28	29	29	29	-	-
Water Level * (From Ground Level)	m	-	3.3	5.3	11.0	9.2	-	-
BOD_3 at 30 ^{0}C	mg/L	APHA 5210 B	ND	3	2	ND	2	-
# Electrical Conductivity	µS/cm	APHA 2510 B	417	160	186	137		4
Total Coliforms/100 mL (Confirmed MPN)	-	APHA 9221 C	2200	2800	$2.4x10^3$	230	-	-

APHA – Standard Methods for the examination of water and waste water APHA, AWWA , WEF, 2012 22nd edition

 # SLAB Accredited **L.O.D – Limit of Detection** **EU – Expanded Uncertainty**

*** Measured on site** **ND – Not detected**

Analyses were carried out by Mr. Deshan Perera – Research Scientist, Ms. K. de Alwis & Ms. Y. Pitawela – Senior Research Technologists Ms. R. Weerasooriya, Mr. A. Peiris & Mr. H.L.E. Hasalaka – Assistant Research Technologists & Ms. S. Amarasena – Assistant Research Technologist under supervision of Ms. S. Liyanage – Research Scientist.

.....
Authorized Signatory

.....
Authorized Signatory

Dr. Kushani Mahatantila
B.Sc.,M.Phil. D.Sc. (Japan)
Research Scientist
Chemical and Microbiological Laboratory

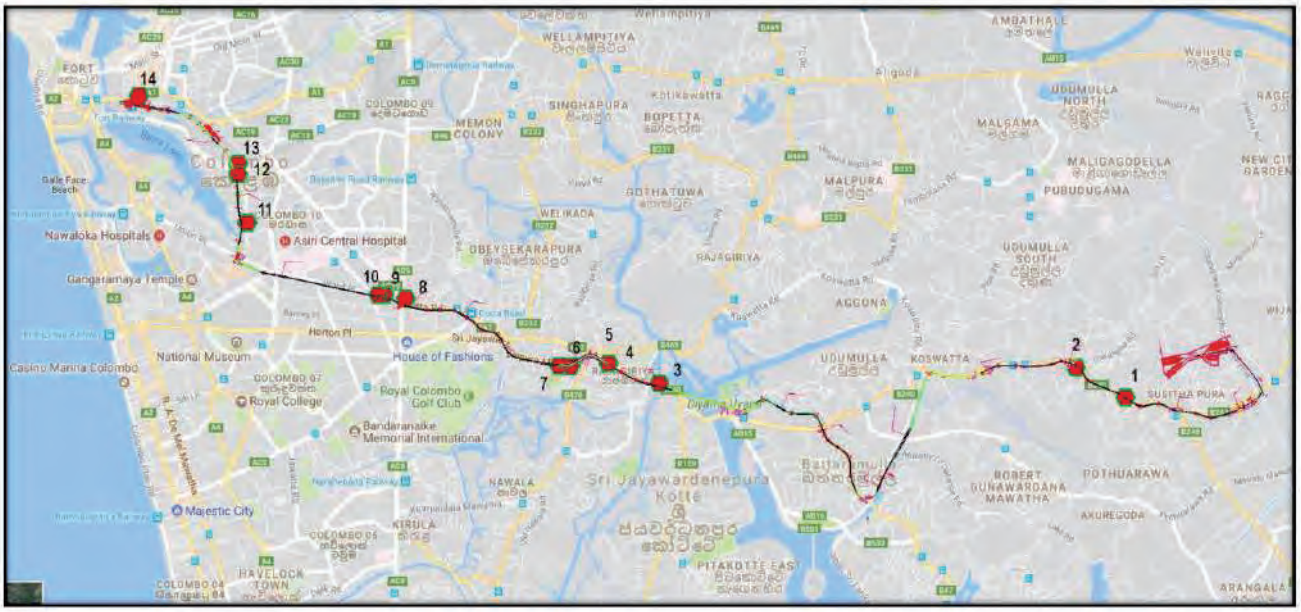
2017/09/02
/dpc

Himashi Karunaratne
B.Sc. (Hons.) M.Sc.
Research Scientist
Chemical & Microbiological Laboratory
Industrial Technology Institute

Annex F

Bo tree survey

1. List of Bo Trees along proposed LRT route



ID	NAME OF PLACE	LATITUDE	LONGITUDE	ID	NAME OF PLACE	LATITUDE	LONGITUDE
1	Salawanoddyaramaya Temple Bo Tree	6°54'16.93"N	79°57'0.92"E	8	Borella Junction Bo Tree	6°54'52.59"N	79°52'40.42"E
2	Thalahena Junction Bo Tree	6°54'29.05"N	79°56'42.27"E	9	This Bo Tree belongs to Thilakarathnaramaya Temple	6°54'53.10"N	79°52'35.80"E
3	Close to KFC (Rajagiriya) Bo Tree	6°54'22.92"N	79°54'12.61"E	10	The Bo Tree Near the Word Place	6°54'53.71"N	79°52'33.37"E
4	Near Rajagiriya Fly Over Bo Tree	6°54'32.56"N	79°53'49.41"E	11	The Bo Tree Near the Nestle company	6°55'17.46"N	79°51'43.55"E
5	Rajagiriya Junction Bo Tree	6°54'34.33"N	79°53'45.65"E	12	Gamini Hall Bo Tree	6°55'36.76"N	79°51'42.26"E
6	In front of Rajagiriya Victoria Home Bo Tree	6°54'30.32"N	79°53'37.47"E	13	Near the Gamini Hall Bo Tree	6°55'37.69"N	79°51'41.79"E
7	Rajagiriya Janadhipathi Vidyala Mawatha Bo Tree	6°54'29.84"N	79°53'34.98"E	14	E.W Bastian Mawatha Bo Tree	6°56'2.68"N	79°51'4.05"E

Figure 1 Location of Bo tree along LRT route

Table1: detail of each Bo tree

ID	Location	PHOTO	NOTE
1	Bo tree belongs to Shalawanoddyaramaya Temple		One major branch have to be cut down. According to the priest this great Bo tree has a miracle power.
2	Bo Tree at Thalahena Junction		Branches to be trimmed. This Bo tree belongs to the temple. (Kotte)

ID	Location	PHOTO	NOTE
3	Bo Tree near KFC - Rajagiriya		Some branches have to be cut down. There is shrine. This Bo tree maintains by the temple. (Kotte).The religious ceremony calls "Breaking water" occurs this place.
4	Bo Tree near Rajagiriya Fly Over		Some branches have to be cut down. There is a shrine.
5	Bo Tree at Rajagiriya Junction		Branches to be trimmed. There is a shrine.
6	Bo Tree In front of Rajagiriya Victoria Home		Some branches have to be cut down. Victoria Home people attends all religious activities.
7	Bo Tree near Rajagiriya Janadhipathi Vidyalaya		Some branches have to be cut down. Premises owned by Rajagiriya Janadhipathi Vidyalaya. There is a shrine. Religious activities undertaken by school or Montessori community.
8	Tree at Borella Junction		Branches to be trimmed. There is a shrine. Premises owned by CMC. People in surrounding area continuous religious activities.

ID	Location	PHOTO	NOTE
9	Bo Tree belongs to Thilakarathnaramaya Temple		Branches to be trimmed. According to priest Rathgama Upananda Thero this old Bo Tree is owned by the temple. (Thilakarathnaramaya). No objections for trimming. But should be organized religious activities when trimming or cutting branches . After that it should be balanced the tree.
10	ree near the Ward Place		Some branches have to be cut down. According to priest Rathgama Upananda Thero the area is owned by Thilakarathnaramaya temple. No shrine.
11	Tree near the Nestle Company		Branches to be trimmed. Part of the tree is on ROW. Other part is in side of the Nestle Co. premises. Very Old Bo tree. Religious activities carry out by workers of Nestle.
12	Bo Tree near Gamini Hall		Branches to be trimmed. There is a shrine. No special society or person to carry out religious activities. People in surrounding area continuous religious activities.
13	ee near the Gamini Hall		Some branches have to be cut down. Bo Tree is growing with Tamarind tree. It is on pavement area. No Shrine.
14	ee at E.W Bastian Mawatha		Branches to be trimmed. There is a shrine. People in the area takes on day to day religious activities. Land is owned by CGR or UDA.

2. Discussions with stakeholder regarding Bo Trees along the proposed Light Rail Route.

1: *Shalawanodyaramaya Bo Tree*	
ID	*01*
Potential Impact	*A branch of the Bo tree May be impacted*

This Bo Tree own and maintains by a committee headed by chief priest of Sri Shalawanadyramaya , Thalangama North, Malabe.The survey team had a discussion with the chief priest of the Temple.

The chief Priest of Sri Shalawanadyramaya , Thalangama North, Malabe is a very broad minded person. According to him he had been in Europe Countries for his researches. He expressed his views and ideas towards the very positive manner.

The Thero stated that the branch of the Bo tree must be cut down, because it is very dangerous. A high tension electricity line runs below this particular branch. According to the Thero, they tried to cut down 02 times after all religious activities. The Electricity Board also tried to cut down the branch. But it was notpossible. Finally Electricity Board has decided to put the cable as an under ground cable. Thero said that the Buddhist community believe this particular Bo Tree is having a miracle power. Also he thinks this particular branch is not growing. He can remember that during the last 20 years this branch is of same size.

The discussion completed with following suggestions.

- The Thero can inform to the Buddhist Society of the temple (Dhayaka Sabhawa) when the project design completed.
- At the beginning no need to discuss with (Dhayaka Sabhawa)
- Cutting down the branch should be done after performing all religious activities.

With the development, all people to be adapted to the realistic situations.

2: *Thalahena Bo Tree*		
ID	*02*	
Potential Impact	*No Direct Impact*	

Discussion had with the Chief Priest of Sri Bodhi Rukkaramaya-Thalahena, Malabe *regarding Thalahena Bo Tree.* The Thalahena Bo Tree is owned by the "Bodhi Bharakara Mandalaya".The chief Patron of the society is the Chief Priest of the Bodi Rukkaramaya Temple.The three wheel drivers of the surrounding area and the Buddhist people in the area take care the day to day religious activities for the Bo Tree.

The chief Priest expressed his ideas in a very positive manner.

The Thero stated that the if there is a need to cut down the branches ,considering the impacts for the community due to the project it should be done. But it must be done after performing all religious activities. The Thero said that there are 06 persons representing the " Bodhi Bharakara Mandalaya" and at the correct time Thero discuss with them.

But according to the cad drawing the requirement is to trim some leaves.

3: *Thilakarathnaramaya Bo Tree*		
ID	*09*	
Potential Impact	*A branch of the Bo tree May be impacted*	

For the information of this BO Tree a discussion had with the priest of Thilakarathnaramaya

This Bo Tree belonging to the temple Thilakarathnaramaya is very old one. The flower offering table in this temple close to the Bo Tree, was constructed in1885. The year in which the Wesak Full moon day was declared by the government as a public holiday. The Thero is very positive.. He said that all of us should be positive and flexible for the changes toward the development. His suggestions are ,

- Cutting down the branch should be done after performing all religious activities.
- Pruning the branches should be done balance the tree.

4: *Bo Tree at the Nestle Company*		
ID	*10*	
Potential Impact	*A branch of the Bo tree may be impacted*	

This particular Bo Tree is at Nestle Company premises .Manager Administration expressed his views regarding the Bo Tree and the development of the projects. According to him This Bo tree also an old one. The staff of the company is performing the religious activities since 1947/1948.
They also believe that this Bo Tree has a miracle power. According to him even the foreign directors also respect to the Bo Tree. He said that if it is required to trim some small branches it should be done after performing all religious activities properly.

5: *Boralla Bo Tree*		
ID	*08*	
Potential Impact	*A branch of the Bo tree may be impacted*	

Discussed with the devotees of the respected Boralla Bo Tree. The premises belongs to Colombo Municipal Council. People in surrounding area perform religious activities. The people is believing that the Bo Tree is very important for the Buddhist Community and the Bo Tree is having a miracle power. If it is removed it may come harm to the people involved. Their thought is to avoid the Bo tree.
After the explanation of the project and the type of the impact to this Bo Tree they accepted the smooth trimming . But before the trimming It should be performed all religious activities should be properly performed.

Annex G

Utility map

Transmission Line around the proposed LRT Route


Crossing
Legend
Athurugiriya- Kolonnawa 132 kV crossing at CINEC
Depot Access
Feature 1
Feature 2
Main Line
Pannipitiya-Biyagama 132 kV crossing at CINEC
Kandana
Welisara
Ragama
Eldeniya
Wattala
Gonawala
Peliyagoda
(04) WTC
(05) Fort
(03) Slave Island
(06) Transport Centre
(07) St. Joseph's
olombo
(02) Seema Malakaya
(08) National Hospital
(09) Borella
(10) Cotta Road
(11) Welikada
(12) Rajagiriya
(01) Kolupitiya
(13) Sethsiripaya
(14) Battaramulla
(17) Lumubini Temple
(19) Malabe
(16) Rpbert Gunawadena
(15) Palan Thuna
Sri Jayawardenepura Kotte
Ruhunupura
Nugegoda
Maharagama
Google Earth
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Data SIO, NOAA, U.S. Navy, NGA, GEBCO
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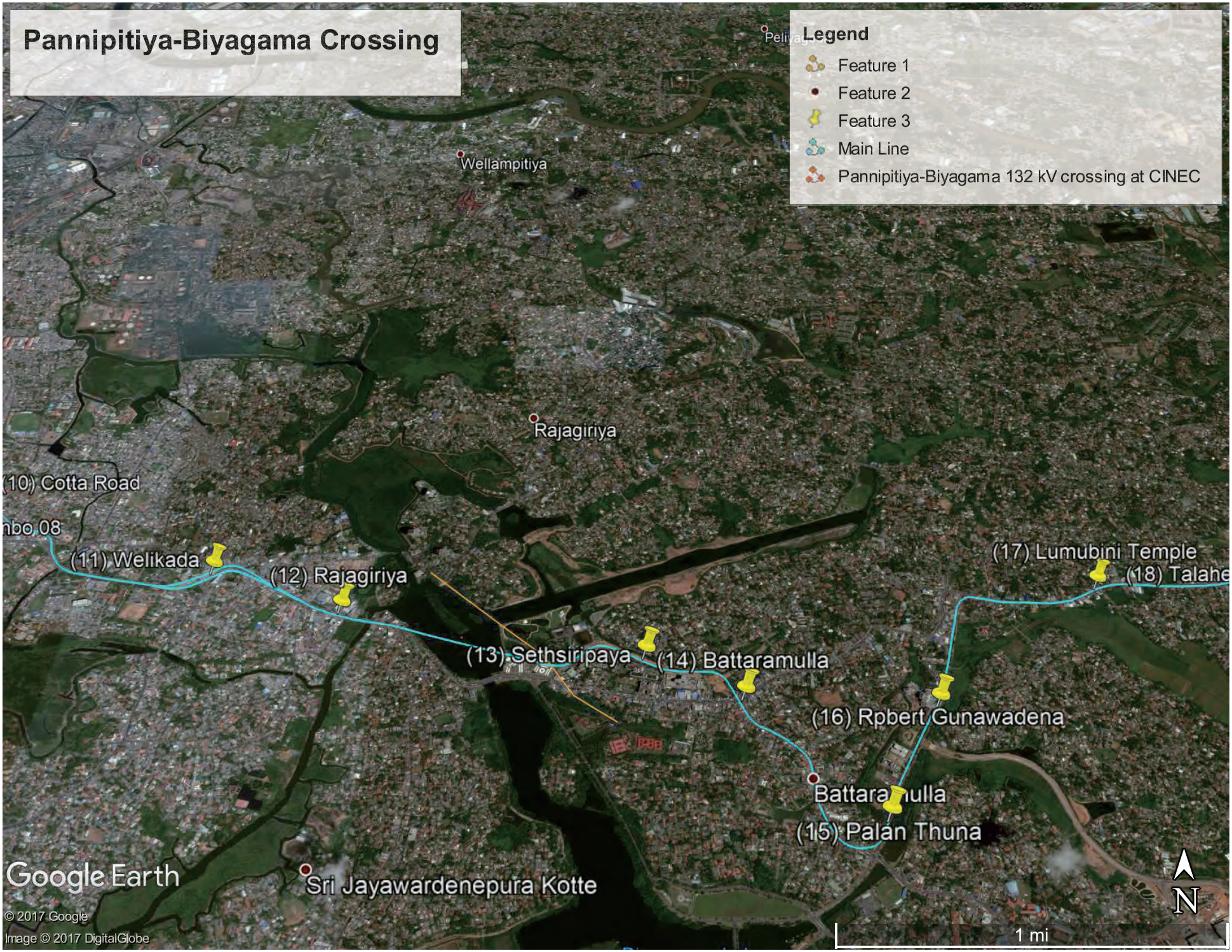
3 mi


Pannipitiya-Biyagama Crossing
Legend
Feature 1
Feature 2
Feature 3
Main Line
Pannipitiya-Biyagama 132 kV crossing at CINEC
Wellampitiya
Rajagiriya
(10) Cotta Road
(11) Welikada
(12) Rajagiriya
(13) Sethsiripaya
(14) Battaramulla
(15) Palán Thuna
(16) Rpbert Gunawadena
(17) Lumubini Temple
(18) Talahe
Sri Jayawardenepura Kotte
Google Earth
© 2017 Google
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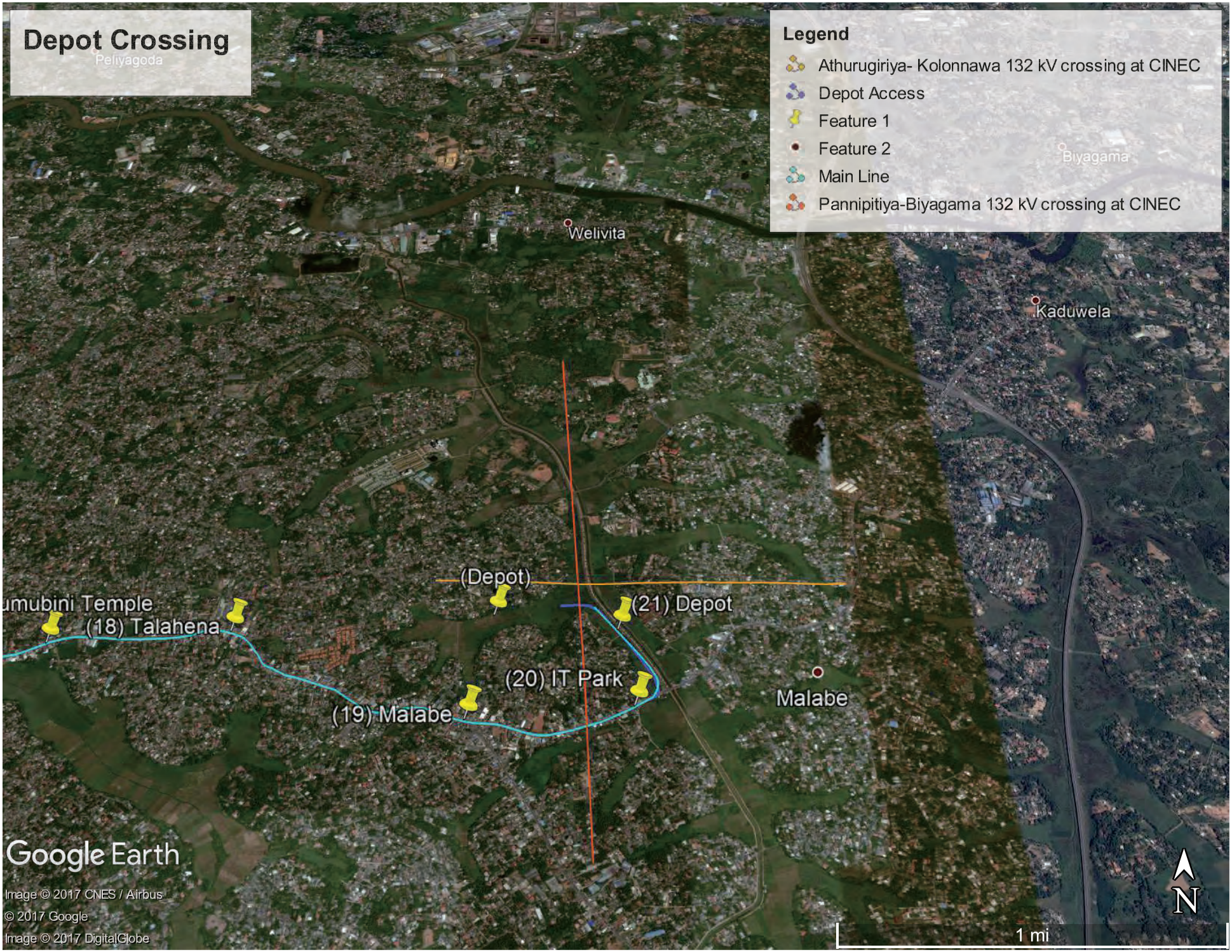
Depot Crossing
Peliyagoda
Legend
Athurugiriya- Kolonnawa 132 kV crossing at CINEC
Depot Access
Feature 1
Feature 2
Main Line
Pannipitiya-Biyagama 132 kV crossing at CINEC
Biyagama
Welivita
Kaduwela
(Depot)
(21) Depot
umubini Temple
(18) Talahena
(20) IT Park
(19) Malabe
Malabe
Google Earth
Image © 2017 CNES / Airbus
© 2017 Google
Image © 2017 DigitalGlobe
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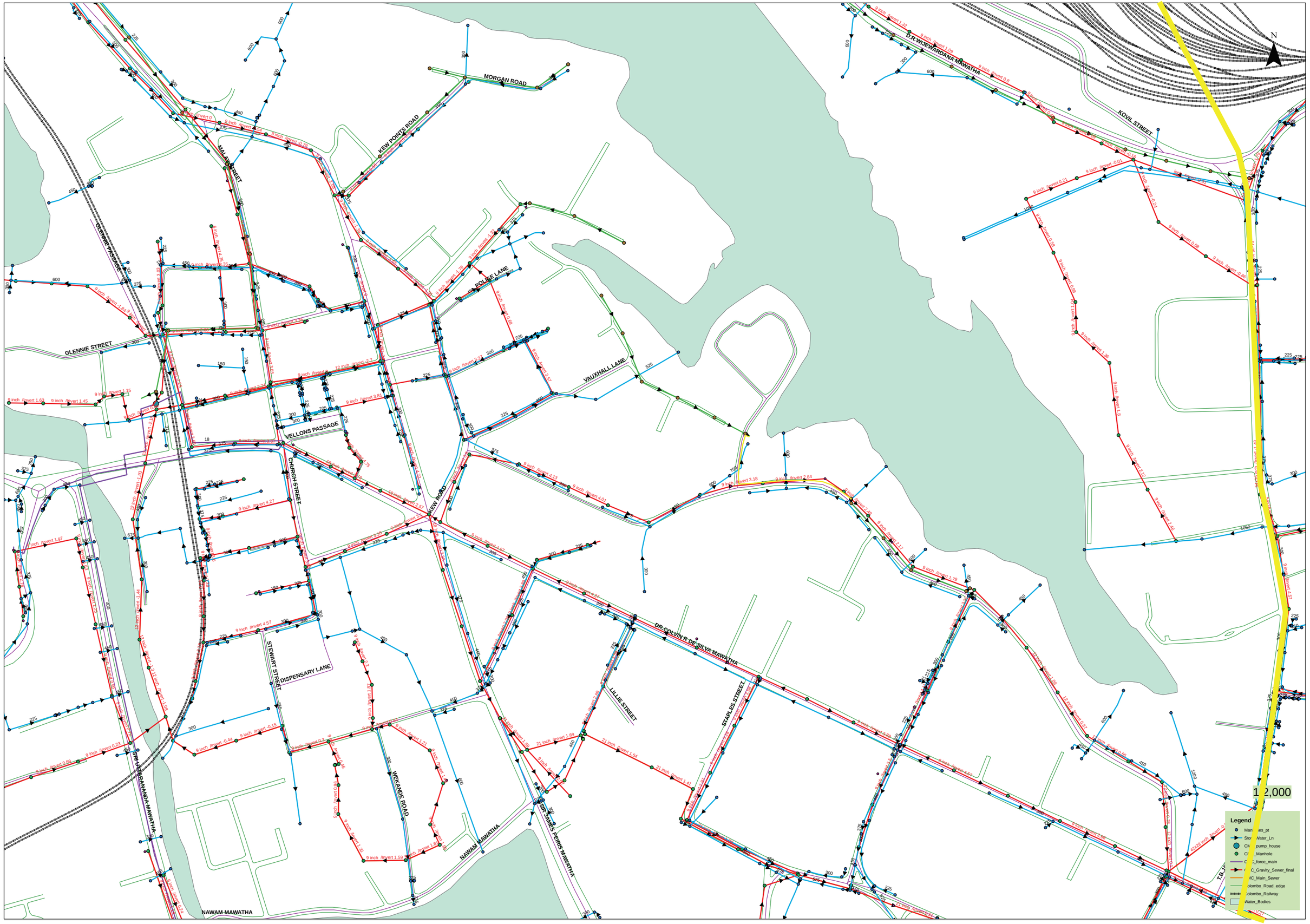
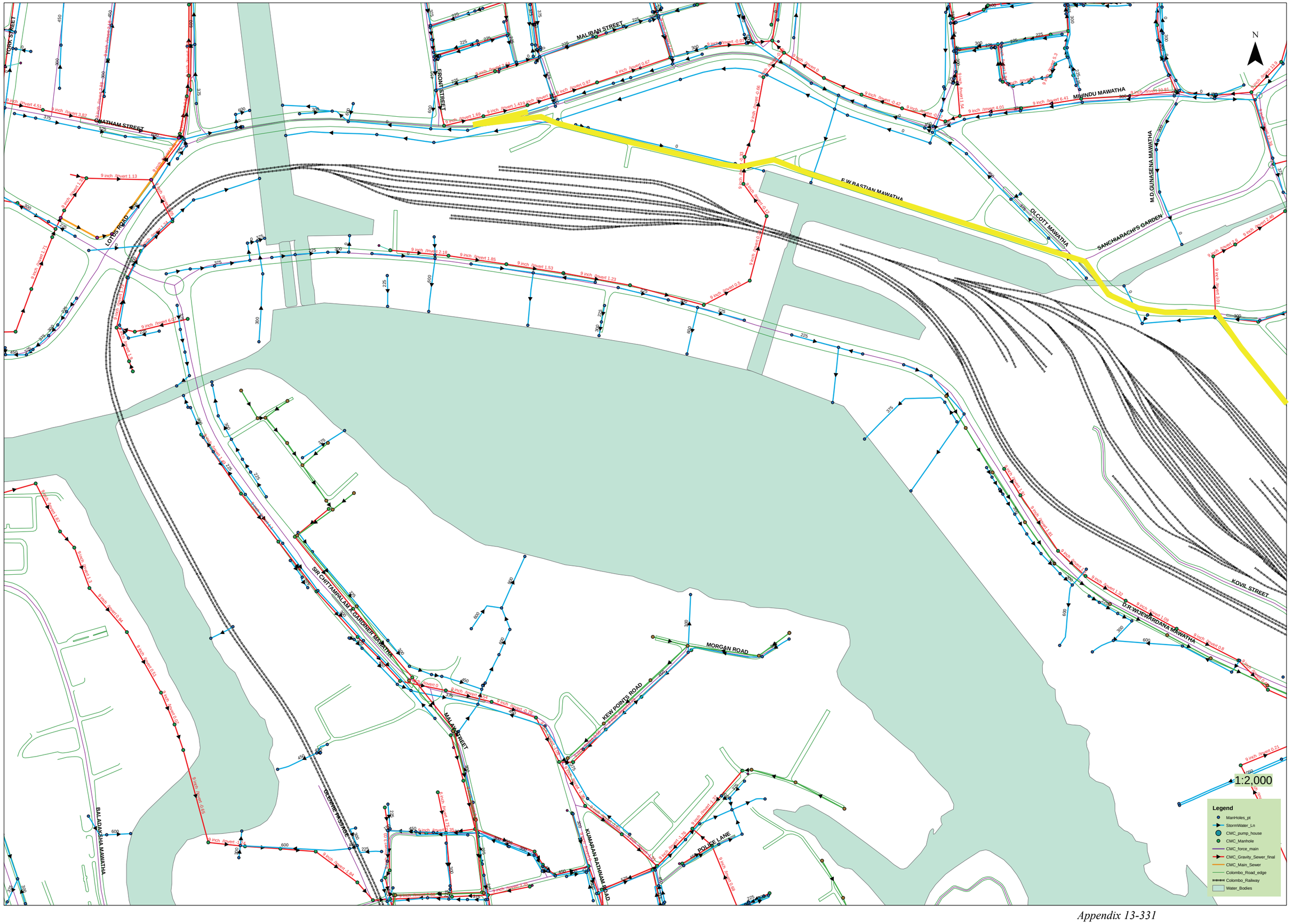
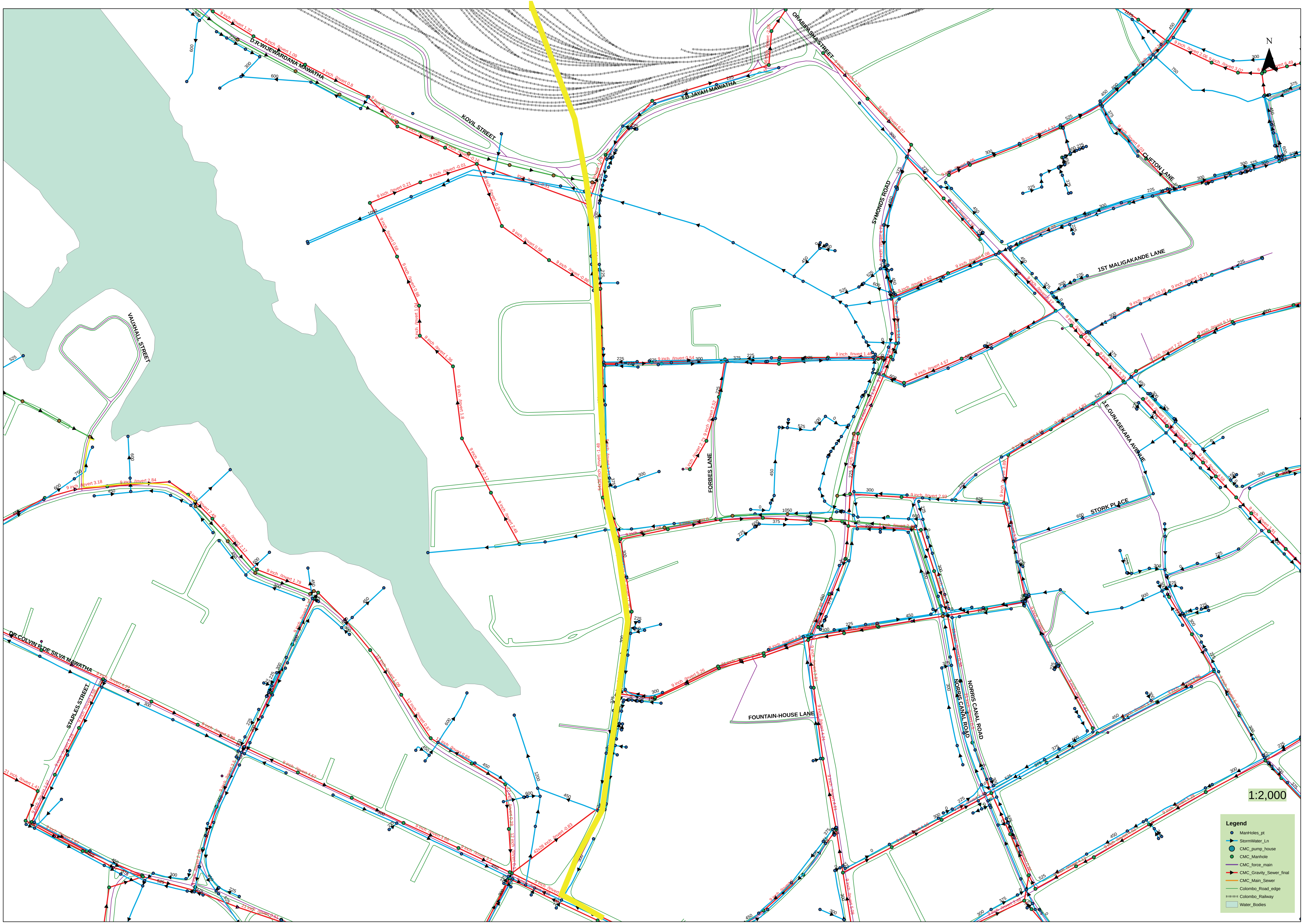
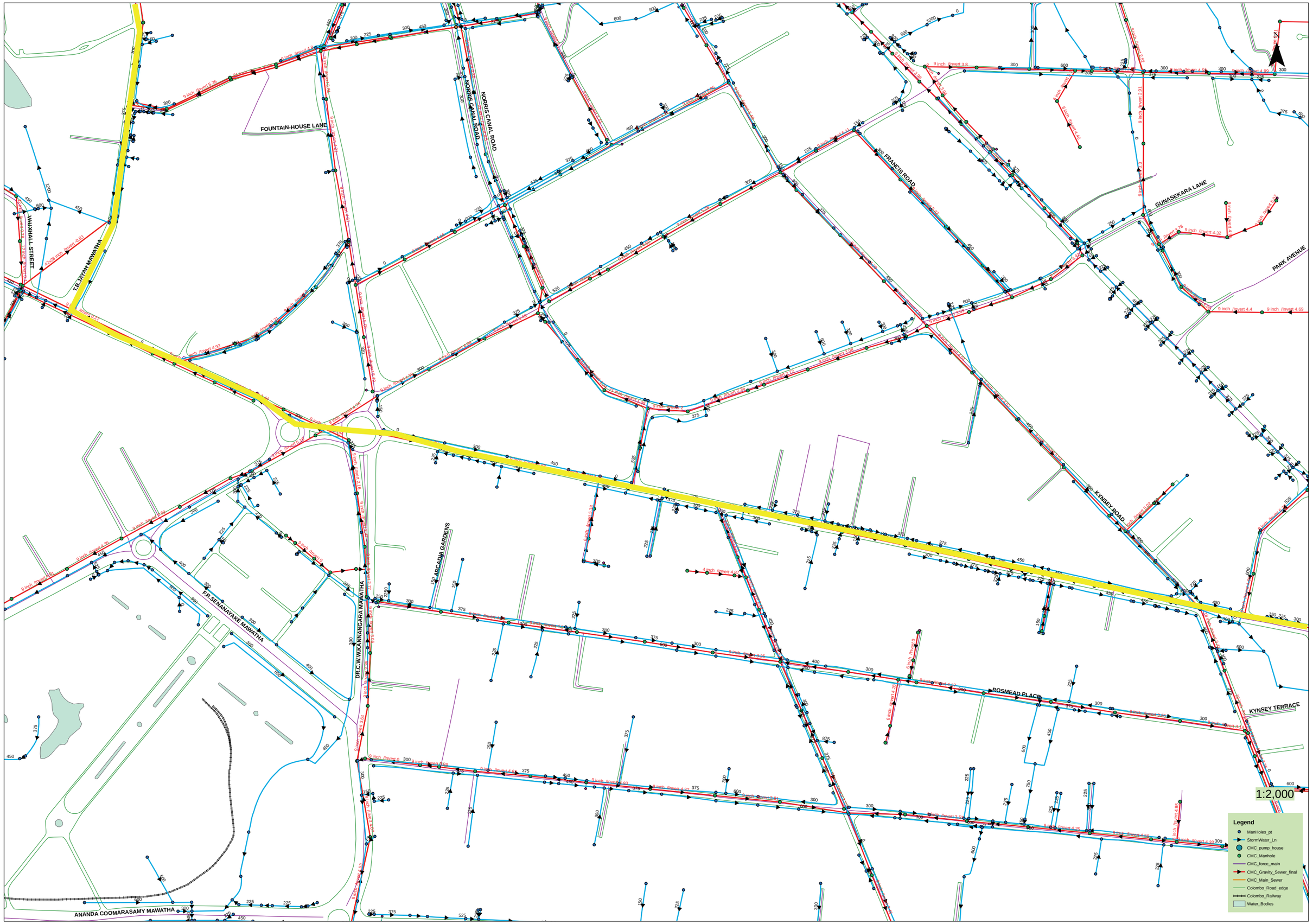
1 mi

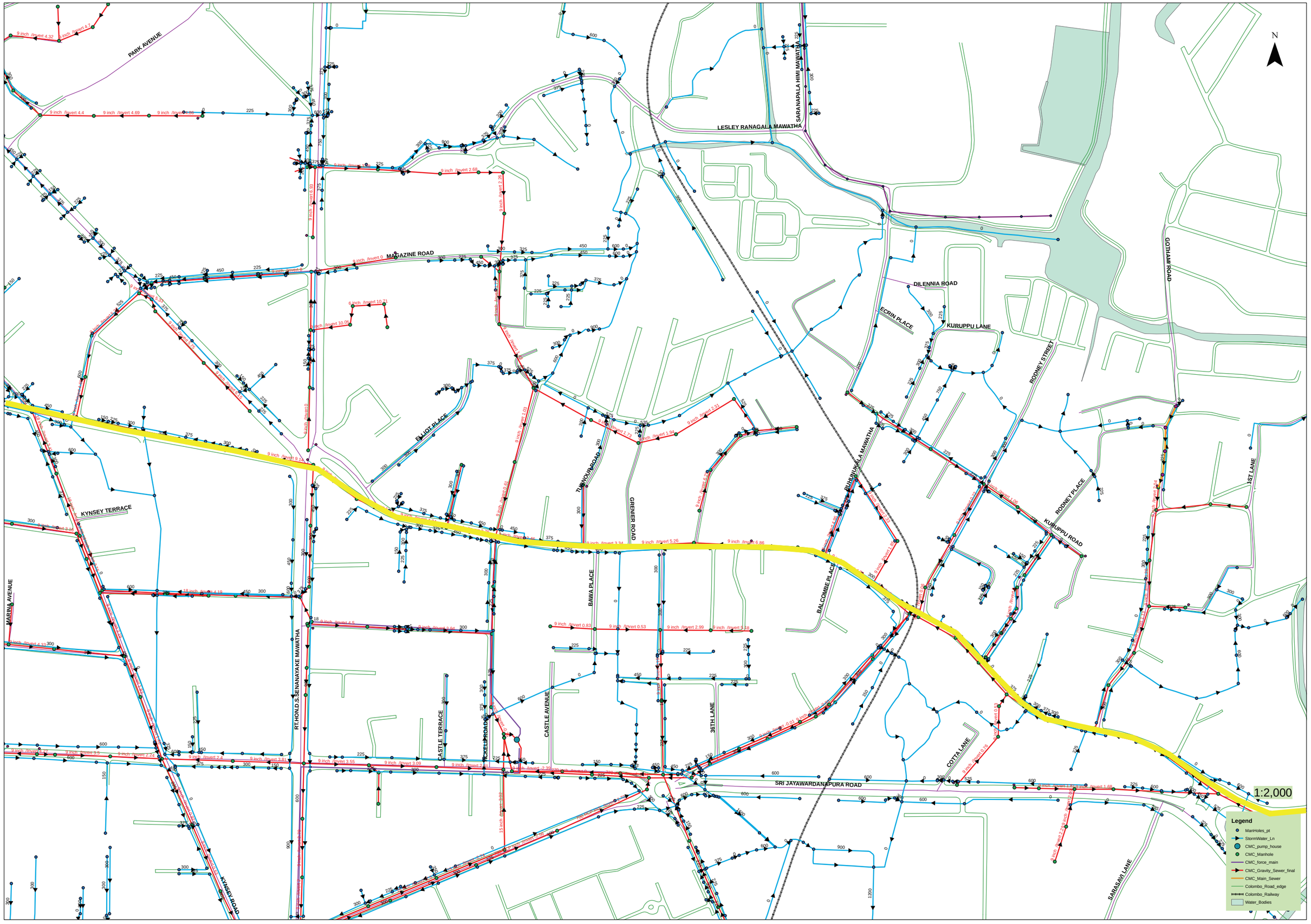
Sewage system around the proposed LRT Route


MORGAN ROAD
KEW POINT ROAD
MALAY STREET
GLENNIE PASSAGE
GLENNIE STREET
POLICE LANE
VAUXHALL LANE
VELLONS PASSAGE
CHURCH STREET
KEW ROAD
STEWART STREET
DISPENSARY LANE
WEKANDE ROAD
NAWAM MAWATHA
SIR JAMES PERIS MAWATHA
DR.COLVIN R DE SILVA MAWATHA
LILLIE STREET
STAPLES STREET
KOVIL STREET
D.R.WIJEWARDANA MAWATHA
N
1:2,000
Legend
Main_Manholes_pt
Storm_Water_Ln
CMC_pump_house
CMC_Manhole
CMC_force_main
CMC_Gravity_Sewer_final
CMC_Main_Sewer
Colombo_Road_edge
Colombo_Railway
Water_Bodies


N
YORK STREET
GRATHAM STREET
LOTUS ROAD
FRONT STREET
MALIBAN STREET
E.W.BASTIAN MAWATHA
OLCOTT MAWATHA
SANCHIARACHI'S GARDEN
M.D.GUNASENA MAWATHA
MILINDU MAWATHA
KOVIL STREET
D.R.WIJEWARDANA MAWATHA
SIR CHITTAMPALAM A GARDINER MAWATHA
MALAY STREET
KEW POINTS ROAD
MORGAN ROAD
KUMARAN RATHNAM ROAD
POLICE LANE
BALADAKSHA MAWATHA
GLENNIE PASSAGE
1:2,000
Legend
ManHoles_pt
StormWater_Ln
CMC_pump_house
CMC_Manhole
CMC_force_main
CMC_Gravity_Sewer_final
CMC_Main_Sewer
Colombo_Road_edge
Colombo_Railway
Water_Bodies


N
D.R.WIJEWARDANA MAWATHA
KOVIL STREET
T.B.JAYAH MAWATHA
ORABIPASHA STREET
SYMONDS ROAD
CLIFTON LANE
1ST MALIGAKANDE LANE
VAUXHALL STREET
FORBES LANE
J.E.GUNASEKARA AVENUE
STORK PLACE
DR.COLVIN R.DE SILVA MAWATHA
STAPLES STREET
FOUNTAIN-HOUSE LANE
NORRIS CANAL ROAD
1:2,000
Legend
ManHoles_pt
StormWater_Ln
CMC_pump_house
CMC_Manhole
CMC_force_main
CMC_Gravity_Sewer_final
CMC_Main_Sewer
Colombo_Road_edge
Colombo_Railway
Water_Bodies


FOUNTAIN-HOUSE LANE
NORRIS CANAL ROAD
FRANCIS ROAD
GUNASEKARA LANE
PARK AVENUE
VAUXHALL STREET
T.B.JAYAH MAWATHA
F.R.SENANAYAKE MAWATHA
ARCADIA GARDENS
DR.C.W.KANNANGARA MAWATHA
KYNSEY ROAD
ROSMEAD PLACE
KYNSEY TERRACE
ANANDA COOMARASAMY MAWATHA
1:2,000
Legend
ManHoles_pt
StormWater_Ln
CMC_pump_house
CMC_Manhole
CMC_force_main
CMC_Gravity_Sewer_final
CMC_Main_Sewer
Colombo_Road_edge
Colombo_Railway
Water_Bodies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PARK AVENUE
LESLEY RANAGALA MAWATHA
SARANAPALA HIWI MAWATHA
GOTHAMI ROAD
DILENNIA ROAD
KURUPPU LANE
ECRIN PLACE
RODNEY STREET
RODNEY PLACE
KURUPPU ROAD
1ST LANE
MAGAZINE ROAD
ELLIOT PLACE
TURNOUR ROAD
GRENIER ROAD
BUHUKUKULA MAWATHA
BALCOMBE PLACE
BAWA PLACE
CASTLE TERRACE
CASTLE AVENUE
36TH LANE
COTTA LANE
SARASAVI LANE
SRI JAYAWARDANAPURA ROAD
KYNSEY TERRACE
MARINA AVENUE
RT.HON.D.S.SENANAYAKE MAWATHA
KYNSEY ROAD
Legend
ManHoles_pt
StormWater_Ln
CMC_pump_house
CMC_Manhole
CMC_force_main
CMC_Gravity_Sewer_final
CMC_Main_Sewer
Colombo_Road_edge
Colombo_Railway
Water_Bodies