



Environmental Impact Study for Proposed Road Widening and Sewer Works along Lorong Lada Hitam

EIS Report

Prepared for
Building Construction Authority

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2023



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EIS Report

For Building Construction Authority

For and on behalf of
EnviroSolutions & Consulting

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EXECUTIVE SUMMARY

EnviroSolutions & Consulting Pte Ltd (ESC) has been appointed by the Building and Construction Authority (BCA) to prepare the Environmental Impact Study (EIS) for the Proposed Road Widening and Sewer Works along Lorong Lada Hitam (hereinafter referred as the “Project”) within Mandai area, abutting the Central Catchment Nature Reserve (hereinafter referred as the “Site/Project Area”).

The purpose of the EIS is to provide information on the baseline biodiversity, air quality and noise conditions at the Site, assess the nature and extent of potential environmental impacts arising from the construction of the Project and related activities that take place concurrently, recommend mitigating measures to minimise the adverse environmental impacts due to the Project, as well as provide a proposed environmental monitoring and management plan (EMMP) to be implemented in the course of construction of the Project.

Project Description

The 1.45-hectare site is located in the north of Singapore in the Mandai area at Lorong Lada Hitam. It lies within the Central Catchment Nature Reserve (CCNR) boundary but is separated from the main tract of the CCNR by Mandai Road. This project involves expunging part of Lorong Lada Hitam and widening it from its current dual one-lane carriage way to a dual two-lane carriage way. The general construction activities associated with the road widening works include site clearance, cutting and filling of slope, access road construction, demolition of existing road and drains, asphalt works, and other features required for a road such as the construction of kerb, drainage, sewers, traffic lights, cables/utilities, and streetlights.

There will be no temporary or permanent encroachment into the nature reserve for the project’s works along Lorong Lada Hitam, except for a 1.5m² working area for the construction of the new sump. Apart from that small area, during construction, the proposed road widening and related demolition works will take place entirely within the existing and proposed road reserve line.

Environmental Baseline

Baseline studies were carried out between July to September 2020. Below is a summary of the environmental baseline findings:

- Habitat mapping – The study area is dominated by four distinct floral habitats that are determined based on the land use history of the area and observations made during the flora survey. Main habitats identified are rubber dominated forest, native dominated forest, mixed native and exotic forest and, grass and scrub;
- Biodiversity, Flora – A total of 89 plant species were identified, of which 40 species (45%) are of conservation concern. Out of the 40 species which are of conservation concern, 2 species are extinct, 13 species are critically endangered, 9 species are endangered, and 16 species are vulnerable. NParks has also informed of the presence of an additional critically endangered tree species, bringing the total flora species to 90, of which 41 are of conservation concern;
- Biodiversity, Fauna – A total of 97 species of fauna were recorded from the fauna transect surveys conducted, camera trapping as well as chance encounters. This comprises 34 birds, 9 mammals, 2 amphibians, 6 reptiles, 36 butterflies and 10 odonates. These represent a mixture of species typical of open habitats such as scrub and parkland, as well as species dependent on secondary forest. However, it is worth noting that many species that were expected to occur in similar habitats were not recorded;
- Air-borne Noise – One week of continuous noise monitoring was carried out from 25th August 2020 to 1st September 2020 on Site. Noise levels from 7am – 7pm were generally within NEA’s maximum permissible noise levels for construction work, with slight exceedances mainly due to road traffic noise;
- Air Quality – Secondary data was obtained from the Department of Statistics Singapore and used as the baseline data. The data shows that the Annual Mean and 99th percentile 24-hour Mean for PM₁₀ and PM_{2.5} is above the 2020 Target Value while the Maximum 24-hour Mean for Sulphur Dioxide and Maximum 8-hour Mean for Ozone are above the 2020 Target Value.

Environmental Impact Assessment

Sections 5 to 9 detail the methodology used for impact identification and assessment, the potential environmental impact predicted for the Project, and the likely residual impacts after the implementation of mitigation measures. There are likely to be potential impacts on biodiversity, soil erosion, water quality, noise, air quality, and waste throughout the project period of construction. The impacts are identified, assessed, and summarised below:

Table S1: Summary of Environmental Impact Assessment

Environmental Aspect	Environmental Impact	Prediction of Impact Significance	Residual Impact after Mitigation Measures
Air	Air quality impact during construction	Negligible	Negligible
	Air Quality impact during demolition works	Negligible	Negligible
	Air quality impact during road operation	Negligible	Negligible
Noise	Increase ambient noise level during construction and demolition	Minor	Negligible
	Increase ambient noise level during operation	Negligible	Negligible
Soil	Soil erosion during construction and demolition works	Minor	Negligible
Water Quality	Water quality impact during construction	Minor	Negligible
	Water quality impact during demolition works	Minor	Negligible
Biodiversity – Flora	Habitat and Trees Loss	Minor	Minor
	Change in Water Quality and Supply	Negligible	Negligible
	Change in Slope Stability and Soil Compaction	Negligible	Negligible
Biodiversity - Fauna	Habitat Clearance	Negligible	Negligible
	Noise Impacts to Fauna	Minor	Negligible
	Human-wildlife Conflict	Minor	Negligible
	Roadkill	Negligible	Negligible
Waste	Waste generation during construction and demolition works	Negligible	Negligible

Mitigation Measures and Environmental Monitoring and Management Plan (EMMP)

Proposed mitigation measures have been prepared for each potential environmental impact in order to minimize impact levels during construction and operation. An EMMP has also been developed to be implemented during the course of Project construction and operation in order to ensure that residual impacts are minimised, as well as to justify the effectiveness of the mitigation measures and prepare/ implement contingency plans as needed. The EMMP is described in detail in Section 8.

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1 INTRODUCTION

1.1 Overview

EnviroSolutions & Consulting Pte Ltd (ESC) has been appointed by the Building and Construction Authority (BCA) to prepare the Environmental Impact Study (EIS) for the Proposed Road Widening and Sewer Works along Lorong Lada Hitam (hereinafter referred as the “Project”) within Mandai area, abutting the Central Catchment Nature Reserve (hereinafter referred as the “Site/Project Area”).

The purpose of the EIS is to provide information on the baseline biodiversity, air quality and noise conditions at the Site, assess the nature and extent of environmental impact arising from the construction and operation of the Project and related activities that take place concurrently, recommend mitigating measures to minimise the adverse environmental impacts due to the Project, as well as provide a proposed environmental monitoring and management plan (EMMP) to be implemented during the course of construction and operation of the Project. The EIS is to be conducted in the least environmentally intrusive manner and the information obtained will contribute to the decision-making on:

- Any environmental impacts that are likely to arise as a result of the Project; and
- The conditions, requirements and recommended measures for the construction and operation of the Project to mitigate adverse environmental consequences, or opportunities to improve on existing conditions.

1.2 Project Background

The Study Area for this EIS is located in the Mandai area along Lorong Lada Hitam. It comprises approximately 1.45 ha of secondary forest that is surrounded by Lorong Lada Hitam to the north and east, Mandai Road to the south and a continuous forest patch to the west, as demarcated in red in Figure 1. The Site has been zoned as “Open Space” in the URA Master Plan 2019 (see Figure 2).



Figure 1: EIS Study Area boundary along Lorong Lada Hitam



Figure 2: URA Land Use Plan (URA Master Plan 2019)

1.3 Scope of Works

The scope of the EIS for this Project includes the following:

- a) Identification of all potential receptors within the Project site and in the vicinity of the Project site, including the ecosystem of all nearby streams and water bodies;
- b) Establishment of a baseline study to collate and confirm the existing environmental conditions including identifying nearby biodiversity receptors;
- c) Identification of the potential impacts and recommendation on corresponding mitigation measures and environmental monitoring and management strategies to reduce the impacts;
- d) Recommendations on contingency plans in the event that mitigating measures are ineffective;
- e) Preparation of the written scope, specifications and drawings of the recommended mitigation measures and environmental monitoring and management strategies for the proposed construction and operation of the Project;
- f) Development of an environmental monitoring and management plan during both the construction and post-construction operational stage;
- g) Preparation and submission of EIS report for review and acceptance by the agencies such as BCA, NParks, URA, PUB, NEA, and other relevant agencies;
- h) Attendance of meetings and briefing the relevant agencies such as BCA, NParks, URA, PUB, NEA, etc. including the Authority and Authority's Representative on the progress and results of the EIS;
- i) Preparation of slides and presentation to the relevant agencies such as BCA, NParks, URA, PUB, NEA, etc. including the Authority and Authority's Representative on the progress and results of the EIS;
- j) Coordination and interfacing with the relevant agencies such as BCA, NParks, URA, PUB, NEA, etc. including the Authority and Authority's Representative;
- k) Liaison with the relevant agencies and following up on additional works required for obtaining the approval/clearance from the relevant agencies for the EIS. The Consultant shall consult and comply with all the requirements imposed by the relevant agencies and seek their approvals;

- l) Obtaining all the necessary requirements from the agencies such as BCA, NParks, URA, PUB, NEA, and other relevant agencies for the EIS;
- m) Submission of all the necessary reports, drawings, photos and related documents for the EIS; and
- n) Working responsively and cooperatively with the Authority, Authority's Representative and all the relevant agencies.

1.4 Limitations

This EIS was awarded in March 2021 and is based on site observations, baseline monitoring results and conditions which existed at the time of the assessment. The number and locations of monitoring points were primarily based on information provided about the Project. If significant adjustments were later made to the design, this may render the baseline environmental conditions established during this study less reliable.

The impact assessment has been undertaken using the regulations and laws as they stand at the time of the EIS awarding and BCA's scope of works for the EIS agreed with the agencies. Should the assessment criteria and/ or the legislation change thereafter, the conclusions and recommendations may require further consideration before the Project enters the construction and operation phases.

2 PROJECT DESCRIPTION

2.1 Site Location

The 1.45 ha site of the EIS study area (the Site) is located in the north of Singapore in the Mandai area along Lorong Lada Hitam. The Site is located on a hilly slope, with the highest elevation in the north closest to Lorong Lada Hitam which then slopes south towards Mandai Road. It lies within the Central Catchment Nature Reserve (CCNR) boundary but is separated from the main tract of the CCNR by Mandai Road. CCNR occupies over 2000 hectares and is Singapore's largest remaining nature reserve, which is highly sensitive from an ecological perspective and highly valued by the general population and nature groups of Singapore. The main tract of CCNR forests lies to the south of the project site across Mandai Road, which is the water catchment for the country's main reservoirs (MacRitchie, Upper Seletar, Upper Peirce and Lower Peirce Reservoirs); it harbours mature secondary rainforest, with a few large primary forest patches of conservation significance, characterized by mature Keruing, Meranti, and Jelutong trees. It has one of the richest biodiversity in Singapore and supports an array of wildlife including Critically Endangered species like the Raffles Banded Langur, Sunda Pangolin, Sunda Slow Loris, and Lesser Mousedeer. Similarly, CCNR provides shelter and food to many bird species including migrants and forest-dependent residents.

Separated from the main patch of the CCNR by Mandai Road, the Site is occupied by dense vegetation, dominated by large Albizia and rubber trees. While the Site can be expected to be less biodiverse than the main areas of CCNR due to the separation from the main forest tract and its relatively small size, it may still harbour species of conservation significance given its proximity to the main tract of CCNR forests. To the south of the Site, and across Mandai Road, lies the Upper Seletar Reservoir (approximately 190m away), Mandai Crematorium and Nee Soon Camp. To the north, the site is bordered by Mandai Depot, Mandai Restricted Area and Sembawang Air Base. Figure 3 below presents the key topography, nearby receptors, and the elevation profile of the Site.

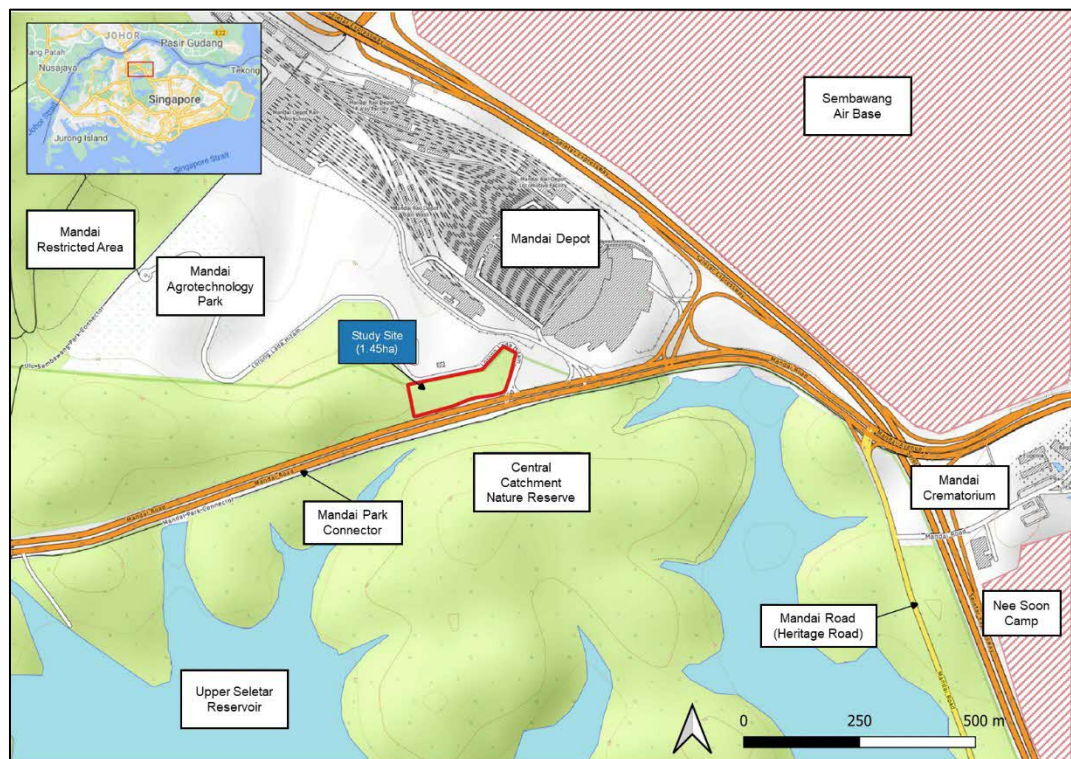


Figure 3: EIS Study Area Location (The Site) and its Surroundings

Existing land use within a 200m influence zone¹ likely to be impacted by the Project are mainly existing transport facilities, nature reserve and waterbodies as shown in Figure 4.

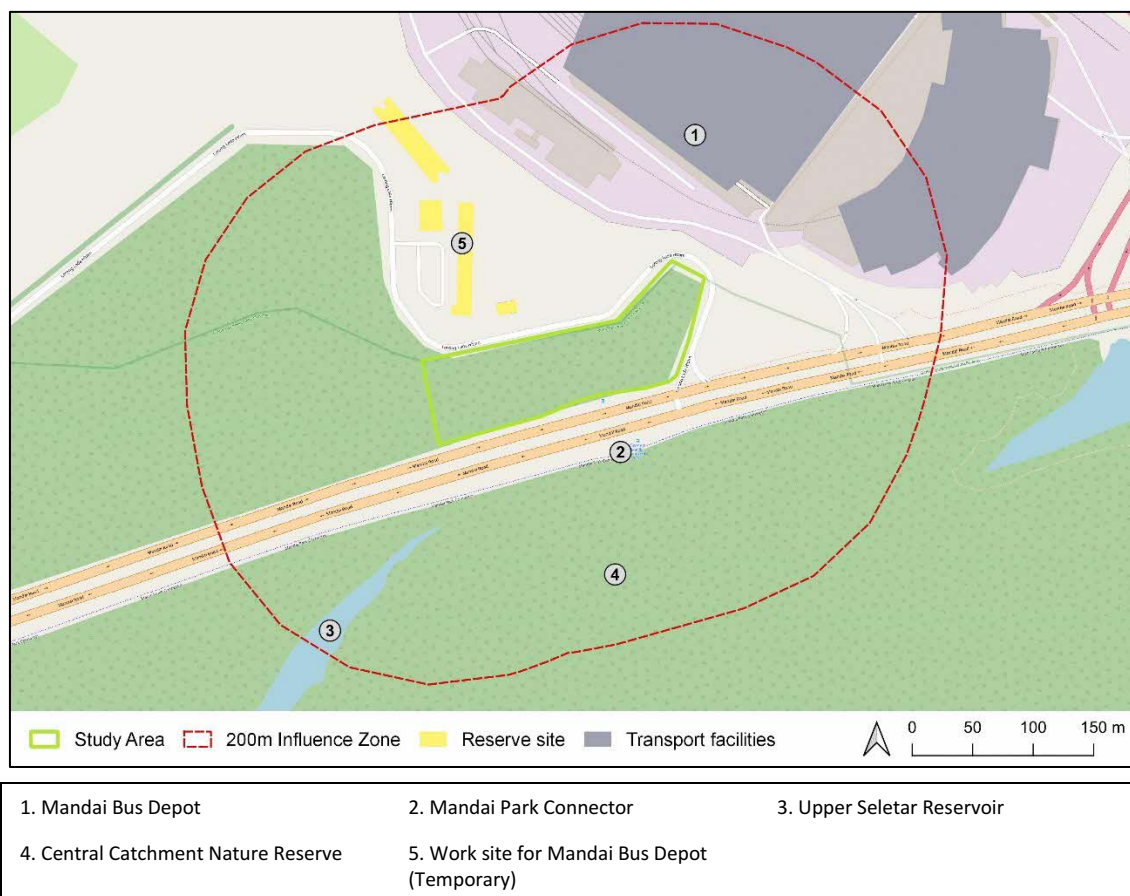


Figure 4: Land Uses identified within 200m Potential Influence Zone of the EIS Study Area (the Site)

¹ Buffer distance identified for the Project's area of influence is based on the International Finance Corporation's Guidance Notes: Assessment and Management of Environmental and Social Risks and Impacts (2012)

2.2 Project Description

This Project involves expunging part of Lorong Lada Hitam and widening it from its current dual one-lane carriage way to a dual two-lane carriage way as shown in Figure 5 below. The proposed work is in the vicinity of the Site. The general construction activities associated with the expunging of a vegetated land and road widening works include, but are not limited, to the following:

- Vegetation clearance;
- Excavation/earthworks;
- Access road construction;
- Asphalt works;
- Construction of kerb, drainage, traffic lights, cables/utilities, streetlights, and other features of a road; and
- Construction of sewer and associated manholes.

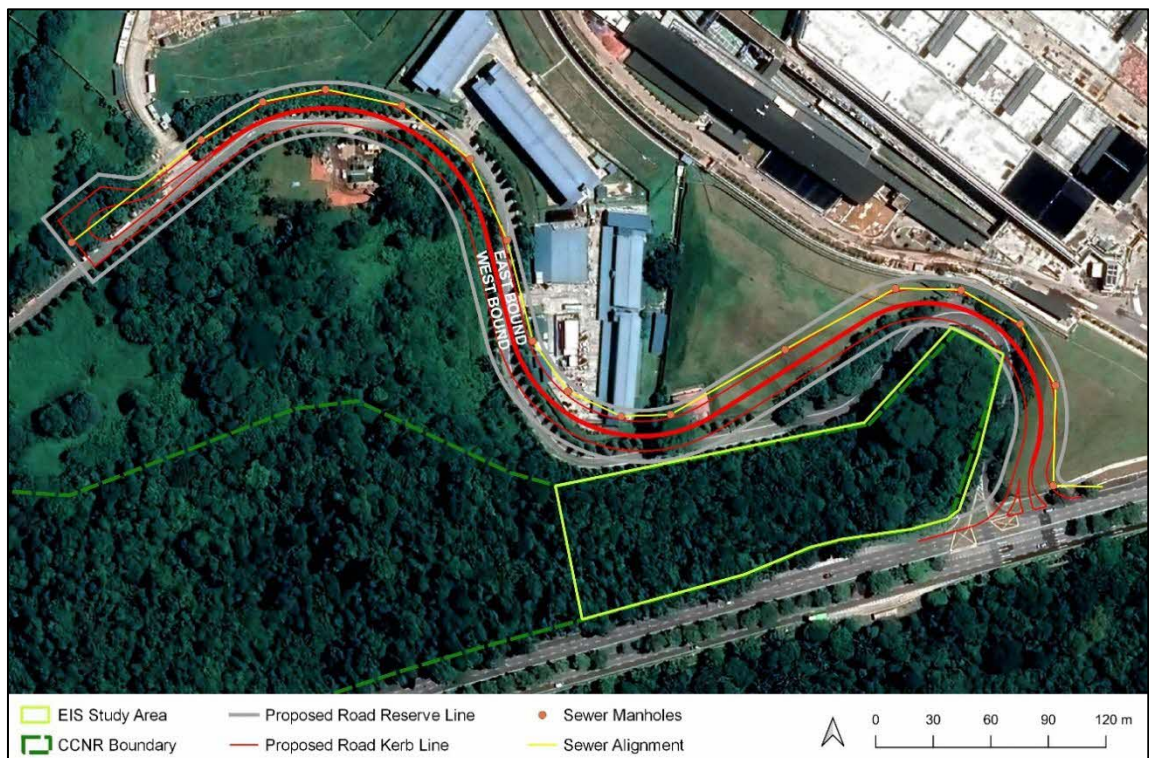


Figure 5: Proposed Road Layout of the Project

Minor tree felling and vegetation clearance will be required in preparation for Project's works within the Project's working area, which primarily consists of the new Proposed Road Reserve Line as well as the existing road reserve line (Figure 6). Majority of the nature reserve area within the Site will be left untouched, with the exception of a 1.5m² working area within CCNR for the construction of the new sump. It is also expected that the proposed Road Reserve Line will encroach slightly into the Site at the north-eastern corner, potentially causing a small loss in habitat of about 18m² outside of the nature reserve area. Note that the proposed Road Reserve Line and Sewer alignments have been modified multiple times to minimize encroachment into the Site and the Nature Reserve, as well as to avoid any cutting and filling of slopes which may risk slope failure and other related impacts.

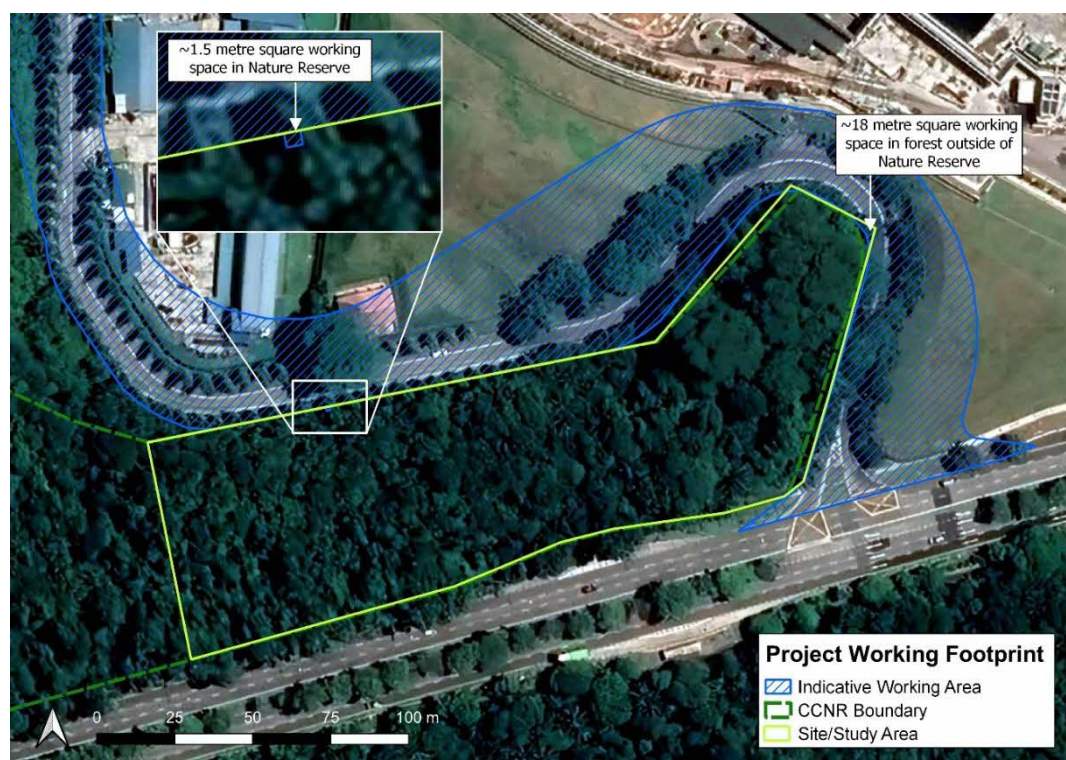


Figure 6: Indicative Working Areas for the Project

Construction Activities

The Project involves vegetation clearance, demolition, and earthworks to achieve the platform levels required for construction of sewers, drains and roads. The road materials will be based on LTA standard type 2 pavement structures which includes asphaltic wearing course, asphaltic base course, graded granite aggregate base course, sub-base material, and subgrade material.

The working and storage areas for the project, inclusive of hoarding installation, will be mostly contained within the existing and proposed road reserve line, outside of CCNR. Only a 1.5m² working area (1.2m x 1.2m) within the CCNR will be required for the construction of the new sump. The existing roads, drains and lamp posts will be demolished and replaced or reinstated where applicable. To minimize excavation and demolition works near CCNR, the existing drain abutting the site and CCNR will be partially demolished; only the top section will be manually demolished, after which it will be backfilled with earth. The proposed sewer will be constructed at a depth of 12 to 20.5m below the proposed road reserve using pipejacking to reduce excavation works and potential environmental impacts.

Table 1 Table 1 describes the activities during the construction stages and the typical equipment used for each activity.

Table 1: Construction activities and typical equipment to be used

Construction Stage	Description of Activity	Equipment
Site Clearance	Vegetation clearance within proposed road reserve line and installation of hoardings Installation of ECM Installation of temporary shoring (phase 2)	Excavators, dump trucks, generators, concrete trucks, compactor, rollers, and bulldozers
	Felling of trees and levelling of ground	Excavators, dump trucks, generators, concrete trucks, compactor, and rollers
	Setting up of site office	Excavators, dump trucks, generators, concrete trucks, compactor, and rollers
Demolition	Demolition of existing road, lampposts, and drains (on opposite side of the Site)	Excavators, dump trucks, generators, concrete crushers, bulldozers
	Partial demolition of existing drains along the Site and nature reserve	Jackhammers
Earthworks	Excavation of existing ground profile Slope cutting Slope cutting with close turving Retaining wall construction Backfilling of proposed slope and proposed road level with earth	Excavators, dump truck, generators, cranes, semi-trailer, compactor
Construction of roads, sewers, and drains	Partial demolition of existing drain (top-section) and removal of existing lampposts Backfilling of existing drains with earth Pavement construction Laying of sewers using pipejacking Laying of drainage along newly constructed roads UPVC Scupper pipe installation Construction of foot path cum drain and new road level (phase 2)	Trucks, compactor and rollers, generators, cranes, compactor, tunnel boring machine, concrete trucks, semi-trailer, excavators, dump truck, mill, and patch machines
Concreting	In-situ concreting, and waterproofing works	Generators, cranes, concrete trucks, concrete pumps, semi-trailer
Reinstatement	Surface reinstatement	Cranes, trucks, excavators, lorries, pavers, compactor, and rollers

Construction Schedule

At the time of writing, the detailed construction schedule is unavailable, but the works are expected to be completed in 18 months. Construction of the Project is tentatively planned as follows:

- Site clearance and earthworks in preparation for the proposed road widening works – 6 months; and
- Proposed road widening and construction of sewers and drains will be carried out in 12 months.

Construction Sequence

During the construction period, Lorong Lada Hitam will be closed and the proposed construction works will be conducted in the following sequence:

- Installation of hoardings;
- Installation of temporary shoring and earth retaining structures;
- Installation of Earth Control Measures (ECM);

- Excavation of existing ground profile;
- Partial demolition of existing drain and existing lamppost removal;
- Slope cutting;
- Backfilling of existing drain with earth;
- Filling of proposed road level with earth;
- Construction of new roads;
- Construction of pavement;
- Installation of 250mm UPVC Scupper Pipe;
- Slope cutting with close turfing; and
- Construction of foot path and drain.
- Construction of sewers and manholes;
- Removal of hoardings.

Detailed Drawings

The proposed construction layout plan is shown in Figure 7 below. Cross-sectional drawings for the areas in close vicinity to CCNR, CH 620 and CH 420 (locations indicated in Figure 7), are also provided in Figure 8 and Figure 9 respectively.

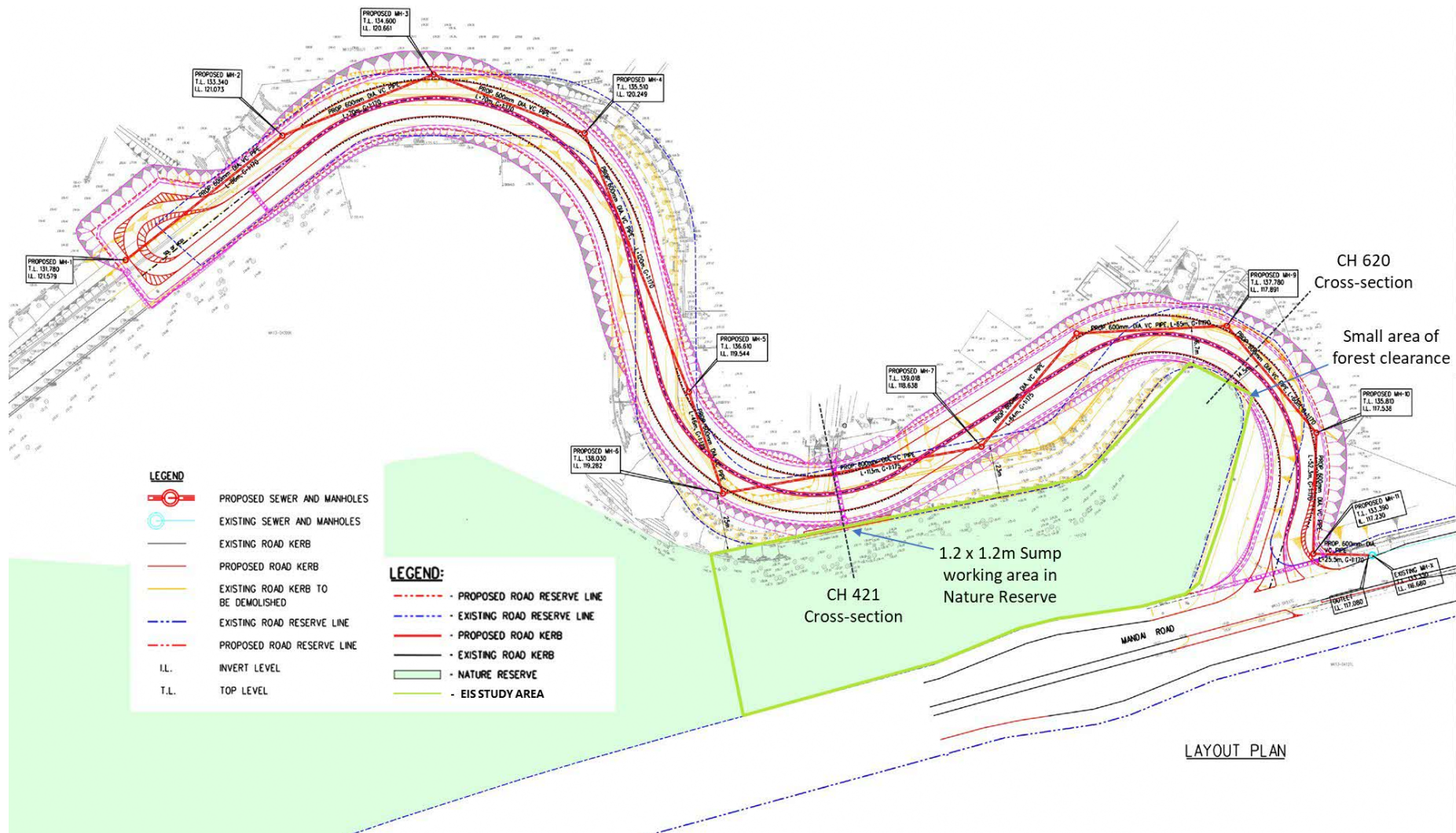


Figure 7: Site Layout Plan (Source: BCA, 2022)

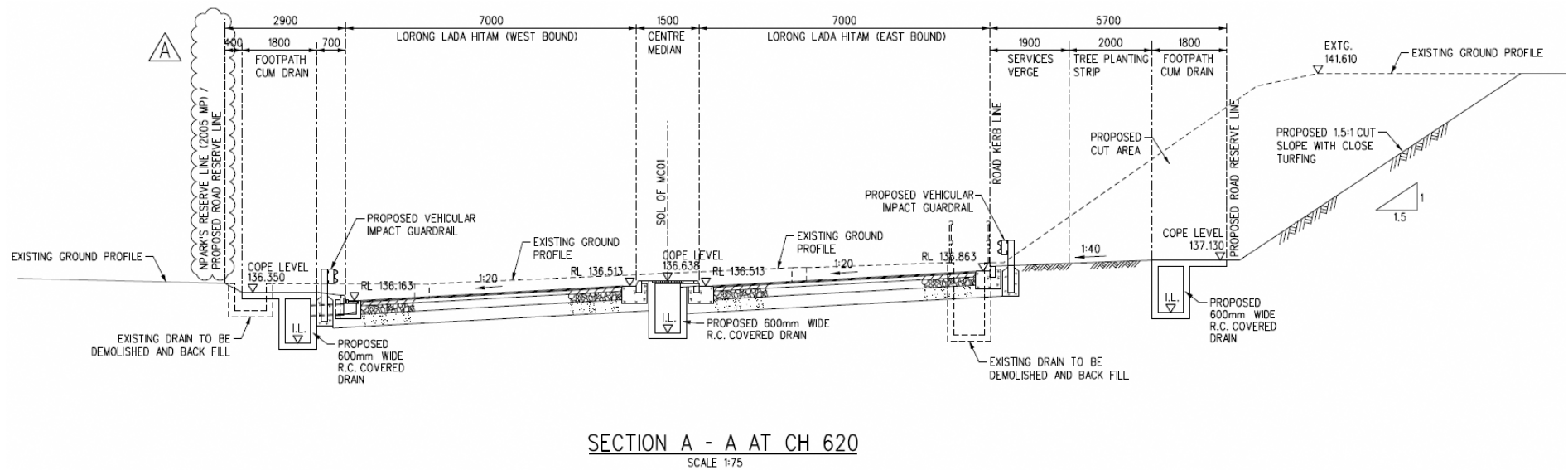


Figure 8: Proposed Construction cross-section for CH 620 (Source: BCA, 2022)



3 ENVIRONMENTAL LEGISLATIONS, POLICIES, PLANS, STANDARDS AND CRITERIA

The purpose of this section is to describe the relevant legislations and standards, to ensure that the Project will be in compliance with relevant authorities' standards and practices.

Two general categories of Acts and Regulations are relevant. Firstly, the regulation of wastes and emissions from industries, hospitals, households, and vehicles (pollution control laws). Secondly, those that deal with the protection of natural areas and wildlife (nature conservation laws). The sections below provide details of the Acts and Regulations that protect and control impacts on the environment relevant to this EIS.

3.1 Biodiversity

There are two primary Acts relating to biodiversity in Singapore, namely the Parks and Trees Act (2006) and the Wildlife Act (2020).

3.1.1 Flora

The Parks and Trees Act is an Act under National Parks Board's (NParks) purview, to protect biodiversity, habitats, and planting, maintenance and conservation of trees and plants within national parks, nature reserves, tree conservation areas, heritage road green buffers and other specified areas.

Applicable aspects of the Parks and Trees Act are provisions:

- Relating to the removal of trees on vacant land that are greater than 1 m in girth. In these instances, special permission may be required from the NParks commissioner of parks and recreation; and
- Relating to restricted activities carried out in nature reserves.

3.1.2 Fauna

Wildlife Act prohibits the unlicensed killing, harming, feeding, releasing, or trapping and removal of any wild animals and birds in Singapore, governed by the National Parks Board of Singapore (NParks). The Director General of NParks has the power to issue directions to developers on wildlife-related measures. The wild animals and birds are referring to all species of animals and birds of a wild nature, but does not include domestic dogs and cats, horses, cattle, sheep, domestic pigs, poultry, and ducks. The Wildlife Act mainly addresses the protection of wild animals within and outside of protected areas.

3.2 Ambient Air Quality

The Pollution Control Department (PCD) of the National Environment of Singapore is responsible for the prevention and control of air pollution in Singapore. Pursuant to the Environmental Protection & Management Act 2008, the Minister for the Environment has appointed a "Director-General of Environmental Protection" to assist in the implementation and administration of the Act and its regulations.

Together with the Environmental Protection & Management (Prohibition on the Use of Open Fires) Order 2008, Environmental Protection & Management (Vehicular Emissions) Regulations 2008 and the Environmental Protection & Management (Air Impurities) Regulations 2008, it regulates the emission of air pollutants from industrial or trade premises.

Ambient Air Quality

In 2012, Singapore adopted the Ambient Air Quality Targets (on ozone, nitrogen dioxide, sulphur dioxide, particulate matter, and carbon monoxide (CO) based on the World Health Organization's (WHO) Air Quality Guidelines for the prevention of public health impacts by air pollution. These ambient air quality targets are set to be achieved by the end of 2020.

National Environment Agency (NEA) makes reference to the World Health Organisation Air Quality Guidelines (WHO AQGs) for reporting Singapore's ambient air quality status. The targets are shown in Table 2.

Table 2: Singapore Ambient Air Quality Targets

Pollutant	Singapore Targets by 2020	Long Term Targets
Sulphur Dioxide (SO ₂)	24-hour mean: 50µg/m ³ (WHO Interim Target) Annual mean: 15 µg/m ³ (Sustainable Singapore Blueprint target)	24-hour mean: 20µg/m ³ (WHO Final)
Particulate Matter (PM _{2.5})	Annual mean: 12µg/m ³ (Sustainable Singapore Blueprint target) 24-hour mean: 37.5µg/m ³ (WHO Interim Target)	Annual mean: 10µg/m ³ 24-hour mean: 25µg/m ³ (WHO Final)
Particulate Matter (PM ₁₀)	Annual mean: 20 µg/m ³ 24-hour mean: 50 µg/m ³ (WHO Final)	
Ozone	8-hour mean: 100µg/m ³ (WHO Final)	
Nitrogen Dioxide (NO ₂)	Annual mean: 40µg/m ³ 1-hour mean: 200µg/m ³ (WHO Final)	
Carbon Monoxide (CO)	8-hour mean: 10mg/m ³ 1-hour mean: 30mg/m ³ (WHO Final)	

Provisions made in the Environmental Protection and Management Act include the requirement that occupiers of industrial or trade premises install and maintain air pollution control equipment and ensure that air impurities emitted from their premises are not in excess of existing standards. Table A1 in Appendix A details the allowable standards of air impurities within the SS 593:2013 Code of Practice for Pollution Control with amendments in November 2014.

Vehicular Emissions

NEA sets minimum exhaust emission standards for all vehicles under the Environmental Protection and Management (Vehicular Emissions) Regulations (see Table 3 below). All motor vehicles to be registered in Singapore must comply with the specified exhaust emission standards based on different classes of vehicle. New petrol vehicles will have to meet the stricter Euro VI emission standards from year 2017.

Table 3: Exhaust Emission Standards for Motor Vehicles

Class of Vehicle	Exhaust Emission Standards
Petrol driven motor vehicles	(i) EC Directive 98/69/EC-B (2005); or (ii) Paragraphs 102 and 121 of Article 28 of the Japanese Ministry of Land, Infrastructure and Transport Announcement No. 1318 dated 26th September 2003.
Diesel driven motor vehicles	
(a) Passenger car	(i) Regulation (EC) No. 715/2007, Table 1, Annex 1; or (ii) JPN2009.
(b) Motor vehicle (other than a passenger car) with gross vehicle weight not exceeding 3.5 tons	(i) Regulation (EC) No. 715/2007, Table 1, Annex 1; or (ii) JPN2009.
(c) Motor vehicle (other than a passenger car) with gross vehicle weight exceeding 3.5 tons	(i) EC Directive 2005/55/EC-B2 (2008); or (ii) JPN2009.
Motorcycles and scooters	
Motorcycles and scooters (registered before 1 October 2014)	Directive 97/24/EC
Two-wheeled	Row B of the table referred to in paragraph 2.2.1.1.5 of Annex II of Chapter 5 of Directive 97/24/EC of the European Parliament and of the Council of the European Union, as amended by Directive 2002/51/EC of the European Parliament and of the Council of the European Union of 19 July 2002.
Three-wheeled	Row A of the table referred to in paragraph 2.2.1.1.5 of Annex II of Chapter 5 of Directive 97/24/EC of the European Parliament and of the Council of the European Union, as amended by Directive 2002/51/EC of the European Parliament and of the Council of the European Union of 19 July 2002.

(Source: Environmental Protection and Management (Off-Road Diesel Engine Emissions) Regulations 2012)

Off-Road Diesel Engines

With effect from 1 July 2012, all off-road diesel engines imported into Singapore must comply with the EU Stage II, US Tier II or Japan Tier I off-road diesel engine emission standards, according to Environmental Protection and Management (Off-Road Diesel Engine Emissions) Regulations 2012. These standards specify exhaust emission limits for carbon monoxide, hydrocarbons, oxides of nitrogen, particulate matter, and smoke opacity of exhaust fumes (see Table 4 below). Off-road diesel engines include construction equipment such as cranes, excavators, forklifts, and power generators.

Table 4: Emission Standards from Off-Road Diesel Engine

Net Power (P) (kW)	Singapore (Mandatory Standard)
P > 560	US Tier II
130 < P < 560	US Tier II or EU Stage II or Japan Tier I
75 < P < 130	US Tier II or EU Stage II or Japan Tier I
37 < P < 75	US Tier II or EU Stage II or Japan Tier I
19 < P < 37	US Tier II or EU Stage II or Japan Tier I
P < 19	US Tier II or Japan Tier I

(Source: Environmental Protection and Management (Off-Road Diesel Engine Emissions) Regulations 2012)

3.3 Air-borne Noise

In Singapore, National Environmental Agency regulates noise levels from construction sites using a set of permissible noise limits.

3.3.1 Environmental Protection and Management Act (Control of Noise at Construction Sites) (Amendment) Regulations 2011

Operating under the Environmental Protection Management Act, the Environmental Pollution Control (control of Noise at Construction Sites) (Amendment) Regulations which was introduced in 1999 and revised to Environmental Protection And Management (Control Of Noise At Construction Sites) Regulations in 2008, with amendment in 2011 (hereafter referred to as the Construction Noise Regulation), sets acceptable noise limits from construction activity with in Singapore, including corrections based on ambient background noise levels.

The Pollution Control Department of the NEA is responsible for the regulation and prevention of noise pollution from construction sites in Singapore. The agreed noise assessment criteria are based on the Singapore Construction Noise Regulations as provided in Table 5 below.

Table 5: Singapore Construction Noise Regulations Assessment Criteria

Type of Affected Building	Worksite Operational Hours		
	Day (0700-1900)	Evening (1900-2200)	Night (2200-0700)
Hospital, School, University, Aged Care Facility	60 dB $L_{Aeq,12hr}$	50 dB $L_{Aeq,12hr}$	
	75 dB $L_{Aeq,5min}$	55 dB $L_{Aeq,5min}$	
Residential (within 150 m of construction site) (i) on Mondays to Saturdays (ii) on Sundays and public holidays	75 dB $L_{Aeq,12hr}$	65 dB $L_{Aeq,1hr}$	55 dB $L_{Aeq,1hr}$
	90 dB $L_{Aeq,5min}$	70 dB $L_{Aeq,5min}$	55 dB $L_{Aeq,5min}$
	75dB $L_{Aeq,5min}$	55dB $L_{Aeq,5min}$	55dB $L_{Aeq,5min}$
All other buildings	75 dB $L_{Aeq,12hr}$	65 dB $L_{Aeq,12hr}$	
	90 dB $L_{Aeq,5min}$	70 dB $L_{Aeq,5min}$	

In addition to the setting of the permissible noise limits, NEA has also implemented a rule prohibiting work on Sundays and Public Holidays (PH) for construction sites located within 150m from residential premises and noise sensitive premises as follows:

- Construction Work Commenced on or after 1st September 2011: No work allowed from 10.00pm on Saturday/eve of Public Holiday to 7.00am on the following Monday/day after the Public Holiday.

3.4 Water Quality

Pollution Control Department (PCD) of the Ministry of Sustainability and the Environment is responsible for the regulation of liquid effluent in Singapore. The main legislative instruments governing water pollution are:

- Environmental Protection and Management Act (Part V – Water Pollution Control) 2008;
- Environmental Protection and Management (Trade Effluent) Regulations 2008;
- Sewerage and Drainage Act 2001; and
- Sewerage and Drainage (Surface Water Drainage) Regulations 2007.

The Director-General of Environmental Protection (of the PCD) is responsible for the implementation and administration of these statutory requirements. The provisions given under each of these Acts or Regulations are described below.

3.4.1 Environmental Protection and Management Act (Part V – Water Pollution Control) 2008

The Environmental Protection & Management Act (Part V Water Pollution Control) includes the following measures to protect waterbodies from pollution:

- Penalties for the discharge of toxic or hazardous substances into inland waters (e.g. river, stream, lake or reservoir, whether natural or artificial);
- Requirements for Director-General's approval for the discharge and treatment of trade effluent, oil, chemical, sewage or other polluting matters; and
- Measures to be undertaken to prevent water pollution due to storage or transportation of toxic substances or any polluting matters.

The Act also provides the Director-General with the power to instruct industrial operations by notice in writing, regarding the removal and cleaning up of polluting matters.

3.4.2 Environmental Protection and Management (Trade Effluent) Regulations 2008

The Environmental Protection and Management (Trade Effluent) Regulations 2008 help to govern Singapore's wastewater management system; these regulations establish regulatory control over industrial and other activities that may have adverse impacts on water quality.

These regulations provide details on trade effluent quality standards for discharge of wastewater into watercourses or to land but does not cover the discharge of trade effluent into the public sewer system. Under these regulations, no trade effluent can be discharged into watercourses or land without obtaining prior permission from Ministry of Sustainability and the Environment. Trade Effluent standards and permitting requirements are stipulated in the regulations and all wastewater must be treated to the stipulated standards prior to discharge, with standards being applied depending on the watercourse being discharged into. Controlled watercourses have particularly stringent standards, as these are located within certain (unprotected) water catchment areas.

3.4.3 Sewerage and Drainage Act 2001 & Sewerage and Drainage (Surface Water Drainage) Regulations 2007

The Sewerage and Drainage Act (Cap. 294) is administered and enforced by Public Utility Board (PUB). The Act governs the construction, maintenance, improvement, operation and usage of the sewerage and drainage systems as well as discharge of trade effluent into the system. Under the Act, PUB is authorized to construct and maintain the storm water drainage system, and any alteration and construction of the drainage system shall require PUB's approval.

The Sewerage and Drainage (Surface Water Drainage) Regulations describe the Code of Practice (COP) on surface water discharge into storm water drainage system as well as the minimum engineering requirement for design and construction of the system. The regulations also specify:

- The maximum discharge limit for Total Suspended Solids (TSS) as 50 milligrams per litre (mg/L) of the discharge; and
- Requires every contractor to comply with the COP on Surface Water Drainage.

3.5 Soil and Groundwater Quality

The guidelines for soil and groundwater quality remediation work are referenced from the Code of Practice for Pollution Control and JTC owned land. The JTC EBS guidelines present assessment standards for chemical compounds which have been adopted from the Environmental Quality Objectives set by the Netherlands Ministry of Housing (2000) and from the Soil Remediation Circular (2009), referred to in this report as the Dutch guidelines.

The JTC EBS guidelines present assessment standards for chemical compounds which have been adopted from the Environmental Quality Objectives set by the Netherlands Ministry of Housing (2000) and from the Soil Remediation Circular (2009), referred to in this report as the Dutch guidelines.

The Dutch guidelines are used in the Netherlands as enforceable standards whereby contaminants are subdivided into two categories, Target and Intervention ("T" and "I"), dependent upon the contaminant concentrations, and classified as follows:

- "T" values are considered to mark the boundary between contaminated and uncontaminated soils and waters
- "I" values define sites where some form of intervention would be required.

These standards indicate that if the contaminant concentration is below the Target value, the soil is regarded as unpolluted. If the concentration is above the Intervention value, removal or clean-up is usually required. If the concentration level lies between the Target and Intervention values, further investigation of the site may be required to resolve uncertainties with respect to possible pollution and associated risks.

Although not enforceable in Singapore, the Dutch guideline values can be used for comparison purposes to evaluate level of impact. The Dutch guidelines specified are internationally recognised and scientifically proven and are commonly used outside of the Netherlands. An Intervention level comprises the maximum permissible level, which, if exceeded, requires attention to prevent potential risk to human health and the environment.

It should also be noted that the Dutch Guidelines were developed for a very specific case in the Netherlands; that is, a country where 100% of the drinking water supply is sourced from groundwater. As such, the detection limits for many of the contaminants assessed under these standards are very low, especially for groundwater. However, the extent of comparison is somewhat limited for Singapore, where groundwater is not utilised as a drinking water resource.

3.6 Waste Management

3.6.1 Environmental Public Health (EPH) Act 1987

The Environmental Public Health (EPH) Act contains specific provisions relating to industrial waste and its disposal. The Commissioner for Public Health may require the owner or occupier of any workplace to furnish information on the amount, type and nature of any industrial waste found on his premises. The owner or occupier may also be required to treat the industrial waste at his own expense before disposal.

3.6.2 EPH (Toxic Industrial) Waste Regulations 1988

EPH (Toxic Industrial) Waste Regulations specifies wastes which are classified as toxic industrial wastes (TIW) and regulates their handling, transport, and disposal. The Code of Practice on Pollution Control (COPPC) provides recommended control measures for industries and trade premises in handling, transport, and disposal of TIW. Factories are required to install in-house treatment facilities to recycle and reuse their TIW or to treat their TIW for safe disposal. However, factories may apply for clearance from the Pollution Control Department (PCD) to engage licensed TIW collectors to collect their wastes for recycling or treatment for safe disposal.

3.6.3 EPH (General Waste Collection) Regulations 1989

The EPH (General Waste Collection) Regulations govern the collection and disposal of general waste. All waste collectors must be licensed and listed by the NEA. Wastes are classified into three types (bulky wastes, putrefiable waste, sludge) and disposed of differently in particular vehicles, e.g., sludge and latrine wastes from aircraft and portable toilets must be transported in tanker trucks. All wastes must be disposed of only at disposal facilities or incineration plants. The collector must keep proper records including the place and

frequency of collection, place of disposal, type and tonnage of waste collected and disposed of and the vehicle used. Collectors must ensure that the refuse or waste is not dropped, scattered or spilled into any public place.

3.6.4 Code of Practice (COP) for Environmental Control Officers (ECO)

The Code of Practice (COP) for Environmental Control Officers (ECO) stipulates the role of occupiers of construction sites and of the ECO, and their responsibilities pertaining to waste management at construction sites.

3.6.5 Environmental Public Health Act 2002

Under Part VI of EPHA (General Health Requirements for Buildings) and EPH (Employment of Environmental Control Officers) Order, the developer of a construction site shall employ an NEA-registered Environmental Control Officer (ECO) to ensure that the site is kept free from environmental health issues. Depending on the contract sum of the construction site, the Act requires either a full-time or part-time ECO to be employed. In relation to vector control, an ECO is responsible for general supervision of provision in the CVPA, identifying conditions on a construction site favourable for vectors breeding and recommend remedial measures.

4 DESCRIPTION OF THE BASELINE ENVIRONMENT

The purpose of this section is to describe the existing baseline conditions, particularly on biodiversity, noise, and air quality baseline. The baseline will consider the Project area and a 200m influence zone from the Project boundary.

4.1 Land Use History

The study site has been effectively protected since 1900, first as a water catchment reserve, and later as a nature reserve. The vegetation on the site has been allowed to regenerate undisturbed for at least the past 120 years. Its proximity to primary forest has given opportunity for forest species to establish due to the distribution of seeds by wind and fauna activity.

Table 6: Summary of Land Use History

Year	Description
Pre-1900	The site lies immediately adjacent to the Sembawang Forest Reserve established c. 1884 by Nathaniel Cantley ² . Forest reserves were established to encompass good forest containing timber of commercial value. The location of the eastern boundary of the Sembawang forest reserve (Figure 10: 1924 Topographic Map) indicates that the Study site had no valuable timber at the time that the forest reserve was gazetted. We can deduce that the study site had been subjected to gambier and pepper cultivation at some time prior to 1884 and that the site had been cleared of original forest. The 1951 aerial photography (Figure 11) illustrates the stark difference in vegetation between the forest reserve and the study site with primary forest abutting the western extent of the study area. It is also evident from the aerial photography that there had been substantial disturbance towards the western half of the site. This observation is significant in consideration of the floristic content of the site today.
1900-1950	A Municipal Catchment Reserve including the watersheds of the Seletar and Kalang rivers was gazetted c. 1900. The study site being within the Sungai Seletar catchment would have been included within the municipal catchment and any activities on the site would have been stopped at that time. The parts of the Sembawang Forest Reserve that coincided with the Sungai Seletar catchment were also considered to be part of the municipal catchment. Rubber (<i>Hevea brasiliensis</i>) was introduced as a commercial crop c. 1910 and as such the study site would never have been planted with rubber as it had previously been reserved as water catchment. It also is noted that the 1924 topographic map (Figure 10) shows that rubber plantations occurred immediately to the north of the study site, however no rubber is shown within the site. Despite this fact, almost half the site is dominated by rubber trees. It is hypothesised that the rubber trees dominating the western half of the study site had established themselves from adjoining rubber plantations to the north during the early 1900's.
1951-present	The Central Catchment Nature Reserve was gazetted to coincide with the area of the municipal catchment. The land continued to function as a water catchment and in addition the management of the flora and fauna came under the control of the PWD parks and gardens department (later to be moved under the custodianship of the National Parks Board).

² Nathaniel Cantley was the second superintendent of the Singapore Botanic Gardens and first superintendant of the Singapore Forestry Department which he established at the pleasure of the governor. He was responsible for establishing the first 14 forest reserves on Singapore Island including the Sembawang Forest Reserve.

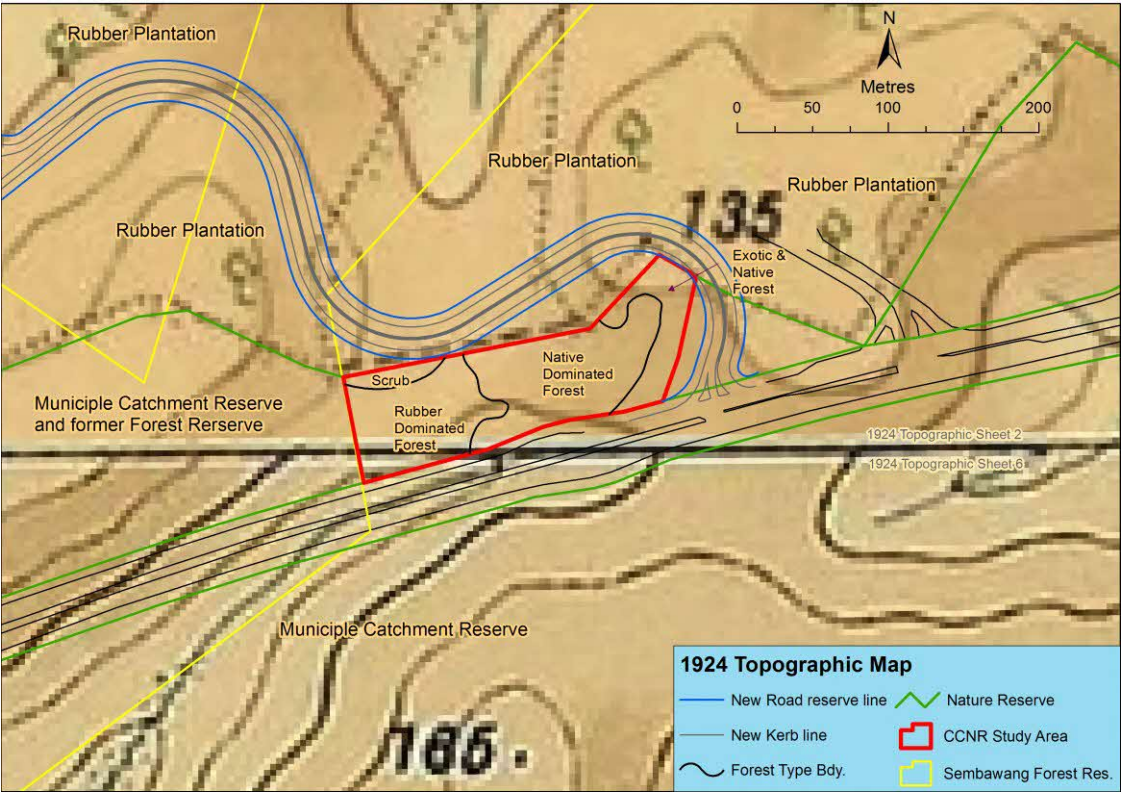


Figure 10: 1924 Topographic Map

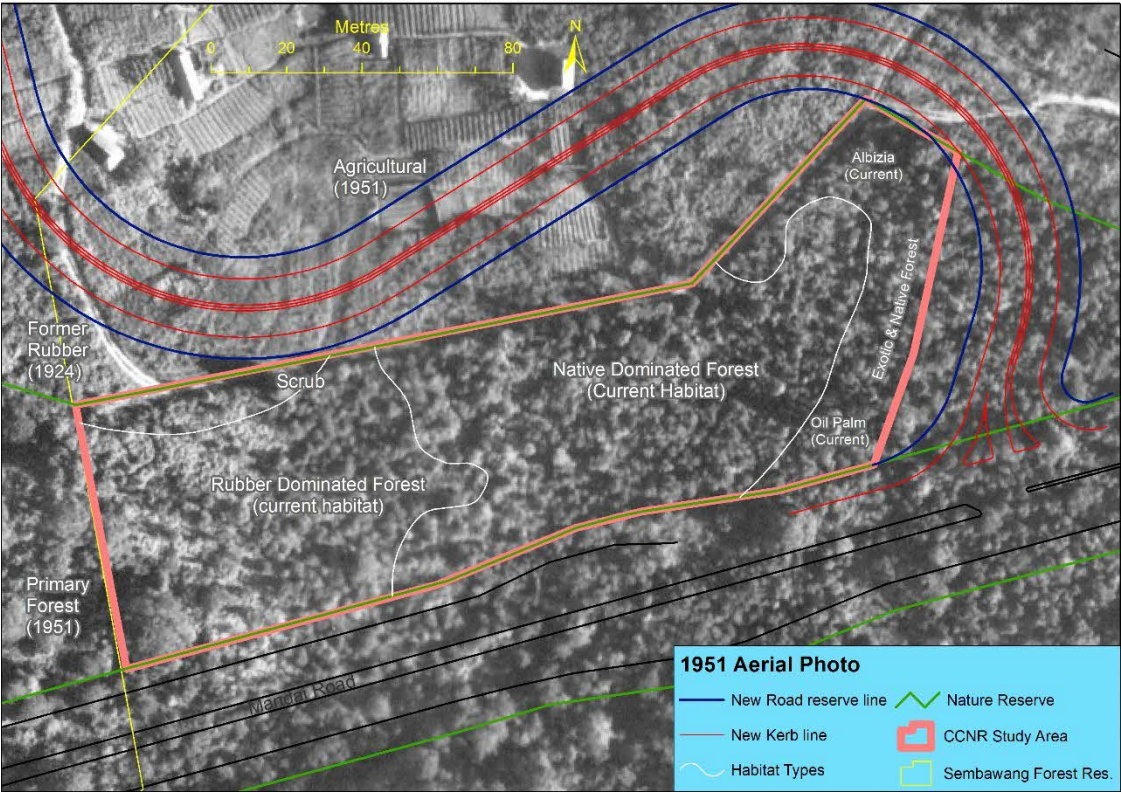


Figure 11: 1951 NAS Aerial Photography

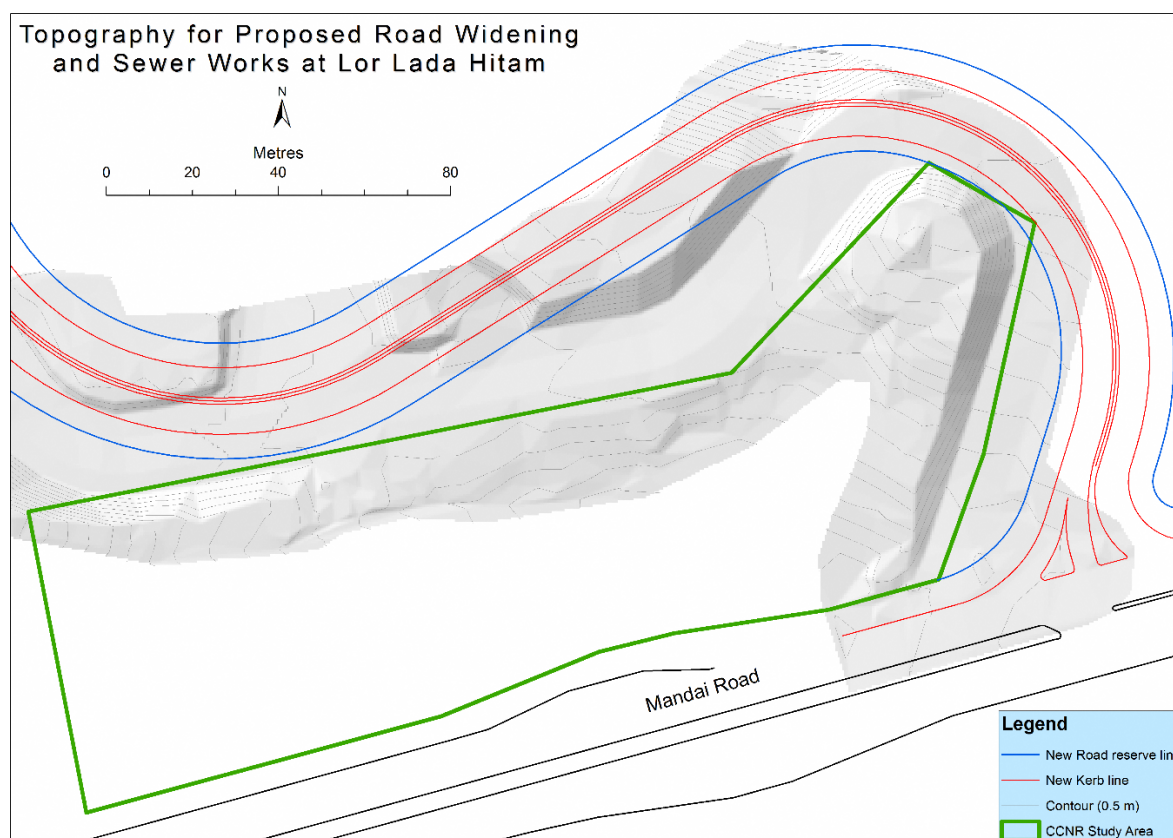


Figure 12: Site Topography Map

4.2 Biodiversity

All species from the flora and fauna surveys were identified. To supplement the plant catalogue present in the Singapore Red Data Book (SRDB), the Checklist of the Total Vascular Plant Flora of Singapore published by Raffles Museum of Biodiversity Research, National University of Singapore (2009) has been used as a secondary source. Each species is first classified as either native, exotic, or a weed of uncertain origin as seen in Table 7 below. Natives are then categorised as either extinct or extant as defined in the Singapore Red Data Book, 2nd Edition (Davison, 2008). The categories of this Checklist for each of the threatened species include additions and corrections to those of Tan et al. (2008). Exotics are categorised as either spontaneous or cultivated only. Casuals and naturalised exotic species are sub-categories of spontaneous exotics. Weeds of uncertain origins has no further sub-categories.

Table 7: Classification system for vascular plant species

Status	Categories & Definitions (adapted from Pyšek et al., 2004)
Native Species that have originated in a given area without human involvement or have arrived there without intentional or unintentional intervention of humans from an area in which they are native.	Extinct Native species classified as globally extinct are species endemic to Singapore and not seen in or collected from the wild in the last 30 years, and those classified as nationally extinct are those non-endemic species which have not been seen in or collected from the wild in the last 30 years.
	Extant Native species classified as critically endangered, endangered, or vulnerable are as defined by Davidson (2008). Species with more than 1000 mature individuals are considered common.
Exotic Species whose presence is the result of either intentional or unintentional human involvement.	Spontaneous Exotic species that survive outside cultivation or without direct human care.
	Causal Exotic species that do not form self-replacing populations and rely on repeated introduction or limited asexual reproduction for persistence.
	Naturalised Exotic species that form self-replacing, usually sexually reproducing populations.

Weed of uncertain origin Species without biogeographic or historical evidence of being non-native but are restricted to only human-modified or human-disturbed habitats.	
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Conservation statuses of animals were based largely on the Singapore Red Data Book (2nd Edition) (2008) by Davison et al. The definitions of each Singapore Red Data Book (SRDB) category can be found in Table 8 below.

Table 8: Singapore Red Data Book (2008) Threatened Categories

SRDB Category	Criteria
Globally Extinct (EX)	The species is extinct in the world over, in the wild or in cultivation.
Nationally Extinct (NE)	The species is extinct in Singapore, but it still survives outside Singapore. A species is presumed nationally extinct if it has not been recorded within the last 30 years for plants, or 50 years for animals.
Critically endangered (CR)	There are fewer than 50 mature individuals, OR more than 50 mature individuals but less than 250, with some evidence of decline or fragmentation.
Endangered (EN)	There are fewer than 250 mature individuals, and no other evidence of decline or fragmentation.
Vulnerable (VU)	There are fewer than 1,000 mature individuals but more than 250 and there may or may not be any other evidence of decline, small range size or fragmentation.
Near Threatened (NT)	Approaching but not yet reaching the threshold for the above criteria.

For odonates, conservation statuses were based off a more recent publication by Ngiam & Cheong (2016) which provides an updated assessment which supersedes those of SRDB (2008). The definitions of each conservation status category for odonates by Ngiam & Cheong (2016) are shown in Table 9 below.

Table 9: Definitions for conservation statuses of threatened odonata by Ngiam & Cheong (2016)

Conservation Status	Criteria
Nationally Extinct (NE)	A species is presumed nationally extinct if it has not been recorded within the last 50 years.
Critically endangered (CR)	Found in 1 location only.
Endangered (EN)	Found in 2 to 3 locations.
Vulnerable (VU)	Found in four to five locations.
Near Threatened (NT)	Found in more than five locations but habitat type/locations are at risk, or very sporadic records of few individuals.

Note: Locations in these criteria refer to 6 forest patches that have been delineated in Ngiam & Cheong (2016).

4.2.1 Methodologies

4.2.1.1 Terrestrial flora survey

A tree inventory survey was carried out. All living trees with a trunk girth (circumference) of more than 30cm were mapped and identified with a tree series number, detailing its species, girth, and height. In addition, significant seedlings/saplings, shrubs, climbers, and epiphytes were noted during the course of the flora survey.

The specific method employed was as follows:

- Trees with a girth at or above 30 cm were surveyed using a Trimble GNSS GPS receiver. Real-time kinematic (RTK) corrections were obtained from a base station located at Jalan Pemimpin;
- At the same time, the trees were tagged with a sequential number tag and the girth and height noted along with the coordinates and sequential tree number;
- A second pass was undertaken to identify species, the names of which were logged against the tree tag number; and

- Species for which field identification is not possible are referred to the SING herbarium for expert opinion.

In general, most species that were encountered during the flora survey were not fertile and identifications were achieved by observation of vegetative features. This can result in a degree of uncertainty for species that require fertile specimens for reliable identification. Uncommon species were identified / verified with reference to the Biodiversity Online web site hosted by the Lee Kong Chian Natural History Museum (LKCNCNM) as well as through consultation with various experts in the community.

The species names and conservation status are sourced primarily from the Singapore Red Data Book (2nd Edition published 2008) and supplemented with the Checklist of the Total Vascular Plant Flora of Singapore published by Raffles Museum of Biodiversity Research, National University of Singapore (2009) as a secondary source of data.

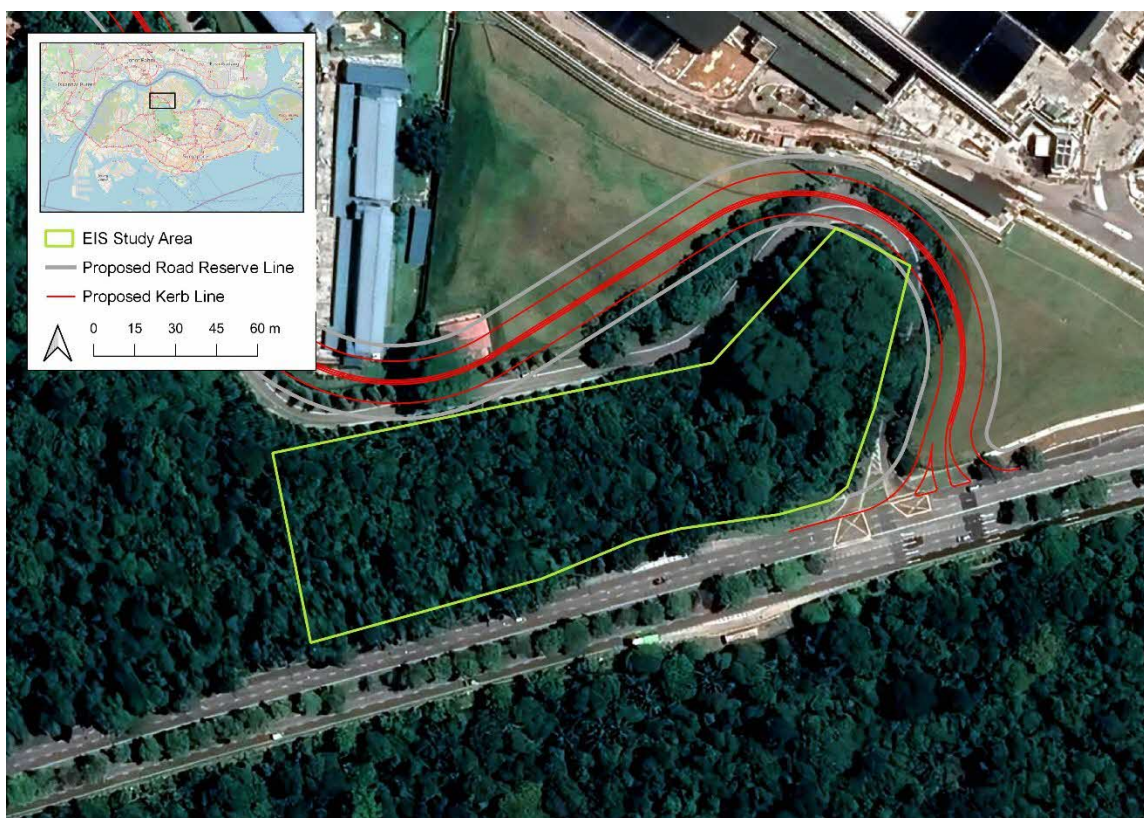


Figure 13: Flora Survey Study Area

4.2.1.2 Terrestrial fauna survey

Fauna surveys were carried out at the study area from 20th July – 19th August 2020. Over this period, two diurnal and two nocturnal transect surveys were carried out to detect and identify birds, mammals, reptiles, amphibians, butterflies and odonates. The transect route skirted around the study area before cutting through the middle of the forest as shown in Figure 14. Fauna species were detected using visual and auditory means with the aid of binoculars and torches at night, and their locations were recorded by a hand-held GPS device. In addition, whenever one of the survey personnel was on site, notable records of species not detected during the transect surveys were added as incidental / chance encounter records. Species identifications were conducted on site as far as possible, failing which photos were taken for identification using published and other online resources ex-situ.

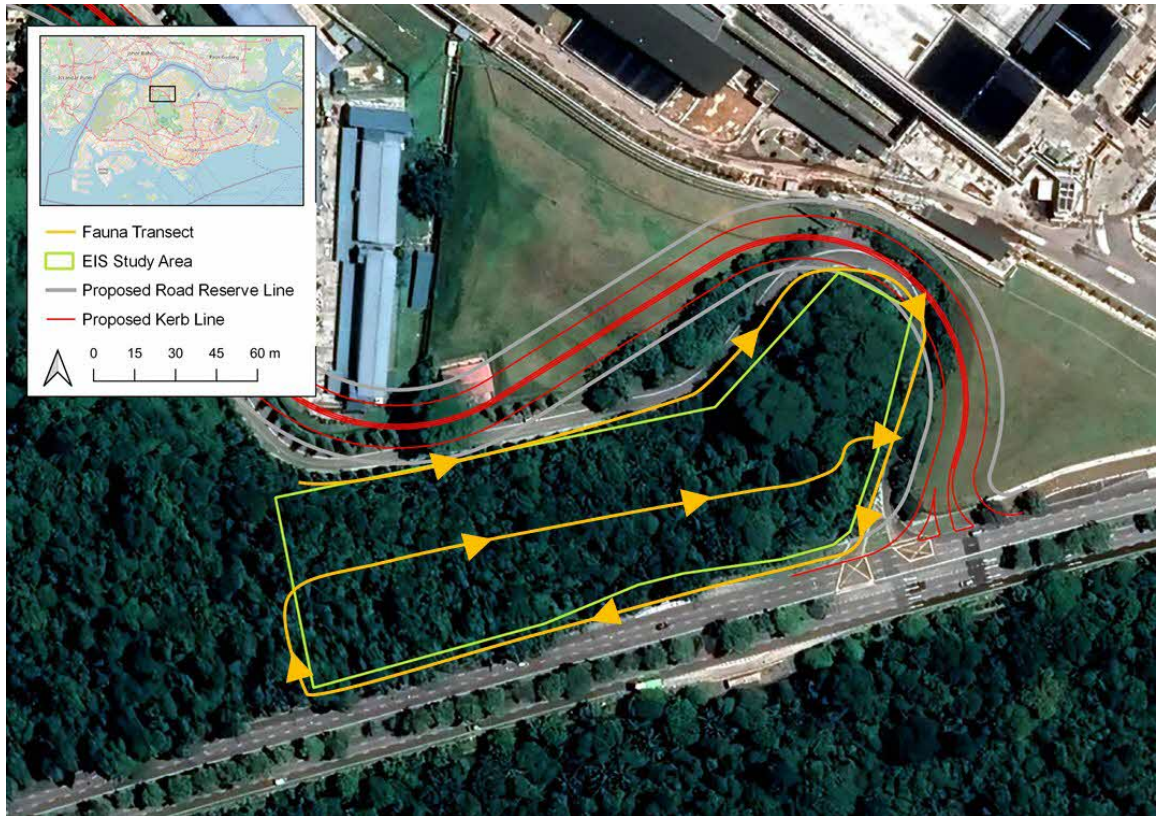


Figure 14: Fauna transect

In addition to the transect surveys, four camera traps were placed in the forest to record animal activity in the absence of humans over the period of one month from 20th July – 19th August 2020. Camera traps were spread out within the forested study site at selected locations shown in Figure 15. The camera trap set-ups involved tying the camera using a cable-lock and a nylon strap around a tree to secure the camera trap. A small padlock was also used to lock the camera to prevent unauthorised access to data or theft of the device. The cameras were set-up approximately 20 cm off the ground and operated continuously for 24 hours every day, capturing 10-second videos of 720p resolution upon trigger, with a trigger interval of 30s. Species identification, abundance, and behaviour were noted from the footage.

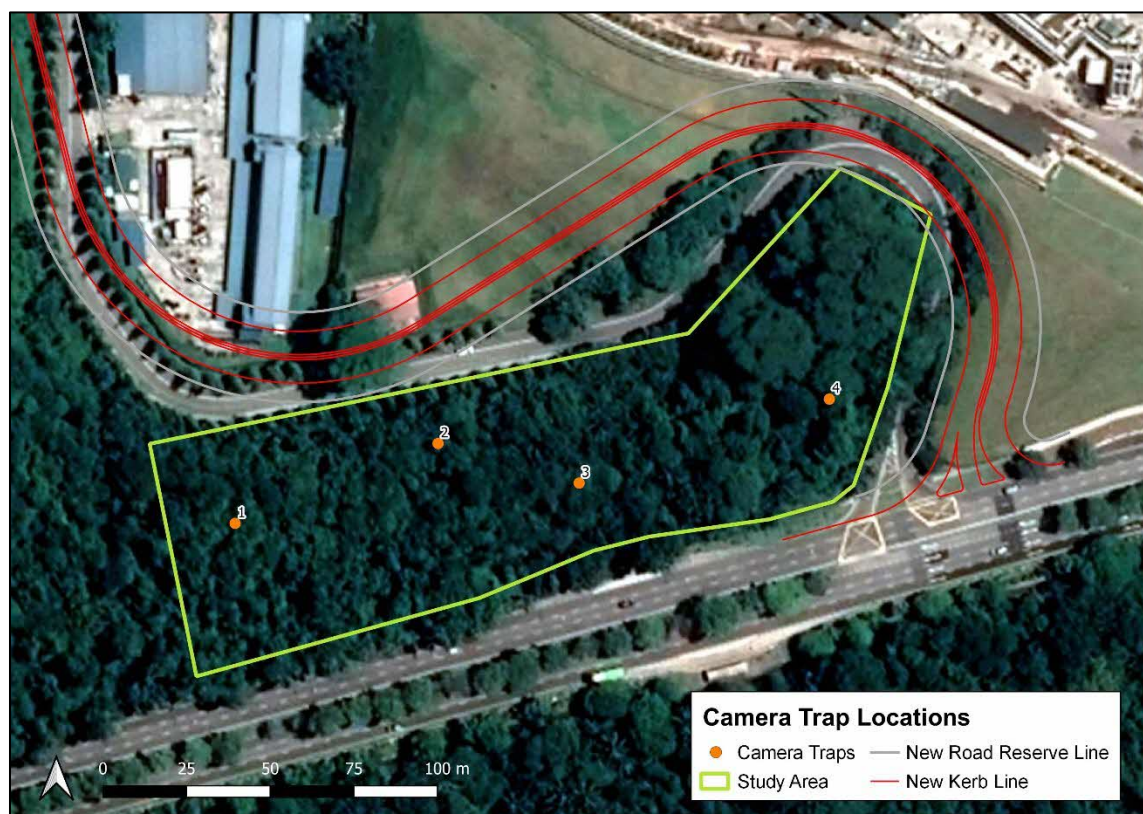


Figure 15: Camera Trap Locations

4.2.2 Results

4.2.2.1 Terrestrial flora survey

Summary of Floral Observations

Within the study area, a total of 89 flora species were observed from the baseline survey. Out of the 89 species, 40 (45%) of these species are of conservation concern.

It is noted that NParks has indicated that there is a single *Dipterocarpus kunstleri* within the study area as well, which was not recorded during the baseline survey. The total number of flora species within the study area is thus 90 in total, of which 41 are of conservation concern.

Species of Conservation Concern

Out of the 41 species with conservation concern, 2 species are extinct, 14 species are critically endangered, 9 species are endangered, and 16 species are vulnerable. The list of species with conservation concern are shown in Table 10 and the full list of flora identified at the project site is found in Appendix A. Some species of conservation concern are also shown in Figure 16.

Table 10: Summary of Flora Species with Conservation Concern (SRDB)

Nationally Extinct (NE)	Critically Endangered (CR)	Endangered (EN)	Vulnerable (VU)
<ul style="list-style-type: none"> <i>Piper ribesiodes</i> <i>Syzygium myrtifolium</i>* 	<ul style="list-style-type: none"> <i>Agelaea macrophylla</i> <i>Artocarpus nitidus</i> <i>Calophyllum soulattri</i> <i>Dillenia reticulata</i> <i>Dipterocarpus kunstleri</i>[^] <i>Eurycoma longifolia</i> <i>Garcinia atroviridis</i> <i>Leea angulata</i> <i>Memecylon sp</i> <i>Piper flavimarginatum</i> <i>Xerospermum noronhianum</i> <i>Gnetum gnemon</i>* <i>Baccaurea motleyana</i>* <i>Nephelium lappaceum</i>* 	<ul style="list-style-type: none"> <i>Aphanamixis polystachya</i> <i>Carallia brachiata</i> <i>Cratoxylum cochinchinense</i> <i>Horsfieldia sucosa</i> <i>Knema cf malayana</i> <i>Pellacalyx axillaris</i> <i>Pentace triptera</i> <i>Pometia pinnata</i> <i>Sandoricum koetjape</i> 	<ul style="list-style-type: none"> <i>Bauhinia semibifida</i> <i>Bridelia stipularis</i> <i>Endospermum diadenum</i> <i>Limacia scandens</i> <i>Lindera lucida</i> <i>Ochanostachys amentacea</i> <i>Oncosperma tigillarum</i> <i>Oxyceros longiflorus</i> <i>Palaquium obovatum</i> <i>Phaeanthus ophthalmicus</i> <i>Phytocrene bracteata</i> <i>Plectocomia elongata</i> <i>Shorea leprosula</i> <i>Syzygium polyanthum</i> <i>Syzygium syzygioides</i> <i>Xanthophyllum eurhynchum</i>
<p>Notes:</p> <p>* these species are persistent from cultivation and are assessed as common native species</p> <p>[^] This species was not detected during the baseline surveys but is indicated by NParks to be present</p>			

Two species that are nationally extinct were identified during the baseline survey. *Syzygium myrtifolium* is a commonly planted roadside tree and will be assessed as a common native species as noted above. *Piper ribesiodes* have been rediscovered in other parts of Singapore before this baseline survey, its nationally extinct status is likely to be updated in future classification.



Agelaea macrophylla



Artocarpus elasticus



Leea angulata



Phytocrene bracteata

Figure 16: Photos of Flora Species with Conservation Concern

Habitat Mapping

The study area is dominated by four distinct habitats that are determined based on the land use history of the area and observations made during the flora survey. The four habitats are listed below and shown in Figure 18.

- Rubber dominated forest which exists on the western half of the site;
- Native dominated forest featuring forest species which exists on the eastern half of the site;
- Mixed native and exotic forest about the southern and eastern extend of the study site; and
- A small section of grass and scrub exists at the North West extent of the site.

A kernel density algorithm was applied to the tree point data using conservation status as the scaling factor. The resulting heat map illustrates the areas where native species are concentrated in relation to areas of naturalised and exotic species. The resulting heat map is illustrated in Figure 17.

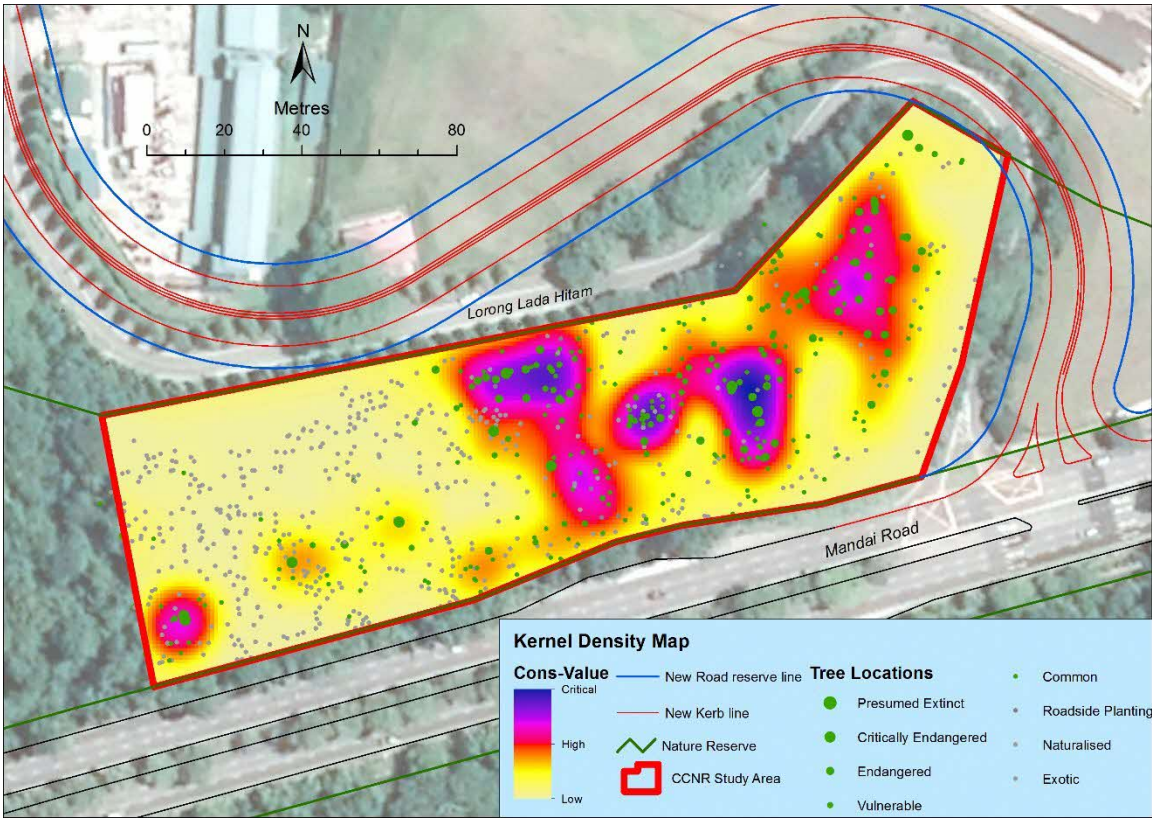


Figure 17: Heat Map showing Concentration of Native Species as compared to Exotic and Naturalised Species



Figure 18: Habitat Map

4.2.2.2 Terrestrial fauna survey

Summary of Fauna Observations

A total of 97 species of fauna were recorded from the fauna transect surveys, camera trapping as well as chance encounters, comprising 34 birds, 9 mammals, 2 amphibians, 6 reptiles, 36 butterflies and 10 odonates. These represent a mixture of species typical of open habitats such as scrub and parkland, as well as species dependent on secondary forest. However, it is worth noting that many species that would be expected to occur in similar habitats were not recorded.

From the 4 camera traps deployed from 20th July – 19th August 2020, a total of 329 camera trap events were recorded, comprising of at least 10 species of animals. CT01, CT02, and CT03 recorded similar numbers of camera trap events (83, 90 and 90 events respectively), while CT04 recorded relatively less (66 events), likely due to it being nearer to the forest edge. Within the 329 camera trap events recorded, a total of 445 animals were identified (Table 11). Wild Pigs were the most commonly recorded animal, followed by Long-tailed Macaques.

Table 11: Number of Animals Recorded on Camera Traps

Species	CT01	CT02	CT03	CT04	Total
Common Emerald Dove	3	0	33	3	39
Common Treeshrew	1	1	2	0	4
Dog	6	4	11	18	39
Long-tailed Macaque	31	26	18	0	75
Plantain Squirrel	1	2	0	3	6
Rat sp.	0	0	0	19	19
Red Junglefowl	6	9	8	8	31
Spotted Dove	0	0	0	1	1
Squirrel sp.	1	0	0	0	1
Sunda Scops Owl	1	0	0	0	1
Wild Pig	75	84	47	23	229
Total	125	126	119	75	445

Full details of the fauna survey findings are detailed in Appendix B and C.

Species of Conservation Concern

Only 3 out of the 96 species (3.1%) recorded were identified to be nationally threatened. A summary of the results for species of conservation concern is shown in Table 12 below. Of these 3 species, only 2 species of birds and 1 species of reptile has been identified to be Endangered; there are no threatened species for mammals, amphibians, butterflies and odonate groups. It is worth noting that the Collared Threadtail, a damselfly observed during the surveys, is classified as Endangered according to the SRDB (2008) but is considered as Least Concern (not threatened) in the updated assessment by Ngiam & Cheong (2016).

Table 12: Fauna Species with Threatened Local Statuses

Taxa	Threatened Status		
	Critically Endangered	Endangered	Vulnerable
Birds		<ul style="list-style-type: none"> Red Junglefowl (<i>Gallus gallus</i>) Blue-crowned Hanging Parrot (<i>Loriculus galgulus</i>) 	
Reptile		<ul style="list-style-type: none"> Wagler's Pit Viper (<i>Tropidolaemus wagleri</i>) 	

The Red Junglefowl was recorded on all 4 camera traps in the study area, while the Blue-crowned Hanging Parrot was heard while flying over the eastern end of the study area. The Wagler's Pit Viper was observed at the northern edge of the forest, coiled up on a branch about 2.5m off the ground. A map showing the

locations of these observations is presented below in Figure 19. Images of the Red Junglefowl and Wagler's Pit Viper are shown in Figure 20.

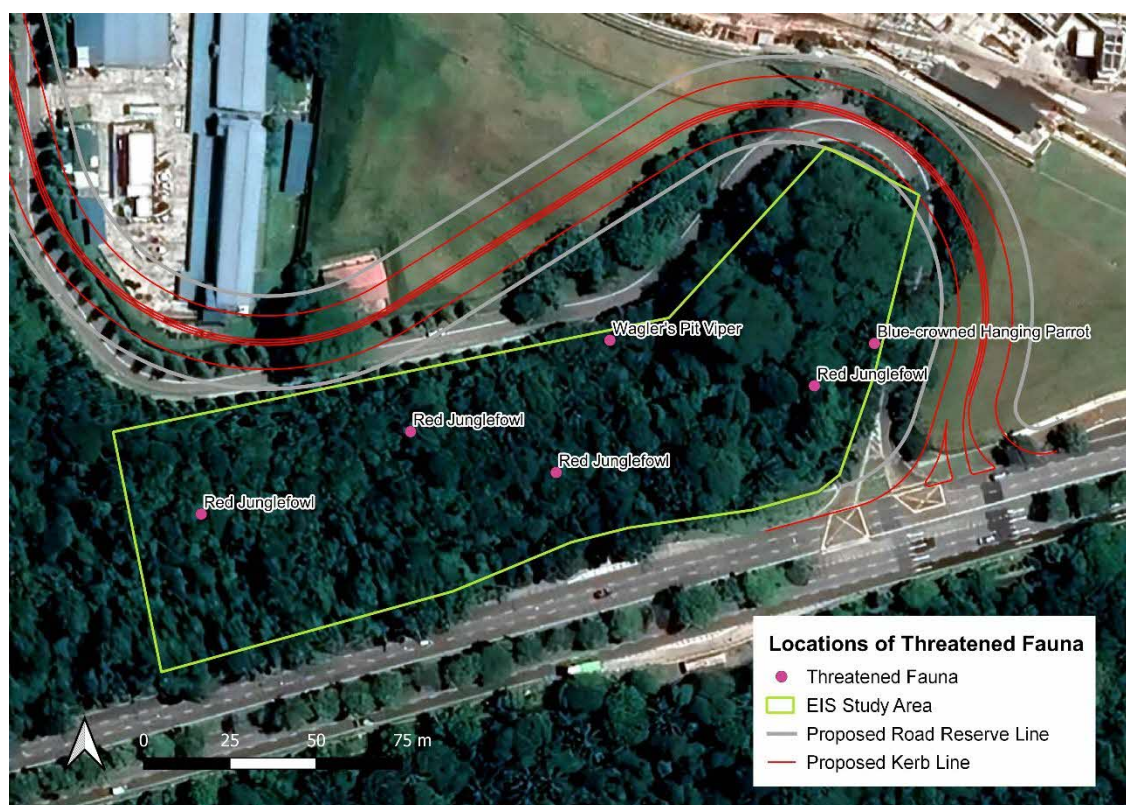


Figure 19: Locations where threatened fauna were observed



Figure 20: Photos of the Red Junglefowl (left) and the Wagler's Pit Viper (right)

Both the Red Junglefowl and Blue-crowned Hanging Parrot have now become locally common despite being listed as Endangered in the SRDB (2008). The Red Junglefowl was absent from the main island of Singapore in the 1980s until the first accepted record in 1998, but they have since grown in numbers either through introductions or dispersal from Malaysia or Pulau Ubin to become common throughout Singapore in secondary forests and scrub (Lim, 2009). Likewise, the Blue-crowned Hanging Parrot population has grown compared to when it was considered an uncommon resident, potentially due to escapees from the pet bird trade. It is now common in a variety of habitats and is no longer thought to be nationally threatened (Yong et al., 2018).

The Wagler's Pit Viper is a lowland forest species that feeds mostly on small mammals, reptiles and birds. They are generally restricted to the forests of the Bukit Timah and Central Catchment Nature Reserve.

Other species not listed in the Singapore Red Data Book but are included in the International Union for Conservation of Nature (IUCN) Red List of Threatened Species are:

- Javan Myna (*Acridotheres javanicus*) – Vulnerable. Originating from the caged bird trade, this introduced non-native species has become a very common bird in Singapore;
- Long-tailed Parakeet – Vulnerable due to habitat loss and hunting and trapping in the region. It is a common bird in Singapore that can be found in a variety of habitats; and
- Long-tailed Macaque – Vulnerable due to hunting and trapping internationally. Common in forests of Singapore, where hunting and trapping is not a threat to the survival of this species.

Remarks

Despite the close proximity to the main tract of forests in the CCNR, as well as being contiguous with a larger forest patch to the west, many species known to be present or even common in similar patches of forest and secondary woodland in the Mandai area were not detected within the study area during the period of surveys. While an absence of records during the study period does not necessarily indicate that these species are truly absent from the study area, many of these absent species are often not difficult to detect during targeted surveys when present. Even in the absence of human observers, some of the more cryptic species can be readily detected by camera traps. This has happened here, with the camera traps capturing images of species not recorded or recorded only a few times during the transect surveys, such as the Red Junglefowl, Common Emerald Dove, Sunda Scops Owl, Common Treeshrew, and Wild Pig.

The study area is separated from the CCNR by Mandai Road, a dual three-lane carriageway. While this does not present a major obstacle for a number of highly mobile bird, bat, and insect species, the significant gap in forest cover, as well as the constant danger posed by vehicles, poses an insurmountable barrier for most terrestrial non-volant species. While there has been a lot of attention paid to incidents in the Mandai area involving vehicular collisions with certain mammal species (such as Sunda Pangolin, Wild Pig, and Sambar Deer), it is likely that many more incidents involving less conspicuous or charismatic fauna have taken place unnoticed and unreported over the years.

Because it is bordered on three sides by roads, with the noise and numerous passing vehicles, it is possible that the study area may be a marginal habitat for a number of forest-dependent species, which could still be present in quieter areas within the larger forest patch (west of study area) between Mandai Road and Lorong Lada Hitam.

Another possible influence is the apparently resident pack of four stray dogs. This may account for the absence of certain species of mammals, birds, and larger reptiles, whether through active predation and harassment, or causing potential prey species to avoid the area. More observations would be needed to determine whether the dogs are completely dependent on humans for sustenance, or whether they chase and harass any of the wildlife.

Finally, the lack of records for many species may simply be the result of the limited number of surveys conducted, as well as the time of the year. Surveys conducted during the migratory bird season or after heavy rain may reveal additional species that were not detected during this short survey period.

Nonetheless, the presence of some forest-dependent species indicates that enough habitat remains, allowing these species to persist across Mandai Road at the fringes of the CCNR.

4.3 Air Quality

4.3.1 Methodologies

Secondary data of the island wide air quality was used to establish the pre-work ambient air quality at the Project area, in accordance to the latest standards set by the National Environmental Agency, which is the Singapore Ambient Air Quality Targets, Singapore Targets by end of 2020. The Singapore's air quality data was obtained from the Department of Statistics Singapore. The data was used to tabulate graphs to understand the trend of different air quality indicators.

4.3.2 Results

Table 13 below shows the annual mean air quality levels in Singapore from 2009 to 2018, and Figure 21 below shows a graphical representation of the annual mean air quality levels in Singapore from 2009 to 2018.

With the exception of the years when Singapore was affected by transboundary smoke haze (2013, 2015 and 2019), general trends show that the pollutant levels of sulphur dioxide, PM2.5, PM10, and carbon monoxide are decreasing over the years. Pollutant levels are expected to further decrease from 2018 to 2020 as new vehicles are expected to meet the Euro VI emission standards, which will result in lower pollutant and particulate emissions for NO₂ in particular, especially for diesel motor vehicles. A large increment in the particulate matters PM10 and PM2.5 in 2013 and 2015 is due to transboundary smoke to haze from biomass burning from neighbouring countries.

Table 13: Annual Mean Air Quality Levels in Singapore from 2009 – 2018

Air Pollutant	Averaging Time	Unit	2020 Target	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Sulphur Dioxide	Annual Mean	µg/m ³	15	9	11	10	13	14	12	12	13	12	9
	Maximum 24-hour Mean	µg/m ³	50	93	104	80	98	75	83	75	61	59	65
Nitrogen Dioxide	Annual Mean	µg/m ³	40	22	23	25	25	25	24	22	26	25	26
	Maximum 1-hour Mean	µg/m ³	200	147	153	189	154	132	121	99	123	158	147
PM 10	Annual Mean	µg/m ³	20	29	26	27	29	31	30	37	26	25	29
	99th Percentile 24-hour Mean	µg/m ³	50	59	76	55	57	215	75	186	61	57	59
PM 2.5	Annual Mean	µg/m ³	12	19	17	17	19	20	18	24	15	14	15
	99th Percentile 24-hour Mean	µg/m ³	37.5	44	56	41	42	176	51	145	40	34	32
Carbon Monoxide	Maximum 8-hour Mean	mg/m ³	10	1.9	2.4	2	1.9	5.5	1.8	3.3	2.2	1.7	2
	Maximum 1-hour Mean	mg/m ³	30	3.9	2.8	2.6	2.4	7.5	2.7	3.5	2.7	2.3	2.5
Ozone	Maximum 8-hour Mean	µg/m ³	100	105	139	123	122	139	135	152	115	191	150

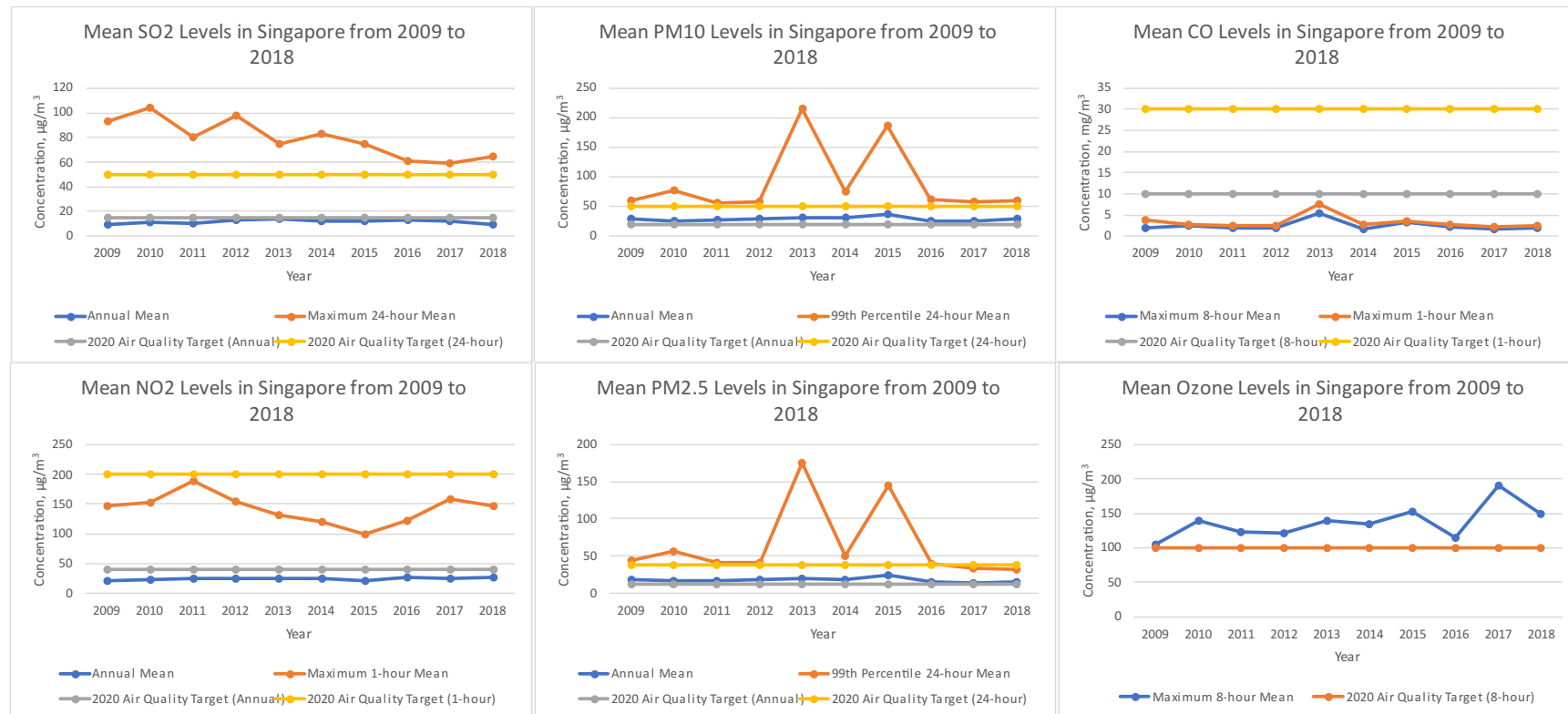


Figure 21: Annual Mean Air Quality Levels in Singapore from 2009 – 2018

4.4 Air-Borne Noise

4.4.1 Methodology

To establish pre-work ambient noise conditions of the Project area in accordance to latest standards set by the National Environment Agency, baseline noise monitoring was conducted from 25th August 2020 to 1st September 2020 to provide a representative baseline condition of the noise levels at the potentially affected areas. One point was selected to conduct the air-borne noise monitoring as illustrated in Figure 22.

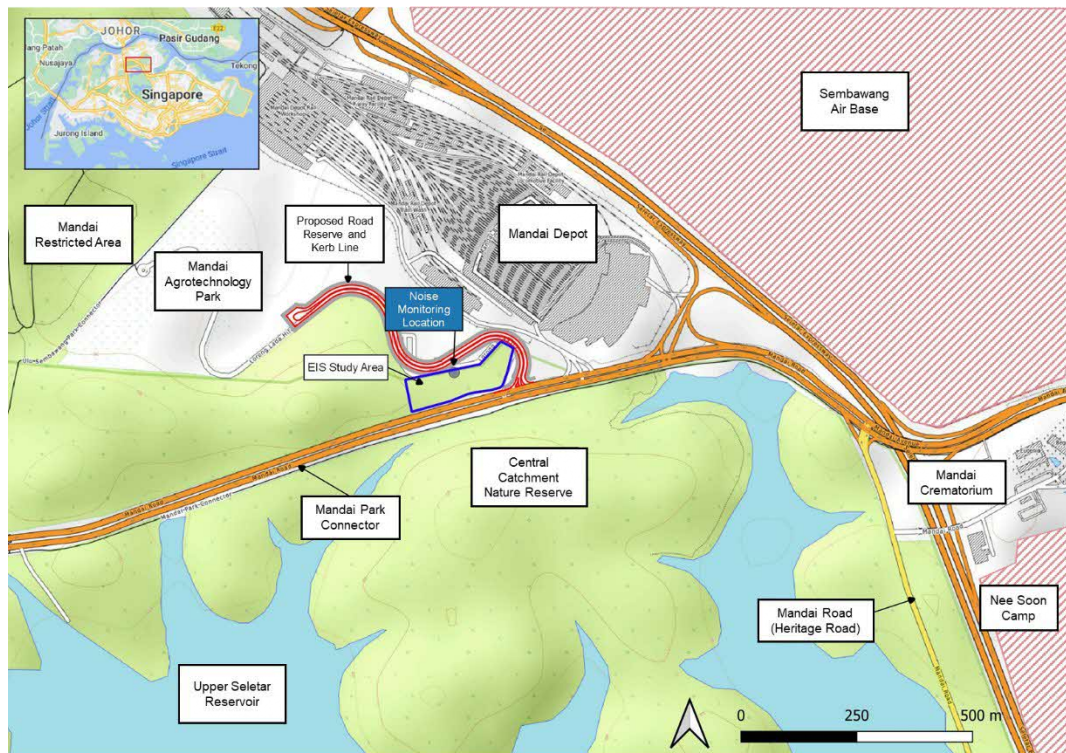


Figure 22: Noise Monitoring Locations

The Sound Level Meter (Type 1) was placed from a height of 1.5m to 3m from the ground and approximately 1.5m to 2m away from all reflective facades. The sound pressure levels (LAeq) of LA90 (5 mins), LAeq (5 mins) and its corresponding Lmax and Lmin for every 5 mins period were monitored 24 hours continuously over a period of 7 days. The measured noise levels are used to compare against the permissible noise limits specified in the Environmental Protection and Management (Control of Noise at Construction Sites) Regulations (2011 Edition). In cases where a work site occurs within 150m of a sensitive land use, the Regulation also imposes restrictions upon the working hours of the site (unless an exception is approved by the Director General) to:

- No work from 10pm (Saturdays/ eve of Public Holiday) to 7am (Mondays/ day after Public Holiday).

Measurements were undertaken using an ACE6270+ Sound Level Meter (Type 1). The instrument provides the functions and features vital for contemporary demand measurement standards and guidelines which include the IEC 61672-1:2002 Class 1. The noise meter has been calibrated at a recognized calibration laboratory within the valid period and by relevant agency. The locations chosen for monitoring represent a range of noise scenarios for a forested area and provide good coverage of the Project Site.

4.4.2 Results

The findings of each noise monitoring station are summarised in Table 14 and the monitoring results are compared to permissible levels stated in the Control of Noise at Construction Sites Regulations 2011. Those that are in exceedance of the limits for commercial buildings are highlighted in red and bold. The full results of the noise monitoring survey can be found in Appendix D.

Table 14: Noise Monitoring Results Summary

7am – 7pm		7pm – 10pm		10pm – 12am		12am – 7am		7pm – 7am	Observed Noise Source
LAeq 5mins	LAeq 12hrs	LAeq 5mins	LAeq 1hr	LAeq 5mins	LAeq 12hrs	LAeq 5mins	LAeq 1hr	LAeq 12hrs	
53.5 – 73.8	54.1 – 62.6	54.2 – 71.4	54.4 – 67.4	51.9 – 62	54.2 – 57.3	45.9 – 59.7	47.7 – 59.3	51.5 – 62.8	Road Traffic Noise

Noise limits from 7am – 7pm: 60dBA (LAeq 12hrs); 75dBA (LAeq 5mins)

Noise limits from 7pm – 7am: 50 dBA (LAeq 12hrs); 55 dBA (LAeq 5mins)

The overall baseline noise test results show that the LAeq 5 mins noise levels from 7am – 7pm (day time) are approximately the same as the NEA limits while the LAeq 5 mins noise levels from 7pm – 7am (night time) exceeded the NEA limits. Maximum LAeq 12 hours noise levels also exceeded the NEA limits of 60dBA from 7am to 7pm and 50dBA from 7pm to 7am. Night time noise levels are the highest from 7pm – 10pm, possibly due to nearby road traffic noise from Mandai Road. It must be noted that the regulation on Control of Noise at Construction Sites is primarily for human comfort, and not indicative of wildlife welfare.

5 DESCRIPTION OF ENVIRONMENTAL IMPACT ASSESSMENT METHODOLOGIES

5.1 Impact Identification

For each specific environmental aspect, the assessment will identify the potential impacts and report on the likely significance of the potential environmental impacts. The criteria for determining significance are specific for each environmental aspect and will be defined in the relevant sections. In broad terms it can be characterised as the product of the degree of change predicted (the magnitude of impact) and the value of the receptor/resource that is subjected to that change (sensitivity of receptor). For each potential impact, the likely magnitude of the impact and the sensitivity of the receptor are defined, qualitative and quantitatively to the extent possible. Generic criteria for the definition of sensitivity and magnitude are summarised below.

5.2 Sensitivity Criteria

Sensitivity is specific to each aspect and the environmental resource affected, with criteria developed from baseline information. Generic criteria for determining sensitivity of receptors are outlined in Table 15 below. Each detailed assessment will define sensitivity in relation to its environmental or social aspect.

Table 15: Sensitivity Criteria

Sensitivity	Criteria
High	Receptor (human, physical or biological) has very limited or no capacity to absorb proposed changes
Medium	Receptor has a limited capacity to absorb proposed changes.
Low	Receptor has a moderate capacity to absorb proposed changes.
Negligible	Receptor is generally tolerant of and can accommodate proposed changes.

5.3 Magnitude Criteria

The assessment of impact magnitude is undertaken in two steps. Firstly, the identified impacts of the Project are categorised as positive (i.e. beneficial) or negative (i.e. adverse), which have the following definitions listed in Table 16 below.

Table 16: Definition of Positive and Negative Environmental Impacts

Category	Definition
Positive	An impact that is considered to represent an improvement on the baseline or introduces a positive change
Negative	An impact that is considered to represent an adverse change from the baseline or introduces a new undesirable factor

Secondly, impacts are categorised as major, moderate, minor or negligible based on consideration of parameters as shown below:

- Type – direct or indirect impacts including cumulative and secondary impacts
- Duration of the impact – ranging from ‘beyond construction’ to ‘temporary with no detectable impact’
- Spatial extent of the impact – for instance, ‘within the proposed Site area’, ‘to its immediate surrounding’, ‘within the entire reservoir’, ‘within CCONR’, and beyond
- Reversibility – ranging from ‘permanent requiring significant intervention to return to baseline’ to ‘no change’
- Likelihood – ranging from ‘occurring regularly under typical conditions’ to ‘unlikely to occur’
- Embedded controls – ranging from “many international/national/industry regulations and guidelines to be strictly enforced” to “no established regulations and/or guidelines”

- Compliance with legal standards and established professional criteria – ranging from ‘substantially exceeds national standards or international guidance’ to ‘meets the standards’ i.e. impacts are predicted

Table 17 provides the terminology used in evaluation of magnitude of impacts.

Table 17: Definition of Parameters

Parameters	Designation	Definition
Type	Direct	Direct impacts are caused by the project itself – result from a direct interaction between a planned project activity and the receiving environment/ receptors. Direct impacts are generally easier to assess and control than indirect impacts since the cause-effect relationship is usually obvious.
	Indirect	Indirect impacts are usually linked closely with the project – result from other activities that are encouraged to happen as a consequence of the project. Indirect impacts are more difficult to measure but can ultimately be more important. Over time they can affect larger geographical areas of the environment than anticipated.
Duration	Temporary	Temporary impacts are impacts that typically occur during construction and may last for a short period (<1 year) after construction.
	Permanent	Permanent impacts are impacts that continue to occur after construction and may last for a long period (>10 years).
Spatial extent	Localised	Impacts confined within the project site and its immediate surrounding.
	Widespread	Impacts which extend beyond the project site, affecting the larger ecosystem and/or the region.
Reversibility	Reversible	Impacts which are reversible and diminish upon cessation of activities associated with the project.
	Irreversible	Impacts which are not reversible and do not diminish upon cessation of activities and do not diminish with time.
Likelihood	Certain	Will occur under normal operating conditions.
	Very likely	Very likely to occur under normal operational conditions.
	Likely	Likely to occur at some time under normal operating conditions.
	Unlikely	Unlikely to but may occur at some time under normal operating conditions.
	Very unlikely	Very unlikely to occur under normal operating conditions but may occur in exceptional circumstances.
Embedded Controls	Available	Existing regulations and/or standards to adhere to that can effectively reduce the predicted impacts.
	Unavailable	No existing regulations and/or standards.

Table 18 presents the definition of each magnitude criteria.

Table 18: Magnitude Criteria

Category	Description (adverse impacts)
Major	Fundamental change to the specific conditions assessed resulting in long term or permanent change, typically widespread in nature and requiring significant intervention to return to baseline; would violate national standards or Good International Industry Practice (GIIP) without mitigation. Certain or very likely that an incidence will occur under normal operating conditions. No existing international/national/industry regulations and/or standards to mitigate impacts. Spatial extent of the impact to be the whole CCNR and beyond.

Moderate	<p>Detectable change to the specific conditions assessed resulting in non-fundamental temporary or permanent change.</p> <p>Likely to occur at some time under normal operating conditions.</p> <p>No existing international/national/industry regulations and/or standards to mitigate impacts.</p> <p>Spatial extent of the impact to be within the entire reservoir and/ or CCNR.</p>
Minor	<p>Detectable but small change to the specific conditions assessed.</p> <p>Unlikely to but may occur at some time under normal operating conditions.</p> <p>Several existing regulations and/or standards that must be adhere to and can mitigate predicted impact.</p> <p>Spatial extent of the impact to be the proposed Site area and work sites, and their immediate surroundings.</p>
Negligible	<p>No perceptible change to the specific conditions assessed.</p> <p>Very unlikely to occur under normal operating conditions but may occur in exceptional circumstances.</p> <p>Several existing regulations and/or standards that must be adhere to and can mitigate predicted impact.</p> <p>Spatial extent of the impact to be within the proposed Site and worksite areas only.</p>

5.4 Impact Evaluation

5.4.1 Determining Impact Significance

The objective of impact assessment is to identify the likely significant effects on the environment and people due to the proposed Site. Impacts that have been evaluated as 'moderate' or 'major' are significant effects and identified as such in the specialist chapters. Consequently, impacts that are 'minor' or 'negligible' are not significant (Table 19).

Table 19: Impact Assessment Matrix

Sensitivity		Magnitude			
		Adverse/Beneficial			
		Major	Moderate	Minor	Negligible
	High	Major	Major	Moderate	Minor
	Medium	Major	Moderate	Minor	Negligible
	Low	Moderate	Minor	Negligible	Negligible
	Negligible	Minor	Negligible	Negligible	Negligible

The impact significance derived from the Impact Assessment Matrix is described in the Impact Resolution Matrix below.

Table 20: Impact Resolution Matrix

Impact Significance	Description	Definition
Major	Intolerable	Impact shall be reduced by whatever means possible
Moderate	Undesirable	Impact shall only be accepted if further impact reduction is not practical
Minor	Tolerable	Impact shall be accepted subject to demonstration that the level of risk is as low as reasonably practicable
Negligible	Acceptable	Impact is acceptable

6 IDENTIFICATION OF ENVIRONMENTAL IMPACTS

Potential impacts are identified in this section and mitigating measures are proposed in the following section.

6.1 Key Impact Identification

Key impacts arising from different activities during construction phase of the Project are identified in the table below. The details of impact assessment propose mitigation measures, and environmental monitoring and management plan (EMMP) will be discussed in detail in the following Sections.

Table 21: Key Impact Identification

Construction Works	Equipment/ Machinery	Key Impact
Construction Phase		
Site clearance by removing trees within the road reserve line	Excavators, FEL (Bulldozer), cranes, concrete trucks, dump trucks, generator sets, concrete pumps, compactors, generators	Habitat loss
		Loss of vegetation and wildlife from the site
		Soil erosion
		Water quality - Increase in runoff volume, rate and duration from non-vegetated site, runoff from exposed soil can potentially be contaminated with turbidity and other contaminants from construction wastes
		Waste generation from tree felling and site clearance
		Noise and air emissions
General construction activities, including earthworks and road construction works	Trucks, compactor and rollers, generators, cranes, compactor, concrete trucks, semi-trailer, excavators, dump truck, mill and patch machines	Human-wildlife conflict
		Construction runoff may contain pollutants such as turbidity, building materials, concrete washout, fuel, oil and solvent which will alter the water quality characteristic once it enters the nearby receiving watercourse
		Waste generation from construction activities, including general waste and hazardous waste
		Noise and air emissions
Demolition works	Excavators, dump trucks, generators, concrete crushers, bulldozers, jackhammers	Partial demolition of drain near nature reserve may affect slope stability and flora
		Human-wildlife conflict
		Soil erosion
		Construction runoff may contain pollutants such as turbidity, debris, and fuel
		Waste generation
		Noise and air emissions
Operational Phase		
Road usage by passengers and vehicles	Not applicable	Air quality and Noise impact

7 PREDICTION AND EVALUATION OF ENVIRONMENTAL IMPACTS

The impact assessment will discuss the general impacts expected from construction and operation phases of the Project.

7.1 Air Quality

7.1.1 Assessment Methodology

The Air Sensitive Receptors (ASRs) considered in the air quality assessment are points where people congregate for an extended period of time and are potentially impacted by air pollution. Common examples of ASRs include residential premises, educational institutions, home for the aged, day care centres, community centres, parks, hotels, places of worship, hospitals and medical centres, and sports grounds. At this Site, the sensitive receptors identified in Section 2 are assessed in the air quality assessment, including road and park users.

The air quality impacts from construction and operation of the Project are assessed qualitatively to predict the pollutants' level at ASRs for comparison with the SAAQTs limit values.

The sensitivity criteria for ASRs is adopted from the general criteria described in Section 5.2. The magnitude criteria for impacts to ASRs, based on the magnitude criteria defined in Table 22 below. Impact significance will subsequently be determined by the matrix shown in Table 19.

Table 22: Significance of Air Quality Impacts

Impact Significance	Description
Major	Predicted concentrations exceed SAAQT at both short term and long-term exceedances
Moderate	Predicted concentrations exceed SAAQT at short term
Minor	Predicted concentrations do not exceed SAAQT, but likely to cause nuisance
Negligible	All predicted concentrations are below SAAQT, and unlikely to cause nuisance

7.1.2 Air Quality Impact during Construction

The air sensitive receptors (ASRs) identified within and near to Project Site are mainly park users visiting the nearby Mandai Park Connector and CCNR, road users at Lorong Lada Hitam and Mandai Road and staff/officers working in the nearby Mandai bus depot. The park users generally spend a few hours in the parks and CCNR, and the road users including pedestrians and cyclists generally spend less than 30 minutes on the road. The staff/officers working in Mandai bus depot generally spend most of their time indoors during working hours. These air sensitive receptors are likely to have only temporary exposure to air pollutants emitted from the works areas. Given the small scale of the works, insignificant dust and air pollution concentration is expected. In addition, the Project is located next to the CCNR. The surrounding dense forest have the capacity to absorb the generated dust and air emissions. Therefore, the changes in dust and air pollution are expected to be limited, and the receptors will have some capacity to absorb the changes. The **Sensitivity** of ASRs is assessed to be **Low**.

Emissions from vehicles and equipment including excavators, bulldozers, cranes, generators, trucks and other equipment used during construction and Site clearance, excavations and demolition works will affect the ambient air quality within and surrounding the Project Site. These construction activities will increase the concentration of dust particles, which in turn reduce visibility, and pollutants such as NO_x, SO₂, CO, and potentially cause respiratory and visibility problems to nearby sensitive receptors. The impacted area will be surrounding the construction worksite and the vicinity, especially in downwind directions. Given the small footprint of working area at Lorong Lada Hitam and the short duration of these construction activities, the quantity of on-site construction equipment/machinery and movement of construction vehicles will be limited. The quantity of dust and air pollutants generated by excavation and demolition works are also expected to be low and localized, as only limited extent of excavation works will be involved for slope cutting, and extent of demolition works will only involve demolition of existing roadside drains and lampposts.

Hence, the air quality impacts associated with construction of the Project are therefore considered to be **Negative, Direct, Temporary, Reversible, and Likely**.

Air quality impact might be detectable during construction stage. The change in the ambient air quality is generally small, and the emissions will be dispersed and diluted with clean air. There are existing regulations and good practices introduced by NEA to reduce amount of pollutive emissions from construction vehicles and machinery. For instance, with effect from 1 July 2012, all off-road diesel engines imported into Singapore must comply with the EU Stage II, US Tier II or Japan Tier I off-road diesel engine emission standards, according to Environmental Protection and Management (Off-Road Diesel Engine Emissions) Regulations 2012. These off-road diesel engines include equipment such as power generators, trucks which are used during the construction works. Hence, air emissions from vehicles and equipment will be controlled at sources. In most of the road construction projects in Singapore, the elevated air pollutants levels, as a result of construction activities, will be predicted to be within NEA air quality performance standards. This defines **Minor Magnitude** of impact that contributes to Temporary, Negative air quality impact that is of **Negligible Significance**.

7.1.3 Air Quality Impact during Demolition Works

As discussed in Section 7.1.2 the identified nearby air sensitive receptors are assessed to be of **Low Sensitivity**, given their temporary exposure to vehicular emissions/dust as a result of the short length of stay in the outdoor environment.

During demolition works, excavators and jackhammers will be used to break up existing roads, lampposts and drains to be removed. The demolition works will increase the concentration of dust particles. Other machinery such as bulldozers and dump trucks may contribute to other air emissions such as NO_x, SO₂, CO. These air quality impacts can potentially cause respiratory and visibility problems to nearby sensitive receptors. Air quality impact will be detectable during demolition works. There are existing regulations and good practices introduced by NEA to reduce amount of pollutive emissions from construction vehicles and machinery. Hoarding around the site will also limit the dust from spreading across a large area. Hence, the air quality impacts associated with construction of the Project are therefore considered to be **Negative, Direct, Temporary, Reversible, and Likely**.

The change in the ambient air quality is thus expected to be localized, and the emissions will be dispersed and diluted with clean air. This defines **Minor Magnitude** of impact that contributes to Temporary, Negative air quality impact that is of **Negligible Significance**.

7.1.4 Air Quality Impact during Operation

As discussed in Section 7.1.2 the identified nearby air sensitive receptors are assessed to be of **Low Sensitivity**, given their temporary exposure to vehicular emissions as a result of the short length of stay in the outdoor environment.

During the operation period, the new road constructed along Lorong Lada Hitam will be able to accommodate greater traffic volume, and more frequency vehicular emissions would be expected. However, the perceived change in air quality due to road vehicular emission is expected to be low and to be within NEA air quality performance standards. The air quality impact associated with operation of the Project are therefore expected to be **Negative, Direct, Reversible, Permanent and Unlikely**.

The air sensitive receptors are located distanced away from the new road and will only spend a short duration outdoor. Hence, the impact during operation will cause no perceptible change to the known air sensitive receptors. As such, the **Magnitude** of the noise impacts is considered as **Negligible**. In the absence of the proposed mitigation measures, the **significance** of air quality impact during operation phase has been evaluated **Negligible**.

7.2 Noise Impact

7.2.1 Assessment Methodology

The noise sensitive receptors (NSRs) considered in the noise assessment are people who are staying in or near the site and potentially sensitive to noise. Common examples of NSRs include residential premises located less than 150m from construction sites, educational institutions, home for the aged, day care centres,

community centres, hotels, places of worship, hospitals and medical centres etc. that are not located within affected zone of the project. The NSRs identified in Section 2 including park and road users and staff/officers working in the nearby Mandai bus depot and Mandai Agrotech Park are assessed in the noise assessment.

The noise impacts from construction and operation of the Site are assessed qualitatively to predict the noise levels at NSRs. The predicted noise levels at NSRs during construction phase are compared with the maximum permissible noise levels for construction sites specified in the Construction Noise Regulation. Generally, assessment of noise impacts associated with construction activities will depend on the sequence of construction works, type, quantity, location, noise specifications, percentage on-time and duration of operation of the construction equipment to be used in each activity. Construction noise levels will also be affected by noise characteristics (either continuous or high impact noise) of the equipment.

The sensitivity criteria for NSRs is adapted from the general criteria described in Section 5.2, while the magnitude criteria for noise impacts are referenced to Section 6. Impact significance will subsequently be determined by the matrix shown in Table 19.

7.2.2 Noise Impact during Construction and Demolition

During construction and demolition works, operations of construction vehicles and equipment such as excavators, compactors, generators, jackhammers, and concrete trucks within the worksite will serve as additional noise sources and contribute to the overall noise level within the work site and its surroundings. Such increases in noise level would have a negative impact on nearby sensitive receptors such as wildlife, park and road users and staff/officers working in nearby Mandai Bus depot. Noise impact during construction to wildlife are discussed separately under Section 7.6.

Park users generally spend a few hours in the nature parks and are expected to be constantly moving along the walking trails. The staff working in the Mandai Bus Depot are working indoor during working hours. All the identified nearby sensitive receptors are likely to experience intermittent, temporal exposure to noise emitted from the works areas. Therefore, the **Sensitivity** is assessed to be **Low**.

The existing noise climate at the Project site is dominated by traffic noise. Results from the noise baseline monitoring surveys undertaken on site showed that noise levels at the Site were similar to typical urban environments in Singapore, with occasional exceedances observed during night time due to increased traffic activities at Lorong Lada Hitam and Mandai Road.

During construction and demolition works, the operation of equipment and movement of construction vehicles in different work stages will generate potential temporary noise disturbance to nearby sensitive receptors, in addition to the existing traffic noise. The construction works associated with the project are expected to be undertaken over several stages for short period as shown in Table 1. The construction and demolition works will only take place in the daytime, and the cumulative noise level generated from each construction stage is expected to cause occasional noise exceedances during periods when noisy equipment are in operation. The noise impacts associated with construction of the Project are therefore considered to be **Negative, Direct, Temporary, Reversible, and Likely**.

Given the fact that potential noise exceedances are not continuous, and the receptors are located a distance away from the noise source, the impact can possibly be mitigated by the contractor such that NEA noise limits are only occasionally exceeded. The **Magnitude** is therefore assessed as **Moderate**, resulting in noise impact of **Minor Significance** during construction of the Project.

7.2.3 Noise Impact during Operation

As discussed in Section 7.2.2, the identified nearby sensitive receptors are assessed to be of **Low Sensitivity**, given their temporary exposure to potential noise emissions as a result of the short length of stay in the outdoor environment.

During the operation period, the new road constructed along Lorong Lada Hitam will be able to accommodate greater traffic volume and the key noise contribution would be additional traffic noise from road vehicles mainly during daytime. The noise impacts associated with operation of the Project are therefore expected to be **Negative, Direct, Reversible, Permanent and Likely**.

The potential impacted area of noise during operation is mainly sensitive receptors located distance away from the new road. Hence, the impact during operation will cause no perceptible change to the known sensitive receptors. As such, the Magnitude of the noise impacts is considered as **Negligible**. In the absence

of the proposed mitigation measures, the significance of noise impact during operation phase has been evaluated as **Negligible**.

7.3 Soil Erosion

7.3.1 Assessment Methodology

The sensitivity criteria for soil erosion is adapted from the general criteria presented in Section 5.2. The magnitude criteria for impacts to soil erosion is adapted from the general criteria in Section 5. Impact significance will subsequently be determined by the matrix shown in Table 19, using the evaluated sensitivity and impact magnitude on soil erosion impact.

Table 23: Sensitivity Criteria for Soil Erosion

Category	Criteria Definition
High	Site condition is highly susceptible to soil erosion with little or no capacity to absorb proposed changes Significant disturbance to soil condition.
Medium	Site condition is susceptible to soil erosion with little capacity to absorb proposed changes Moderate disturbance to soil condition.
Low	Site condition is not susceptible to soil erosion with some capacity to absorb proposed changes Slight disturbance to the soil condition.
Negligible	Site condition is not susceptible to soil erosion with good capacity to absorb proposed changes No disturbance to soil condition.

Table 24: Magnitude Criteria for Impacts due Soil Erosion

Category	Criteria Definition (For Negative Impacts)
Major	Certain that there will be changes in soil condition Impact likely to affect hydrology permanently after construction and may last for a period (>10 years) Impacts which extend beyond the work sites and affect CCNR overall No existing regulations and/or standards to reduce the impacts effectively.
Moderate	Likely that there will be changes of soil condition Impact likely to cause soil erosion during construction and last for more than a year after construction Impacts which extend the work sites surroundings in 100m distance Limited existing regulations and/or standards to reduce the impacts effectively.
Minor	Unlikely that there will be changes in soil condition Impact likely to cause soil erosion only temporarily during construction and last for less than a year after construction Impacts which extend to proposed Site and its immediate surroundings, and/or work sites and their immediate surroundings in 20m distance Existing regulations and/or standards readily available to reduce the impacts effectively.
Negligible	No change of soil condition under normal operating conditions, and unlikely to occur even in exceptional circumstances No changes in soil condition Impacts which extend within the proposed Site surroundings and/or within the worksites only Several existing regulations and/or standards that must be adhere to and can mitigate predicted impact.

7.3.2 Soil Erosion during Construction and Demolition Works

The construction works for the proposed road widening and drainage works will involve small amounts of tree felling and vegetation removal, as well as removal of underground roots which may lead to changes in surface soil condition and soil disturbance. Slope excavation for Phase 1 of construction works may also temporarily expose soil, and potentially increase the risk of soil erosion and slope failure during heavy rainfall events in the absence of proper earth control measures. Such impacts will most likely happen during tree felling and slope excavation works, which would last for less than 6 months based on the proposed construction schedule. The slope on the eastern boundary is steep and prone to soil erosion during tree-felling or excavation works, especially during heavy rainfall. Slope failure is unlikely given the small area affected but remains a possible safety risk to construction workers at site and road users.

Demolition of the existing road also expose bare earth which will increase the risk of soil erosion. Demolition of the existing drains removes structural support for the adjacent soil, which may collapse into the drain if loosened.

Hence, the sensitivity of the site to soil erosion during construction and demolition works is evaluated to be of **Medium Sensitivity**.

Potential soil erosion and slope failure will be localised as the vegetation clearance and slope excavation will only take place within the proposed road reserve line. In Singapore's context, it is required by law that ECMs have to be designed and signed off by a Qualified Erosion Control Professionals (QECF), and Earth Retaining or Stabilising Structures (ERSS) have to be designed and submitted to BCA by a Qualified Person (QP) for slopes greater than 1.5m depth. As for depth less than 1.5m, good practice in construction requires contractor to implement temporary measures to control soil erosion and slope stability. In addition, it is also required that Professional Engineer (PE Geo) to be engaged for design and BCA submission on temporary and permanent earth retaining structures for steep slopes. There are reasonable opportunities for prevention and mitigation of slope failure and soil erosion. Therefore, the soil erosion impact associated with construction works is therefore assessed to be **Direct, Temporary, Reversible, Localised, Likely**. The **Magnitude** is therefore **Minor**, resulting in soil erosion impact of **Minor Significance** during construction of the Project.

7.4 Water Quality

7.4.1 Assessment Methodology

The sensitivity criteria used for assessing potential impacts to water quality is adapted from the general criteria in Section 5.2 and is shown in Table 25. The magnitude criteria used for assessing potential impacts to water quality is adapted from the general criteria in Section 5.3, and is shown in Table 26. Impact significance will subsequently be determined by the matrix shown in Table 26, using the evaluated water quality sensitivity and impact magnitude on water quality.

Table 25: Sensitivity Criteria for Water Quality

Category	Criteria Definition
High	The receiving water sensitive receptor is a controlled watercourse with water pumped for drinking purpose after treatment The water sensitive receptor is in proximity (within 50m) to the work sites The water sensitive receptor is an important habitat for aquatic flora and fauna with significant conservation status as per SRDB.
Medium	The water sensitive receptor is a controlled watercourse with water pumped for drinking purpose after treatment The water sensitive receptor is close (within 100m) to the work sites The water sensitive receptor is an important habitat for aquatic flora and fauna.
Low	The water sensitive receptor is an uncontrolled watercourse or drainage/ sewerage system The water sensitive receptor is close to the work sites (within 150m).
Negligible	The water sensitive receptor is an uncontrolled watercourse or drainage/ sewerage system The water sensitive receptor is close to the work sites (within 200m).

Table 26: Magnitude Criteria for Impacts to Water Quality

Category	Criteria Definition (For Negative Impacts)
Major	Significant degradation of water quality with predicted changes above the allowable limit to discharge to controlled/uncontrolled watercourse, and require immediate treatment Certain that there will be degradation of water quality, and certain or very likely that an incidence will occur under normal operating conditions. Impact likely to affect water quality during the construction and impact will last permanently (>10 years) after the construction Impact will affect beyond the Site footprints and to the entire reservoir No existing regulations and/or standards to effectively reduce the predicted impacts.

Moderate	<p>Moderate degradation of water quality with predicted changes near to the allowable limit to discharge to controlled/uncontrolled watercourse</p> <p>Likely that there will be degradation of water quality at the receiving waterbody</p> <p>Impact likely to affect water quality temporarily at some time under normal operation and last for more than a year after construction</p> <p>Impact will affect areas within Site footprints and some parts of the reservoir (>200m from the Site boundary)</p> <p>Limited existing regulations and/or standards available to effectively reduce the predicted impacts.</p>
Minor	<p>Slight degradation of water quality with predicted changes well below the allowable limit to discharge to controlled/uncontrolled watercourse</p> <p>Unlikely to but may occur at some time under normal operating conditions.</p> <p>Impact likely to affect water quality during construction and last temporarily for less than a year after construction</p> <p>Impact will affect receiving waterbody within the Site footprints and its immediate surroundings only (up to 50m from the Site boundary)</p> <p>Existing regulations and/or standards readily available to effectively reduce the predicted impacts.</p>
Negligible	<p>No change of water quality under normal operating conditions, and unlikely to occur even in exceptional circumstances</p> <p>No degradation of water quality</p> <p>Existing regulations and/or standards readily available.</p>

7.4.2 Water Quality Impact during Construction

No natural streams have been identified within the Project site or its area of influence. However, Upper Seletar Reservoir, located within CCNR, is approximately 150m away from the Project site across Mandai Road at its nearest point. Upper Seletar Reservoir is a protected water catchment area where raw water is pumped for treatment at PUB's waterworks to produce potable water. Any instances of uncontrolled surface runoffs occurring at the Project site may eventually flow into Upper Seletar Reservoir at locations closest to the Project site, and potentially affect the water quality in Upper Seletar Reservoir. This is of particular concern if surface runoff becomes contaminated with hazardous wastes such as oil, grease or other chemicals. It is understood that the PUB's water treatment plant was designed with buffer in the treatment threshold so the treatment plant will be able to treat the intake water if the concentrations are within the threshold. As such, considering the above, the **Sensitivity** of water quality impact receptors are assessed as **Medium**.

In consideration of the construction activities as detailed in Section 2.2, activities such as road construction and other general installation and construction works may potentially contribute to undesirable surface runoff if appropriate measures are not implemented. However, earth control measure (ECM) will be adopted to reduce the contamination of water. Apart from surface runoff, slurry from the pipejacking works during sewer construction poses a risk to nearby water catchments if improperly managed. The expected volume of slurry is relatively small and will likely be properly contained and treated, and potential risks to the nearby water catchments are limited. Given the relatively small scale of the related Project activities and short time duration, the potential water quality impacts associated with construction of the Project are therefore considered to be **Negative, Indirect, Temporary, Reversible, and Likely**. The Impact Magnitude is assessed to be **Minor**. As such, the **Impact Significance** of potential water quality impacts is assessed to be **Minor**.

7.4.3 Water Quality Impact during Demolition Works

As discussed in Section 7.4.2, the identified nearby water quality sensitive receptors are assessed to be of **Medium Sensitivity**, given that there are no natural streams present, but surface runoff eventually drains to Upper Seletar Reservoir.

Similar to construction works, demolition of the existing roads, drains and lampposts will utilize machinery and expose bare earth. The surface runoff from the Project site may increase turbidity of water, and carry debris, refuse, oil and grease, and other contaminants such as hazardous substances/chemical spillages that may impact water quality if it ends up in Upper Seletar Reservoir. This may be especially so during the demolition of the existing drains along Lorong Lada Hitam, which may introduce debris and soil directly into the drains. Measures are thus required to temporarily divert water away from the drains leading to Upper

Seletar Reservoir, or construction of temporary shoring, as opposed to conventional open-cut methods. General earth control measure (ECM) will also be adopted to reduce the contamination of water. Given the availability of mitigation measures and limited scale of the demolition works, the impact to water quality is considered to be **Negative, Indirect, Temporary, Reversible, and Likely**. The Impact Magnitude is assessed to be **Minor**. As such, the **Impact Significance** of potential water quality impacts is assessed to be **Minor**.

7.5 Biodiversity – Flora

7.5.1 Assessment Methodology

The assessment of sensitivity for flora is adapted from the general criteria described in Section 5.2 and is shown in Table 27. The magnitude criteria for flora is adapted from the general criteria described in Section 5.2 and is shown in Table 28. Impact significance will subsequently be determined by the impact assessment matrix shown in Section 5.4.1 using the respective evaluated categories for flora sensitivity and impact magnitude on flora.

Table 27: Sensitivity Criteria for Flora

Category	Criteria Definition
High	The vegetated area is considered to be of high ecological importance and / or is designated as a biodiversity conservation area. The vegetated area is considered very rare and /or has limited potential for substitution. There consists high density of native flora species and species with conservation concern (SRDB) or species that are otherwise deemed highly vital/keystone. The vegetated area has very limited or no capacity to absorb changes.
Medium	The vegetated area is considered to have ecological importance and / or is designated as a biodiversity conservation area / buffer of a biodiversity conservation area. The vegetated area is considered rare but has some potential for substitution. There consists moderate density of native flora species and species with conservation concern (SRDB). The vegetated area has limited capacity to absorb changes.
Low	The vegetated area is considered to have low ecological importance. The vegetated area is not considered rare and has potential for substitution. There consists low density of native flora species and species with conservation concern (SRDB). The vegetated area has moderate capacity to absorb changes.
Negligible	The vegetated area is considered to have no ecological importance. The vegetated area is not considered rare and has potential for substitution. There consists low density of native flora species and species with conservation concern (SRDB). The vegetated area is generally tolerant of and can accommodate proposed changes.

Table 28: Magnitude Criteria for Impacts to Flora

Category	Criteria Definition (For Negative Impacts)
Major	Impacts which extend far beyond the project boundary and/or affect CCNR overall Fundamental change to habitat that are permanent and irreversible and do not diminish upon cessation of project activities Change certain to occur under normal operating conditions No existing international/national/industry regulations and/or standards to mitigate impacts.
Moderate	Impacts which extend within the project boundary and up to 50m distance from the project boundary Detectable change to habitat that can be permanent or temporary, irreversible and do not diminish upon cessation of project activities Change very likely or likely to occur under normal operating conditions

	No existing international/national/industry regulations and/or standards to mitigate impacts.
Minor	Impacts which extend within the project boundary and up to 20m distance Minor temporary change to habitat that are reversible and diminish upon cessation of project activities Change likely to occur under normal operating conditions Several existing regulations and/or standards to adhere to that can effectively reduce the predicted impacts
Negligible	Impacts which extend within the project boundary only No perceptible change to habitat under normal operating conditions. Minor change to habitat may occur under exceptional circumstances Several existing regulations and/or standards to adhere to that can effectively reduce the predicted impacts

7.5.1 Impacts to Flora During Construction and Demolition Works

Habitat and Trees Loss

Majority of the forest within the study area will be left untouched; however, as described in Section 2.2, along the north-eastern boundary of the study area, there will be a 18m² encroachment into the forest edge as well as a 1.5m² encroachment (1.2m x 1.2m) into the nature reserve (Figure 23).

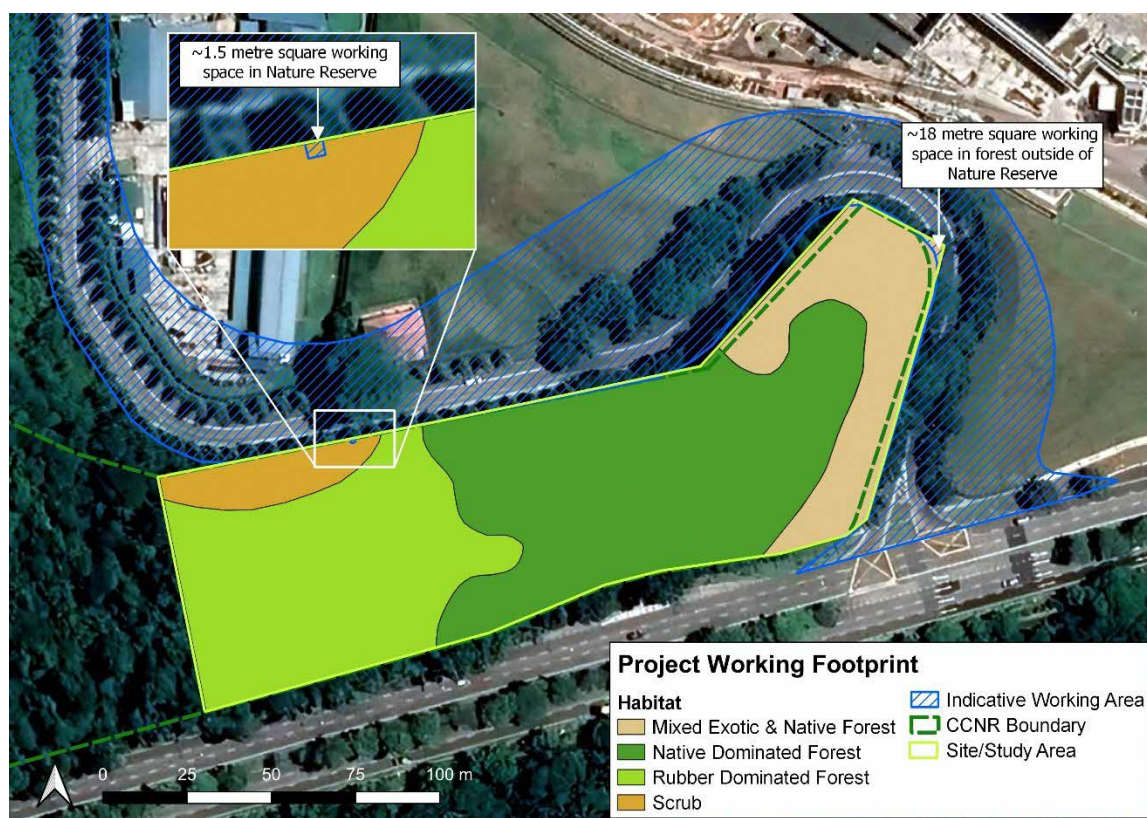


Figure 23: Areas of Habitat Loss due to Project

Within the 1.5m² encroachment into the nature reserve, the area consists of scrub habitat and no trees are expected to be affected. The small area of vegetation that will be cleared is of low conservation value (Figure 17) and is expected to be easily replaced/regenerated.

At the north-eastern boundary of the Site, 18m² of mixed forest edge within the EIS study area will need to be cleared, within which 1 tree (*Claoxylon indicum*; common) will need to be felled. Another 3 trees (all *Dillenia suffruticosa*; common) that are immediately adjacent to the proposed road reserve line may risk being damaged because of the construction works. However, this is deemed to be unlikely. All 4 potentially

affected trees within the study area are common and reside within the exotic and native mixed habitat. The affected habitat and trees are summarised in Table 29 and illustrated in Figure 24.

Additionally, the roadside vegetation along the existing Lorong Lada Hitam will also need to be cleared. There are critically endangered *Gnetum gnemon* trees but they are planted roadside trees and are thus not of conservation concern. The demolition works of the existing road and drains are not expected to incur any habitat loss, as the partial demolition and back-filling of the drains within the nature reserve will be done manually using jackhammers.

Table 29: Estimated Habitat and Trees Loss within EIS Study Area

Affected Habitat	Approximate Area Affected (m ²)	No. of tree loss (no. of CC species*)	No. of potentially damaged trees (no. of CC species)	Total no. of trees affected (no. of CC species)
Scrub (within nature reserve)	1.5	0 (0)	0 (0)	0 (0)
Exotic & Native Mixed Forest (outside nature reserve)	18	1 (0)	3 (0)	4 (0)

*Note: "CC species" refers to species of conservation concern, which means they either have threatened conservation statuses or are vital/keystone species.



Figure 24: Potentially Affected Trees

Most of the study area is within CCNR, which is Singapore's core biodiversity conservation area. The CCNR is considered a rare habitat in Singapore and is of high ecological importance. However, the study area is separated from the core CCNR forest by Mandai Road. As seen in Figure 17, there are patches within this forest, especially in the native dominated habitat, that has a higher density of native species as compared to naturalised and exotic species. However, there is also a large patch that is dominated by rubber trees, as well as patches of scrub. It should be noted that for the areas where vegetation is expected to be cleared lie

within the mixed exotic and native forest and scrub habitats. Potentially affected trees are common and none of them are of conservation concern. Hence, flora is considered to be of **Medium Sensitivity**.

Slight vegetation clearance is certain under normal operating conditions of the road widening works, with only 1 tree within the study area expected to be felled, and only 3 other trees that may potentially risk being damaged due to close proximity. Site clearance will take place only in areas assessed to be of relatively low conservation value. Tree felling may also lead to secondary ecological effects such as edge effect and wind damage. However, the affected trees are found at the edge of the forest and are not likely to experience any significant increase in edge effects. The strongest winds experienced in Singapore come from the Site, there are existing gaps and trees downstream are expected to be resilient to strong winds and are unlikely to experience wind damage. Moreover, the area of clearance is very small (about 19.5m²) compared to the extent of the forested area. In Singapore's context, site reinstatement is required for all construction works after completion. Hence, trees felled during construction will be replanted upon completion of construction where possible. During partial demolition and backfilling of the existing drain between the forest and road, there may be some damage to tree roots that are near the existing drain. However, based on the distribution of trees within the study area (see Figure 17), the occurrence of tree roots in such close proximity to the existing drain are expected to be limited, and root damage is assessed to be unlikely and limited if any. Natural restoration in the long term is also expected as clearance is adjacent to the remaining forested area. Hence, trees and habitat loss are expected to have **Negative, Direct/Indirect, Temporary, Reversible and Likely** impacts on flora and the **Impact Magnitude** is considered to be **Minor**. Hence, **Impact Significance** of habitat and trees loss on flora is assessed to be **Minor**.

Impacts from Change in Water Quality and Supply

As described in Section 7.3.2 and 7.4.2, during vegetation clearance and slope excavation, contaminants such as debris and refuse may be introduced into the environment. Use of machinery may also introduce oil, grease, and other hazardous substances. Surface runoff may carry these contaminants which may infiltrate into the soil and get absorbed by plants, potentially affecting their fitness. However, there are existing embedded controls to reduce any pollution of water and contaminants introduced are likely to be very limited. Slope excavation reduces the land mass and vegetation clearance may decrease rate of water infiltration into the soil, reducing water supply to remaining trees and vegetation. However, slope excavation is only expected on the side of the road opposite from the forest and is highly unlikely to affect the Site and flora of CCNR. The area within the EIS study area which is to be cleared is very small (<1%) as compared to the entire extent of the study area and any impact is likely to be localised at the area where clearance/excavation is carried out. Hence, changes in water supply and quality are expected to have **Negative, Indirect, Temporary, Irreversible and Unlikely** impacts on flora and the **Impact Magnitude** is considered to be **Negligible**. With **Medium Sensitivity** of flora, **Impact Significance** is assessed to be **Negligible**.

Change in Slope Stability and Soil Compaction

As described in Section 7.3.2, excavation and removal of vegetation during construction may cause slope instability and increase soil erosion causing trees to fall. Introduction of machinery into vegetated area can also cause soil compaction, reducing space for roots growth. However, soil compaction is expected to be localised and kept within the working areas. There will be no slope-cutting within the nature reserve and trees are not expected to be unstable or fall. Very few trees are felled as compared to the number of trees that will be retained and the roots of remaining trees will hold onto loose soil.

The existing roadside drains along the nature reserve will be partially demolished manually. Given that only the top section of the drains will be demolished, it is unlikely for any soil collapse to occur in which flora near or within the nature reserve will be affected or lost. Vibration from the jackhammers and other machinery may loosen the soils in the area slightly, but this is expected to be local and have minimal impacts on flora.

As described in Section 7.3.2, there are existing embedded controls in Singapore to minimise occurrence of slope failure and soil erosion. Change in slope stability and soil compaction is expected to have **Negative, Indirect, Temporary and Reversible and Unlikely** impacts on flora and the **Impact Magnitude** is considered to be **Negligible**. With **Medium Sensitivity** of flora, **Impact Significance** is assessed to be **Negligible**.

7.6 Biodiversity – Fauna

7.6.1 Assessment Methodology

The assessment of fauna sensitivity is adapted from the general method described in Section 5.2, and is detailed in Table 30 below. The magnitude criteria for impacts to fauna is adapted from the general criteria in Section 5.3, and is shown in Table 31. Impact significance will subsequently be determined by the impact assessment matrix shown in Section 5.4.1 using the respective evaluated categories for fauna sensitivity and impact magnitude on fauna.

Table 30: Sensitivity Criteria for Fauna

Category	Criteria Definition
High	Fauna species with CR and EN SRDB (2008) statuses, or species that are otherwise deemed highly vulnerable/vital/keystone will be affected by the changes to the surroundings. Affected species are not expected to be able respond to or tolerate said changes to avoid harm.
Medium	Fauna species with CR and EN SRDB (2008) statuses, or species that are otherwise deemed vulnerable/vital/keystone will be affected by the changes to the surroundings, but are likely to be able respond to or tolerate the said changes to avoid harm. OR Fauna species with VUL SRDB (2008) status, or species that are otherwise deemed somewhat vulnerable/vital/keystone will be affected by the changes to the surroundings. Affected species are not expected to be able respond to or tolerate said changes to avoid harm.
Low	Fauna species with VUL SRDB (2008) status, or species that are otherwise deemed somewhat vulnerable/vital/keystone will be affected by the changes to the surroundings. Affected species are expected to be able respond to or tolerate said changes to avoid harm. OR Only fauna species not classified as threatened by the SRDB nor deemed to be otherwise vulnerable/vital/keystone will be affected by the changes to the surroundings. Affected species are not expected to be able respond to said changes to avoid harm.
Negligible	Only fauna species not classified as threatened by the SRDB nor deemed to be otherwise vulnerable/vital/keystone will be affected by the changes to the surroundings. Affected species are likely to be able respond to or tolerate the said changes to avoid harm.

Table 31: Magnitude Criteria for Fauna

Category	Criteria Definition (For Negative Impacts)
Major	Fundamental change to the fauna habitats affecting large areas of CCNR/WNP and beyond that result in long term or permanent impacts, requiring decades or centuries to return to baseline conditions. Would affect multiple fauna species and threaten the survival of sensitive native fauna population(s); community structure will likely be altered and there will be damage to the ecosystem. Certain or very likely that impacts/incidences will occur under normal operating conditions. Increase in the risk of injuries and/or deaths of sensitive fauna species such that multiple such incidences are likely and can be expected to occur as a result of normal operations.
Moderate	Detectable change to the fauna habitats up to a 200m radius of the impact source resulting in reduced resources and subsequently reduced fitness of affected species, but is not expected to threaten the survival of the affected populations. Only small, reversible impacts are expected on the community and ecosystem level. Impacts/incidences likely to occur at some time under normal operating conditions. Increase in the risk of injury and/or death of sensitive fauna species such that few of such incidences are likely to occur as a result of normal operating conditions.
Minor	Detectable but small impacts to fauna habitats within close proximity (about 50m radius) from the impact source, resulting in local and temporal disturbances to few species. Impacts/incidences unlikely to but may occur rarely under normal operating conditions.

	Increase in the risk of injury and/or death of some sensitive fauna species such that such an incident is possible but unlikely to occur as a result of normal operating conditions.
Negligible	Negligible change is predicted to the environmental conditions assessed. Fauna are expected to be unaffected. Risk of injury or death to sensitive fauna is expected to be mostly unchanged and no incidents are expected occur under normal operating conditions, but may occur in exceptional circumstances.

7.6.2 Impacts to Fauna During Construction and Demolition Works

Habitat Clearance

There will be a slight loss of scrub at the north-west of the site and loss of forest edge habitat north-eastern boundary of the study area. During the clearance, animals may be injured or killed if they are present in those areas. The remaining forest area after construction will also be slightly smaller and fauna in that area may have less habitat and resources available.

From the baseline surveys, the fauna present in the forest adjacent to the road works are mostly not considered to be nationally threatened according to the SRDB (2008) and other more recent literature. Only the Wagler's Pit Viper is considered to be an uncommon resident, listed as Endangered in the SRDB (2008). Snakes are mobile but some species may tend to stay still to avoid detection, which makes them vulnerable to injury or death during tree clearance. Incidentally, all 3 species of snakes observed in the study area were at the eastern and northern edges of the forest, near where the slight forest clearance is expected. However, the snakes are able to inhabit the rest of the forest areas and may not necessarily be present at the clearance areas. The clearance will only remove small amounts of edge habitat, and any affected animals can be expected to move to the remaining forest in the study area, as well as the rest of the contiguous forest areas to the west. There are few threatened fauna species in the area, and the fauna have a reasonable capacity to tolerate the slight habitat loss, hence the **Sensitivity** of fauna is assessed to be **Low** in this case.

The vegetation clearance will be limited to a small areas at the forest edge. Injury or death to individual animals may occur during clearance, demolition, and construction works but this is considered unlikely as the site will be hoarded up after clearance. Fauna present at the study area will most likely persist as before after the small loss in secondary forest edge and scrub areas. Therefore, the impact of habitat clearance is **Negative, Direct, Localised, Permanent/Temporary, Reversible** and **Likely**. Due to the relatively small scale of habitat loss and alteration, the **Magnitude** is assessed to be **Minor**.

Impact of habitat clearance on fauna is thus assessed to be of **Negligible Significance**. Despite the Negligible Impact Significance, pre-felling inspections and fauna management plan still need to be implemented as part of the EMMP (see Section 8) to minimize the likelihood of any fauna being harmed by the clearance activities.

Noise impacts to fauna

The road widening works will involve removal of some existing vegetation and infrastructure, excavation, cut and fill, demolition, and paving of the new road using machinery and vehicles. These will generate noise which will disturb the fauna present in the study area.

The impact of the resulting noise on terrestrial fauna can be difficult to quantify and assess, as several studies have shown that as different species react differently to varying levels and types of noise. Despite this, numerous impacts have been identified by studies, some show that animals avoid noise sources and fauna diversity often decreases temporarily; noise as low as 40 dB SPL can cause a local decline in songbird species diversity (Proppe et al., 2013). Noise emissions from the project can also affect avifauna, amphibians, invertebrates and primates by masking vocalisations that they use for communication, mate attraction, prey detection, predator detection, and spatial orientation (Kight & Swaddle, 2011; Morely et al., 2014; Shannon et al., 2015). Increased noise can also cause fauna to become irritable and restless, affecting food intake, social interaction and parenting (Newport et al., 2014).

Noise from construction and demolition can potentially result in reduced fitness and reproductive success for some animals in the forest areas adjacent to construction at Lorong Lada Hitam; vocal animals are more likely to be affected, and some mobile animals may leave the areas where noise levels are elevated. The

vocal animals like birds and amphibians that reside there are generally expected to be tolerant of noise disturbance as most of them can often also be found near urban and degraded habitats with considerable anthropogenic noise. However, it is recognised that the study area is part of CCNR, and it is possible that fauna of conservation concern that were not detected in the survey do use the area occasionally. The fauna **Sensitivity** to noise is therefore assessed to be **Medium** as most species are expected to be able to tolerate or move away from the increase in noise levels to adjacent habitats.

Severe impacts to fauna as a result of the noise from construction and demolition activities is unlikely as the duration of exposure is temporary. Construction will only take place in the day, and thus the activities of nocturnal animals will probably not be affected. The immediate habitat surrounding the noise sources may become less preferential for some animals, and a slight decrease in species richness or abundance may be observed, but fauna diversity within the forest between Lorong Lada Hitam and Mandai Road will likely be unchanged. Overall, the noise emissions are expected to cause **Negative, Direct, Temporary, Reversible** and **Likely** impacts to fauna, resulting in only small, local and temporal disturbances to some species. As such, the **Magnitude** of impacts of noise to fauna is assessed as **Minor**.

The impacts of noise impacts on fauna during construction is thus assessed to be **Minor Significance**.

Human-Wildlife Conflict

Any encounters with wildlife have the potential to escalate into serious conflicts if the situation is not handled appropriately. This can plausibly result in serious injuries from situations such as getting bitten by long-tailed macaques, snakes, or charged by wild pigs. However, such human-wildlife conflict situations are uncommon and low in frequency in Singapore, due to good practice implementation during construction. Conflicts only tend to occur when the flight or fight response in animals is triggered when they get threatened; when animals are unable to flee, a situation with physical conflict may arise. As such, despite the risk of either party getting injured, it is unlikely that an incident of grievous harm will take place under normal circumstances.

Some of the animals in the area may be misunderstood by humans; encounters with animals, particularly snakes, lizards, frogs or bats may elicit negative or even violent responses by workers and personnel on site that may injure or kill the animal. The risk of encounters, however, is low as the construction area is expected to be hoarded up. Encounters within the construction area are still possible as a Black Spitting Cobra was observed within the existing roadside drain during the baseline surveys. Workers and staff will therefore need to be aware of such risks within the site. For partial demolition and backfilling of the existing drain near or within the nature reserve, works will be done manually outside of the hoarded construction area. This increases the risk of encountering wildlife and consequentially human-wildlife conflict. However, this is still unlikely as this partial demolition works will be over a short period of time, and most animals in the area are expected to be able to escape harm.

Encounters are not limited to the construction area and can also occur along Lorong Lada Hitam or Mandai Road as well. Related to the next sub-section on the risk of roadkill, animals such as the wild pig or feral dogs may sometimes roam along roads and may pose a risk to vehicle traffic. This happens when individuals or herds of wild pigs dash across roads unexpectedly, causing drivers to take evasive actions which may result in accidents. Additionally, other forms of HWC such as animals raiding rubbish bins or food storage can potentially occur if stringent waste management measures to securely store and dispose of food and waste are not adopted. Long-tailed macaques were observed in the study area and were noted to feed on food left out for feral dogs. These macaques may have learnt to associate certain cues such as plastic bags or take away containers with food and attempt to snatch these items from the construction site when works begin. Such interactions may become a regular occurrence if not adequately managed and may escalate into confrontational encounters, potentially putting both parties in harm's way. Within the study area, food waste and litter were observed in the forest as well, and measures must be taken to prevent further pollution in the forest which may harm the wildlife.

While incidences of human-wildlife conflict can inflict serious harm or even cause death on rare occasions, only individuals are affected, and it is not expected to result in any population or community level damage. However, if food and waste are not managed adequately, conflict with the local group of Long-tailed

Macaques may come regular. The impact is expected to be **Negative, Direct, Localised, Temporary, Reversible and Unlikely**. Therefore, the **Magnitude** of the impact of human-wildlife conflict is assessed to be **Moderate**.

Most animals near the construction area that may become involved in human-wildlife conflict do not have threatened conservation statuses, and both human and animals have some reasonable capacity to react to the situation in most cases such that no significant injury or death will result. Therefore, the **Sensitivity** of both the humans and wildlife are assessed to be **Low** in the context of human-wildlife conflict. Therefore, the **Significance** of this impact has been evaluated as **Minor**.

Despite the Negligible Impact Significance, strict measures for good housekeeping, proper food and waste management and education for wildlife encounters still need to be implemented as part of the EMMP (see Section 8) to minimize the likelihood of human-wildlife conflict occurring.

Roadkill

During construction, only one lane of Lorong Lada Hitam will be kept open. There will most likely be hoarding installed between the forest and the road, which will mostly prevent any roadkill along Lorong Lada Hitam. Access to the construction site will be via Mandai Road, which has forests to its north and south. Animals have been recorded crossing Mandai Road and some unfortunately end up as roadkill. Animals that have become victims of roadkill on Mandai Road include the Sambar Deer, Wild Boar, Pangolin and Leopard Cat. Many of these species are not adapted to react quickly enough to oncoming vehicles and will not be able to avoid becoming roadkill. Several of these species from the nature reserves are of high conservation status; the Sunda Pangolin and Leopard Cat are considered Critically Endangered. However, such reported incidents are few and far between, possibly indicating that animals may not frequently attempt to cross Mandai Road, or that animals have some capacity to avoid getting hit by vehicles. Therefore, the **Sensitivity** of the fauna is assessed to be **Medium** in this case.

While the construction works will require heavy vehicles to transport equipment and materials onto site regularly via Mandai Road, the increase in traffic relative to the existing traffic will not be significant as Mandai Road experiences heavy traffic daily with many heavy vehicles on the road. Construction works will also take place in the day and nocturnal animals, which tend to be more vulnerable to becoming roadkill, are not likely to be affected by the increase in traffic from this project. The increase in risk of roadkill as a result of the vehicles is therefore expected to be insignificant. The impact is expected to be **Negative, Direct, Localised, Temporary, Irreversible and Very Unlikely**; the impact **Magnitude** is assessed to be **Negligible**. Thus, the impact significance of the construction works on roadkill is assessed to be **Negligible**.

7.7 Waste Impact

7.7.1 Assessment Methodology

The assessment of the potential impacts from waste generation first requires the identification of the potential sensitive receptors of such an impact. The sensitivity criteria for waste management then follows the general criteria in Section 5.2 shown in Table 15. The magnitude criteria for impacts to waste management follow the general criteria in Section 5.3 shown in Table 18. Impact significance will subsequently be determined by the matrix shown in Table 19, using the evaluated sensitivity and impact magnitude on waste management.

7.7.2 Waste Generation during Construction and Demolition Works

Sensitive receptors identified that are potentially affected by waste generated from the Project site are mainly cyclists, pedestrians / commuters along the Mandai Park Connector and the nearby Ulu Sembawang Park Connector. However, users of the park connector network are likely to only be passing by and be temporarily exposed to any potential impacts from waste generation at the Project site. As such, the impact from waste generation during construction is assessed to be of **Low Sensitivity**.

The Project's activities, as detailed in Section 2.2, include cutting and filling of slope along the eastern boundary of the site, site clearance, demolition of existing structures, road construction and other features associated with road construction such as kerbs and drainage etc. However, it is anticipated that there will be relatively minimal site clearance and earthworks to achieve the platform levels required for the Project construction. Construction and demolition activities for this Project may result in waste generation from the following sources:

- Excavated material from the existing ground including from slope-cutting along eastern boundary;
- Broken rock / concrete from the demolition of the existing drain, lamp post or the concrete base of the lamp post;
- Packaging/wrapping/containers (plastic, cardboard, paper, metal, wood etc.) from transported construction materials such as the UPVC Scupper Pipes;
- General wastes (sewage, food, paper, plastic, metals and other packaging etc.) relating to site workers; and
- Oil and lubricants, and other chemical waste.

During the construction and demolition works of the Project, the majority of waste is anticipated to come from excavated material from the existing ground and in particular, slope-cutting. Significant waste volumes are also expected to come from broken rock / concrete from the demolition of existing infrastructure and vegetation clearance. There will also be an increase in the presence of humans in the area, mostly comprising construction workers, which could also potentially generate wastes and sewage.

Hazardous wastes are also expected to be generated from the construction site due to the use of diesel and lubricants for machinery. Hazardous waste has the potential to pose environmental issues such as air, water and land pollution unless they are handled, stored, transported, treated and disposed of in an appropriate manner. Estimates of the quantities are not available at the time of writing this report.

The inappropriate management of waste has the potential to result in direct and indirect adverse impacts to the environment. These include the creation of odour if waste is not collected regularly, windblown litter, and water quality impact if the waste enters water courses through runoff, as well as visual impacts. In addition, disease vectors and scavenging animals may be attracted to the construction sites if the non-hazardous wastes are incorrectly stored on-site. This is particularly crucial given the location of the Project site within CCNR, and its proximity to the main tract of the CCNR forest. The sensitive receptors are the residents in the vicinity of the Project that may potentially experience the above conditions.

There is good practice in waste management in Singapore that require contractors to segregate waste for composting, recycling, disposal or sent for treatment by licensed toxic waste collectors. No soil contamination is expected at the site that may require remediation or a special landfill / dumping ground.

Overall, the likelihood of impacts from non-hazardous waste is likely to happen under normal operation of the construction. However, the volume of wastes generated is expected to be relatively low considering the scale of the Project and its construction duration. The potential impacts from waste associated with construction of the Project are therefore considered to be **Negative, Direct and Indirect, Temporary, Reversible, and Likely**. The impact magnitude is assessed to be of **Minor Magnitude**. Therefore, the impact of waste generation from the Project is expected to be of **Negligible Significance** to the receptors.

8 ENVIRONMENTAL MONITORING AND MANAGEMENT PLAN (EMMP)

The Environmental Monitoring and Management Plan (EMMP) will serve as a reference manual for implementing appropriate mitigation measures and monitoring procedures during project construction. It provides the basis for more technical method statements that will explain how the EMMP's recommendations will be implemented. The EMMP is designed to be updated and amended by the Contractor as additional information becomes available through the design process and government agency consultation.

The implementation of the EMMP shall include the engagement of qualified specialists, subcontractors and service providers to supply labour, equipment and professional services for the environmental management and monitoring works, in compliance with the standards, guidelines and procedures prescribed in the EIS Section 3 and detailed in the EMMP.

Table 32: Proposed Mitigation Measures and EMMP Requirements

Ref.	Environmental Impacts	Recommended Mitigation Measures	Implementation Agent	Implementation Phase*			Compliance
				P	C	O	
Note*: P= Planning; C= Construction, O = Operation							
1	Air quality	<ul style="list-style-type: none">▪ Applying water to excavation areas, soil loading/unloading areas and unpaved roads;▪ Covering soil stockpiles with erosion control blankets;▪ Using hoarding to attenuate winds and therefore reduce likelihood of wind-blown dust;▪ Implementing speed controls on-site;▪ Employ dust suppressors (e.g., atomized spray systems) during all demolition works▪ Ensuring that the cab of all soil storage trucks is covered with tarpaulins;▪ Water spraying regularly for dusty static construction areas/ materials/ operations;▪ Controlling lorries loading capacity to avoid spillage;▪ Engaging an ECO to follow up on Air Quality control measures under the Code of Practice for Environmental Control Officers;▪ Ensuring that trucks used on site comply with the EURO V emission standards for NOx and PM10 as specified in the EC Directive 98/69/EC-B (2005) for passenger cars and light duty vehicles, and EC Directive 1999/96/EC-B1(2005) for heavy vehicles with maximum laden weight more than 3,500 kg;▪ Ensuring construction machinery used complies with the USEPA Tier 2 emission standards for NOx and PM10;▪ Maintaining all machinery, including excavators and gen-sets regularly, to minimize smoke and dust exhaust emissions;	<ul style="list-style-type: none">▪ Contractor▪ ECO		x		Environmental Protection and Management (Vehicular Emissions) Regulations

Ref.	Environmental Impacts	Recommended Mitigation Measures	Implementation Agent	Implementation Phase*			Compliance
				P	C	O	
		<ul style="list-style-type: none"> Using Ultra Low Sulphur Diesel Fuel with a maximum sulphur concentration of 15 parts per million for diesel run construction equipment; Fully switching off vehicles when they are not in use. 					
		<ul style="list-style-type: none"> Monthly site inspection. 	<ul style="list-style-type: none"> Contractor ECO Independent EMMP Consultant 		x		
2	Noise	<ul style="list-style-type: none"> Noise barrier of at least 3m height and Sound Transmission Class (STC) rating of at least 26 to be erected between the construction site and CCNR/ EIS study area; Jackhammers used in manual demolition are to be fitted with mufflers or silencers; Engaging an ECO to follow up on Noise pollution control measures under the Code of Practice for Environmental Control Officers; Scheduling vehicle movement to avoid accumulated noise from vehicles; Providing silencer for noisy equipment/ machinery; Adopting good practice for construction site – regular maintenance of vehicles and machinery, proper training to operators. 	<ul style="list-style-type: none"> Contractor ECO 		x		Code of Practice for Environmental Control Officers Environmental Protection and Management (Control of Noise at Construction Sites) (Amendment) Regulations 2011
		<ul style="list-style-type: none"> Monthly site inspection Continuous monitoring during the construction to ensure the noise levels do not exceed the stipulated noise limit. 	<ul style="list-style-type: none"> Contractor ECO Independent EMMP Consultant 		x		
3	Soil Erosion	<ul style="list-style-type: none"> Maintaining a gentle slope during site clearance and earthwork/ soil cutting to prevent slope failure; Measures such as geotextile or temporary retaining structures/walls should be put in place during the site clearance, tree/root removal, demolition, and earth cutting works to prevent slope failure and soil erosion; Engaging of QP to design temporary earth retaining structure and permanent retaining wall at relevant locations to prevent slope failure during construction; Engaging a Qualified Erosion Control Professional (QECF) to design Earth Control Measures (ECM) including a discharge treatment system. 	<ul style="list-style-type: none"> Contractor QECF ECO 	x	x		<p>Environmental Protection and Management Act</p> <p>Environmental Protection and Management (Trade Effluent) Regulations</p> <p>Code of Practice for Environmental Control Officers</p>

Ref.	Environmental Impacts	Recommended Mitigation Measures	Implementation Agent	Implementation Phase*			Compliance
				P	C	O	
							Code of Practice on Surface Water Drainage Code of Practice on Surface Water Drainage
		<ul style="list-style-type: none"> Monthly site inspection. 	<ul style="list-style-type: none"> Contractor ECO Independent EMMP Consultant 		x		
4	Water Quality	<ul style="list-style-type: none"> The site clearance and earthwork should be planned in phases to minimise the surface area that is being exposed at any one time, and the runoff from the exposed area is within the capacity of the ECM; Installation / construction of temporary shoring should be undertaken to minimize disturbance and encroachment into the immediate vicinity of the adjacent nature reserve areas; Proper drainage system should be designed to accommodate additional runoff from the site during different stages of the construction works; Capacity of the existing downstream drainage along Mandai Road that will take additional runoff from the site should be reviewed to ensure sufficiency. If the existing downstream drainage capacity is not sufficient, additional drainage should be provided to prevent flooding at the downstream areas; Contractor is to ensure the discharge treatment system of the ECM proposed by a QECP is reviewed before implementation. This will ensure the treatment method is suitable and adequate. The ECM must be submitted to and approved by PUB; Separate drainage systems should be provided for contaminated water if there is any, and for storm water runoff during construction. All areas in the construction site where potential sources of wastewater or contaminated runoff should be paved and provided with appropriate bunds to enable the wastewater and contaminated storm water from the entire site to be directed to an onsite settling pond. Contaminated water should be treated prior to discharge into public drainage or sewer; Any slurry from pipejacking for sewer construction must be properly contained and treated. Appropriate secondary containment/bunds should be provided for any treatment plants onsite to prevent slurry spillage into the environment. Any spills should be cleaned up immediately; 	<ul style="list-style-type: none"> Contractor QECP ECO 	x	x		Environmental Protection and Management Act Environmental Protection and Management (Trade Effluent) Regulations Code of Practice for Environmental Control Officers Code of Practice on Surface Water Drainage Code of Practice on Surface Water Drainage

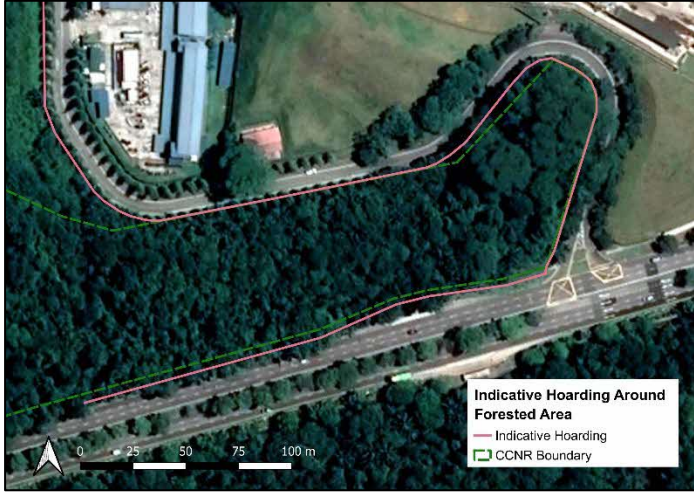
Ref.	Environmental Impacts	Recommended Mitigation Measures	Implementation Agent	Implementation Phase*			Compliance
				P	C	O	
		<ul style="list-style-type: none"> Existing drains undergoing demolition should be diverted or blocked to prevent debris, soils, or contaminated runoff from being discharged into downstream drains; A TSS meter and CCTV camera should be installed at the entrance to any public drains on-site. This is to ensure that parameters of any discharged water are below allowable limits for discharge to public drainage or watercourse, or within permissible levels in any approval letter; Soil stockpiles should be covered with erosion control blankets at the end of each working day; A washing bay should be installed to prevent dust from exiting construction sites. Any collected water should then either be re-used in the washing facility or disposed of after being treated by ECM; Concrete trucks and other equipment should be washed out to prevent concrete from hardening within. This washout should not be discharged directly into any drainage system but collected as wastewater for treatment; Humps should be installed at the site entrances to prevent any silted storm water from exiting via this pathway; Bare earth areas should be isolated with silt fences, and bare earth area should be covered after work; Access path, road or site office area, if any, should be paved up; Any chemical containers being used on site outside of the storage area must be placed inside a secondary containment vessel with sufficient capacity to handle the spilled volume. Water-proof sheets must be used to cover the secondary containment in rainy periods to prevent spill-over; Emergency response equipment, e.g. spill kits, absorbent booms, clean spade and buckets must be well-prepared for use and be in close vicinity to the chemical storage area; and Regularly inspect and clean out in-ground wedge pits should be conducted to maintain adequate sediment holding capacity. 					
		<ul style="list-style-type: none"> Daily monitoring of turbidity of discharge water/tank during the construction period should be carried out on site. 	<ul style="list-style-type: none"> ECO 		x		
5	Habitat and Trees Loss	<p>A flora specialist and/or an ISA certified arborist should be engaged to adopt the following mitigation measures:</p> <p>Before vegetation clearance</p>	<ul style="list-style-type: none"> Contractor ISA certified Arborist EMMP Consultant/ Flora Specialist 	x	x		Parks and Trees Act

Ref.	Environmental Impacts	Recommended Mitigation Measures	Implementation Agent	Implementation Phase*			Compliance
				P	C	O	
		<ul style="list-style-type: none">▪ Flora specialist to assess the vegetation (including trees, shrubs, climbers, saplings and seedlings) found within the proposed worksite (proposed road reserve line) to identify flora species with conservation concern. Flora Specialist and Contractor to discuss with NParks about salvaging any trees, saplings or seedlings of conservation concern;▪ Flora specialist and Certified arborist to verify and assess the trees within 5m of the worksite (proposed road reserve line) boundary that may be affected by the construction, especially impact to tree roots due to excavation/demolition/drainage works.▪ Arborist is to recommend and tree conservation or protection measures necessary for retained trees within 5m of the boundary, including a tree protection zone (TPZ) plan to recommend the dimensions of the TPZ required. Contractor is to implement the measures and adhere to the arborist recommendations strictly;▪ Prepare and submit a tree felling/ transplanting plan (if needed) and detailed method statement to NParks for approval;▪ Educate workers on the importance of vegetation in the CCNR and remind workers to carry out works in a careful manner. <p>During vegetation clearance</p> <ul style="list-style-type: none">▪ ISA certified arborist to supervise transplantation, seedling salvaging and tree felling. <p>Before Demolition Works</p> <ul style="list-style-type: none">▪ Prior to demolishment of the existing road and drains, the Contractor is to engage an ISA-certified arborist to inspect the trees along the drain along the northern boundary of the Study Area to identify any areas where there may be potential damage to nearby tree roots. Trial-trenches to investigate the extent of roots shall be undertaken if deemed necessary by the arborist. <p>During Demolition Works</p> <ul style="list-style-type: none">▪ For all areas with risk of root damage identified, demolition shall be conducted manually and carefully, or as otherwise advised by the arborist, with arborist standing supervision if necessary. This will help to avoid or minimize any damage to tree roots.					

Ref.	Environmental Impacts	Recommended Mitigation Measures	Implementation Agent	Implementation Phase*			Compliance
				P	C	O	
6	Impacts to Flora – Change in Water Supply and Quality	After construction <ul style="list-style-type: none"> Discuss with NParks / relevant parties regarding the species to be replanted; ISA certified arborist to supervise tree replanting. <p>The Contractor shall be held solely liable as per Parks and Trees Act, for any additional tree damage/removal, tree root pruning/cutting, crown pruning outside the EIS-predicted tree impacts without prior agreement from the Client and relevant agencies.</p>					
		<ul style="list-style-type: none"> Post construction arborist weekly inspection of replanted and surrounding trees health (3 months), cost to be borne by contractor 	<ul style="list-style-type: none"> Contractor ISA certified arborist 			x	
		<ul style="list-style-type: none"> If trees look dehydrated during the monthly site inspection, watering should be carried out to prevent long-term damage; If trees look sick during the monthly site inspection, to engage arborist to inspect tree health and propose treatment if deemed necessary, cost to be borne by contractor; There shall be no storage of construction materials, soil stockpiles, parking of vehicles and placement of emission sources (e.g. Gen-sets) inside the TPZ of concerned trees. Substances detrimental to tree health (i.e. chemicals, oils/lubricants, fuels and cement and paint) shall be kept away, stored and mixed at least 2.5m from the TPZ of conserved trees; Secondary containers with enough capacity should be provided to contain any spills, and lids of containers should be closed whenever not in use to prevent spillage. ECM measures should be put in place to reduce contamination of surface run-off. 	<ul style="list-style-type: none"> Contractor ISA certified arborist 		x		
7	Impacts to Flora – Change in Slope Stability and Soil Compaction	<ul style="list-style-type: none"> Monthly site inspection. 	<ul style="list-style-type: none"> Contractor ECO Independent EMMP Consultant 		x		
		<ul style="list-style-type: none"> Tree felling, demolition works, and any slope cutting/filling are to be carried out in a systematic manner such that slope stability is maintained. Temporary shoring and ERSS to be implemented where necessary. If any area appears to be prone to soil erosion, earth control measures (ECM) should be adopted to minimise its occurrence; Tree protection zone to be set up and machinery to be kept within working area. 	<ul style="list-style-type: none"> Contractor BCA/ Design Team 		x		

Ref.	Environmental Impacts	Recommended Mitigation Measures	Implementation Agent	Implementation Phase*			Compliance
				P	C	O	
		<ul style="list-style-type: none"> Monthly site inspection. 	<ul style="list-style-type: none"> Contractor ECO Independent EMMP Consultant 		x		
8	Impacts to fauna - Habitat Clearance	<ul style="list-style-type: none"> Pre-clearance inspection are to be carried out to check the trees and vegetation to be felled for any nesting or roosting animals within 3 days prior (ideally immediately) to clearance and/or hoarding up. Particular attention should be paid to detect any snakes in the areas to be cleared or demolished. Any animals found should be either shepherded away, relocated, or allowed to complete their nesting whichever is deemed appropriate by the EMMP consultant's fauna specialist; Hoarding/noise barrier should be erected to completely surround the worksite after clearance to prevent animals from accessing the construction areas/Lorong Lada Hitam. No gaps are to be allowed between the panels of the hoardings; Hoardings are to extend at least 300mm into the ground. Any access gates must be flushed as close to the ground as possible when closed; A Fauna Management Plan should be developed and implemented to instruct all personnel on site to minimize encounters and react appropriately to fauna encounters, as well as emergency procedures; All personnel are to be briefed about the fauna present on site and the Fauna Management Plan; Following completion of road widening and associated works, site reinstatement including replanting of any bare areas shall be conducted wherever applicable and in consultation with NParks and the EMMP consultant. 	<ul style="list-style-type: none"> Contractor EMMP Consultant Fauna Specialist 	x	x	x	Wild Animals and Birds Act
9	Impacts to fauna - Noise	<ul style="list-style-type: none"> Noise mitigation measures are described in item No. 2 above. 	Contractor		x		
10	Impacts to fauna – Human Wildlife Conflict	<ul style="list-style-type: none"> No feeding, touching, catching or harming of any wildlife is allowed; Hoarding/noise barriers are to be installed completely around the work areas with no gaps between the hoarding sheets or the ground; Fauna Management Plan shall be developed by the EMMP consultant's fauna specialist and implemented by the contractor; All ECB used in the project shall be plastic-free, wildlife friendly and fully biodegradable. This is to avoid trapping snakes and other animals in the mesh of the ECB; 	<ul style="list-style-type: none"> Contractor EMMP Consultant Fauna Specialist 		x		

Ref.	Environmental Impacts	Recommended Mitigation Measures	Implementation Agent	Implementation Phase*			Compliance
				P	C	O	
		<ul style="list-style-type: none"> All personnel are to be briefed about the fauna present on site and the Fauna Management Plan by the EMMP Consultant Fauna Specialist; Workers and personnel are to be trained by the EMMP Consultant Fauna Specialist to conduct daily visual inspections of the existing drains and working areas before starting works or demolitions; Proper housekeeping shall be undertaken at all times to ensure neat storage of materials and stockpiles, appropriate storage of food and waste; Food/food containing belongings are to be stored securely in locked containers/cabinets where wildlife cannot access; Food waste is to be stored in monkey-proof bins and cleared daily; Consumption of food and drinks (including snacks and takeaway drinks) are to be strictly restricted to designated enclosed dining areas to be set-up away from the forest areas. Dining areas shall not be accessible to animals like monkeys. Dining areas are to be maintained and cleaned at all times; All personnel are to be prohibited from entering the forest patch adjacent to the worksite at any time. Any feeding and touching of animals (including Feral Dogs) are strictly prohibited; No littering within the forest patch adjacent to the worksite at any time. 					
11	Impacts to fauna – Roadkill	<ul style="list-style-type: none"> All personnel are to visually inspect work areas for animals before starting work every morning or after any breaks; Monthly site inspection to check on measures; and Keep and timely submit all records of any human-wildlife conflict to the EMMP consultant. 	<ul style="list-style-type: none"> Contractor 	x	x		

Ref.	Environmental Impacts	Recommended Mitigation Measures	Implementation Agent	Implementation Phase*			Compliance
				P	C	O	
		 <p>Figure 25: Indicative Hoarding around Forested Areas</p> <ul style="list-style-type: none"> Keep and submit all records of any roadkill to the EMMP consultant. 					
12	Waste Management	<ul style="list-style-type: none"> A waste management plan should be created that provides further technical details and implementation methods for all measures highlighted in this Table, adopting the principles of Reduce, Reuse, Recycle; All ECB used in the project shall be plastic-free, wildlife friendly and fully biodegradable; The contractor should ensure that information in the waste management plan that is applicable to individual site workers is disseminated to them; In order of preference (1 most preferable), waste should be disposed of in the following ways: <ul style="list-style-type: none"> Minimise initial waste generation wherever possible; Items for waste disposal should be re-used if safe and appropriate (i.e. not hazardous waste containers); and When not re-used on Site, waste should be taken to an off-site recycling facility; Non-recyclable waste should be disposed of appropriately in line with local regulations at a pre-defined off-site location. 	<ul style="list-style-type: none"> Contractor ECO 	x	x		Environmental Protection and Management Act Environmental Protection and Management (Trade Effluent) Regulations Code of Practice on Surface Water Drainage Code of Practice on Surface Water Drainage

Ref.	Environmental Impacts	Recommended Mitigation Measures	Implementation Agent	Implementation Phase*			Compliance
				P	C	O	
		<ul style="list-style-type: none"> All wastes stored on site should be segregated by type, ensuring that incompatible wastes are stored separately; Waste storage facilities should be fit for purpose by ensuring that waste containers/ storage areas are capable of containing predicted waste volumes, for each waste type, in a manner unlikely to cause damage to the environment or harm to human health; Waste storage facilities should be wildlife-proof so as to prevent human-wildlife conflicts by reducing the likelihood of animals such as long-tailed macaques foraging on food and package waste; Waste designated for off-site recycling or disposal will only be transferred to such parties that can demonstrate that they are licensed to transport and/or treat or dispose of the waste in accordance with Singaporean Regulations; Portable toilets for construction workers must be placed inside each construction area, with the sewage pumped away regularly by an appropriately licensed waste disposal company; and All containers which were previously used to store pesticides and other chemicals should be bored with holes to ensure that these containers are not reused. 					
		<ul style="list-style-type: none"> Monthly site inspection 	<ul style="list-style-type: none"> Contractor ECO BCA Independent EMMP Consultant 		x	x	

9 DEFINITION AND EVALUATION OF RESIDUAL ENVIRONMENTAL IMPACTS

9.1 Definition

Residual impacts are defined as those impacts that remain following the implementation of the mitigation measures proposed. Mitigation and Management Measures for each environmental aspect are discussed in Section 8. The significance criteria applied to these impacts are outlined in Section 5- 7 and the assessment of each identified impact are discussed in Section 5-7 as well.

9.2 Evaluation

The evaluation of the residual impacts after implementing mitigation measures is summarised in Table 33 below. Only impacts assessed to be of **Major**, **Moderate** and **Minor** significance have been evaluated in this table. If all mitigation measures are implemented, it is expected that the residual impacts will be of Minor to Negligible Significance.

Table 33: Residual Impacts

Aspect	Unmitigated Impact Significance	Impact Source	Location	Mitigation measure	Residual Impact Significance After implementing mitigation measures
Noise impact during construction phase	Minor	Construction vehicles, machinery and construction works	Project Site and its vicinity	<ul style="list-style-type: none"> Noise barrier of at least 3m height and Sound Transmission Class (STC) rating of at least 26 to be erected between the construction site and CCNR/study area. Engaging an ECO to follow up on Noise pollution control measures under the Code of Practice for Environmental Control Officers; Scheduling vehicle movement to avoid accumulated noise from vehicles; Providing silencer for noisy equipment/ machinery; Adopting good practice for construction site – regular maintenance of vehicles and machinery, proper training to operators. 	Negligible
Soil Erosion during construction	Minor	Vegetation clearance, excavation and slope cutting	Existing road edges	<ul style="list-style-type: none"> Maintaining a gentle slope during site clearance and earthwork/ soil cutting to prevent slope failure; Measures such as geotextile or temporary retaining structures/walls should be put in place during the site clearance, tree/root removal and earth cutting works to prevent slope failure; Engaging of QP to design temporary earth retaining structure and permanent retaining wall at relevant locations to prevent slope failure during construction; Engaging a Qualified Erosion Control Professional (QECF) to design Earth Control Measures (ECM) including a discharge treatment system. 	Negligible

Aspect	Unmitigated Impact Significance	Impact Source	Location	Mitigation measure	Residual Impact Significance After implementing mitigation measures
Water Quality	Minor	Site clearance, earthworks, slurry from tunnel boring, and construction debris from demolition / alteration of existing road and drains	Project site and draining system	<ul style="list-style-type: none"> ▪ The site clearance and earthwork should be planned in phases to minimise the surface area that is being exposed at any one time, and the runoff from the exposed area is within the capacity of the ECM; ▪ Installation / construction of temporary shoring should be undertaken to minimize disturbance and encroachment into the immediate vicinity of the adjacent nature reserve areas; ▪ Proper drainage system should be designed to accommodate additional runoff from the site during different stages of the construction works; ▪ Capacity of the existing downstream drainage along Mandai Road that will take additional runoff from the site should be reviewed to ensure sufficiency. If the existing downstream drainage capacity is not sufficient, additional drainage should be provided to prevent flooding at the downstream areas; ▪ Contractor is to ensure the discharge treatment system of the ECM proposed by a QECP is reviewed before implementation. This will ensure the treatment method is suitable and adequate. The ECM must be submitted to and approved by PUB; ▪ Separate drainage systems should be provided for contaminated water if there is any, and clean storm water during construction. All areas in the construction site where potential sources of wastewater or contaminated runoff should be paved and provided with appropriate bunds to enable the wastewater and contaminated storm water from the entire site to be directed to an onsite settling pond. Contaminated water should be treated prior to discharge into public drainage or sewer; ▪ Any slurry from pipejacking for sewer construction must be properly contained and treated. Appropriate secondary containment/bunds should be provided for any treatment plants onsite to prevent slurry spillage into the environment. Any spills should be cleaned up immediately; ▪ A TSS meter and CCTV camera should be installed at the entrance to any public drains on-site. This is to ensure that parameters of any discharged water are below allowable limits for discharge to public drainage or watercourse, or within permissible levels in any approval letter; ▪ Soil stockpiles should be covered with erosion control blankets at the end of each working day; 	Negligible

Aspect	Unmitigated Impact Significance	Impact Source	Location	Mitigation measure	Residual Impact Significance After implementing mitigation measures
				<ul style="list-style-type: none"> A washing bay should be installed to prevent dust from exiting construction sites. Any collected water should then either be re-used in the washing facility or disposed of after being treated by ECM; Concrete trucks and other equipment should be washed out to prevent concrete from hardening within. This washout should not be discharged directly into any drainage system but collected as wastewater for treatment; Humps should be installed at the site entrances to prevent any silted storm water from exiting via this pathway; Bare earth areas should be isolated with silt fences, and bare earth area should be covered after work; Access path, road or site office area, if any, should be paved up; Any chemical containers being used on site outside of the storage area must be placed inside a secondary containment vessel with sufficient capacity to handle the spilled volume. Water-proof sheets must be used to cover the secondary containment in rainy periods to prevent spill-over; Emergency response equipment, e.g. spill kits, absorbent booms, clean spade and buckets must be well-prepared for use and be in close vicinity to the chemical storage area; and Regularly inspect and clean out in-ground wedge pits should be conducted to maintain adequate sediment holding capacity. 	
Biodiversity-Flora (Habitat and tree loss)	Minor	Habitat and tree loss	Northeast boundary of study area	<p>A flora specialist and/or an ISA certified arborist should be engaged to adopt the following mitigation measures:</p> <p>Before vegetation clearance</p> <ul style="list-style-type: none"> Verify and assess the vegetation (including trees, shrubs, climbers, saplings and seedlings) found in the worksites, especially to identify flora species with conservation concern; Discuss with NParks about salvaging any trees, saplings or seedlings of conservation concern; Prepare and submit a tree felling/ transplanting plan (if needed) and detailed method statement to NParks for approval; Prepare a tree protection zone (TPZ) plan to recommend the dimensions of the TPZ required for trees to be retained that are adjacent to working area; 	Minor

Aspect	Unmitigated Impact Significance	Impact Source	Location	Mitigation measure	Residual Impact Significance After implementing mitigation measures
				<ul style="list-style-type: none"> Educate workers on the importance of vegetation in the CCNR and remind workers to carry out works in a careful manner. <p>During vegetation clearance</p> <ul style="list-style-type: none"> ISA certified arborist to supervise transplantation, seedling salvaging and tree felling. <p>After construction</p> <ul style="list-style-type: none"> Discuss with NParks / relevant parties regarding the species to be replanted; ISA certified arborist to supervise tree replanting. <ul style="list-style-type: none"> The Contractor shall be held solely liable as per Parks and Trees Act, for any additional tree damage/removal, tree root pruning/cutting, crown pruning outside the EIS-predicted tree impacts without prior agreement from the Client and relevant agencies. 	
Biodiversity – Fauna (Noise impacts)	Minor	Construction vehicles, machinery and construction works	Project Site and study area	<ul style="list-style-type: none"> Noise barrier of at least 3m height and Sound Transmission Class (STC) rating of at least 26 to be erected between the construction site and CCNR/study area. Engaging an ECO to follow up on Noise pollution control measures under the Code of Practice for Environmental Control Officers; Scheduling vehicle movement to avoid accumulated noise from vehicles; Providing silencer for noisy equipment/ machinery; Adopting good practice for construction site – regular maintenance of vehicles and machinery, proper training to operators. 	Negligible
Biodiversity – Fauna (Human-wildlife Conflict)	Minor	Wildlife, workers and food	Project Site and its vicinity	<ul style="list-style-type: none"> No feeding, touching, catching or harming of any wildlife is allowed; Hoarding/noise barriers are to be installed completely around the work areas with no gaps between the hoarding sheets or the ground; Fauna Management Plan shall be developed by the EMMP consultant's fauna specialist and implemented by the contractor; All ECB used in the project shall be plastic-free, wildlife friendly and fully biodegradable. This is to avoid trapping snakes and other animals in the mesh of the ECB; All personnel are to be briefed about the fauna present on site and the Fauna Management Plan by the EMMP Consultant Fauna Specialist; Proper housekeeping shall be undertaken at all times to ensure neat storage of materials and stockpiles, appropriate storage of food and waste; 	Negligible

Aspect	Unmitigated Impact Significance	Impact Source	Location	Mitigation measure	Residual Impact Significance After implementing mitigation measures
				<ul style="list-style-type: none"> Food/food containing belongings are to be stored securely in locked containers/cabinets where wildlife cannot access; Food waste is to be stored in monkey-proof bins and cleared daily; Consumption of food and drinks (including snacks and takeaway drinks) are to be strictly restricted to designated enclosed dining areas to be set-up away from the forest areas. Dining areas shall not be accessible to animals like monkeys. Dining areas are to be maintained and cleaned at all times; All personnel are to be prohibited from entering the forest patch adjacent to the worksite at any time. Any feeding and touching of animals (including Feral Dogs) are strictly prohibited; No littering within the forest patch adjacent to the worksite at any time. 	

9.3 Environmental Impact Summary

Environmental impacts arising from construction and operation activities are summarised in Table below.

Table 34: Summary of Prediction and Evaluation of Environmental Impacts

Environmental Aspect	Environmental Impact	Initial Impact Prediction		Residual Impact Assessment
Air quality	Air Quality impact during construction	Type	Direct	Direct
		Duration	Temporary	Temporary
		Reversibility	Reversible	Reversible
		Spatial Extent	Localised	Localised
		Likelihood	Likely	Unlikely
		Availability of embedded controls	Readily available	Readily available
		Nature	Negative	Negative
		Sensitivity	Low	Low
		Magnitude	Minor	Minor
		Impact Significance	Negligible	Negligible
	Air quality impact during construction	Type	Direct	Direct
		Duration	Temporary	Temporary
		Reversibility	Reversible	Reversible
		Spatial Extent	Localised	Localised
		Likelihood	Likely	Unlikely
		Availability of embedded controls	Readily available	Readily available
		Nature	Negative	Negative
		Sensitivity	Low	Low
		Magnitude	Minor	Minor
		Impact Significance	Negligible	Negligible
	Air quality impact during road operation	Type	Direct	Direct
		Duration	Permanent	Permanent
		Reversibility	Reversible	Reversible
		Spatial Extent	Localised	Localised
		Likelihood	Likely	Unlikely
		Availability of embedded controls	Readily available	Readily available
		Nature	Negative	Negative
		Sensitivity	Low	Low
		Magnitude	Minor	Minor
		Impact Significance	Negligible	Negligible
Noise		Type	Direct	Direct
		Duration	Temporary	Temporary

Environmental Aspect	Environmental Impact	Initial Impact Prediction		Residual Impact Assessment
	Noise impacts during construction & demolition	Reversibility	Reversible	Reversible
		Spatial Extent	Localised	Localised
		Likelihood	Likely	Likely
		Availability of embedded controls	Readily available	Readily available
		Nature	Negative	Negative
		Sensitivity	Low	Low
		Magnitude	Moderate	Minor
		Impact Significance	Minor	Negligible
	Noise impacts during operation	Type	Direct	Direct
		Duration	Permanent	Permanent
		Reversibility	Reversible	Reversible
		Spatial Extent	Localised	Localised
		Likelihood	Unlikely	Unlikely
		Availability of embedded controls	Readily available	Readily available
		Nature	Negative	Negative
		Sensitivity	Low	Low
		Magnitude	Minor	Minor
		Impact Significance	Negligible	Negligible
Soil Erosion	Soil erosion during construction and demolition works	Type	Direct	Direct
		Duration	Temporary	Temporary
		Reversibility	Reversible	Reversible
		Spatial Extent	Localised	Localised
		Likelihood	Unlikely	Unlikely
		Availability of embedded controls	Readily available	Readily available
		Nature	Negative	Negative
		Sensitivity	Medium	Medium
		Magnitude	Minor	Negligible
		Impact Significance	Minor	Negligible
Water Quality	Water quality during construction	Type	Direct	Direct
		Duration	Temporary	Temporary
		Reversibility	Reversible	Reversible
		Spatial Extent	Localised	Localised
		Likelihood	Unlikely	Unlikely
		Availability of embedded controls	Available	Available
		Nature	Negative	Negative

Environmental Aspect	Environmental Impact	Initial Impact Prediction		Residual Impact Assessment
		Sensitivity	Medium	Medium
		Magnitude	Minor	Negligible
		Impact Significance	Minor	Negligible
	Water quality during demolition works	Type	Direct	Direct
		Duration	Temporary	Temporary
		Reversibility	Reversible	Reversible
		Spatial Extent	Localised	Localised
		Likelihood	Unlikely	Unlikely
		Availability of embedded controls	Available	Available
		Nature	Negative	Negative
		Sensitivity	Medium	Medium
		Magnitude	Minor	Negligible
		Impact Significance	Minor	Negligible
Biodiversity – Flora	Habitat and tree loss	Type	Direct	Direct
		Duration	Temporary	Temporary
		Reversibility	Reversible	Reversible
		Spatial Extent	Localised	Localised
		Likelihood	Certain	Certain
		Availability of embedded controls	Available	Available
		Nature	Negative	Negative
		Sensitivity	Medium	Medium
		Magnitude	Moderate	Minor
		Impact Significance	Minor	Minor
	Change in water quality and supply	Type	Indirect	Indirect
		Duration	Temporary	Temporary
		Reversibility	Irreversible	Irreversible
		Spatial Extent	Localised	Localised
		Likelihood	Unlikely	Unlikely
		Availability of embedded controls	Available	Available
		Nature	Negative	Negative
		Sensitivity	Medium	Medium
		Magnitude	Negligible	Negligible
		Impact Significance	Negligible	Negligible
		Type	Indirect	Indirect
		Duration	Temporary	Temporary

Environmental Aspect	Environmental Impact	Initial Impact Prediction		Residual Impact Assessment
	Change in slope stability and soil compaction	Reversibility	Reversible	Reversible
		Spatial Extent	Localised	Localised
		Likelihood	Unlikely	Unlikely
		Availability of embedded controls	Available	Available
		Nature	Negative	Negative
		Sensitivity	Medium	Medium
		Magnitude	Negligible	Negligible
		Impact Significance	Negligible	Negligible
Biodiversity - Fauna	Habitat Clearance	Type	Direct	Direct
		Duration	Permanent/ Temporary	Permanent/ Temporary
		Reversibility	Reversible	Reversible
		Spatial Extent	Localised	Localised
		Likelihood	Certain	Certain
		Availability of embedded controls	Available	Available
		Nature	Negative	Negative
		Sensitivity	Low	Low
		Magnitude	Minor	Minor
		Impact Significance	Negligible	Negligible
	Noise Impacts to Fauna	Type	Direct	Direct
		Duration	Temporary	Temporary
		Reversibility	Reversible	Reversible
		Spatial Extent	Localised	Localised
		Likelihood	Likely	Likely
		Availability of embedded controls	Available	Available
		Nature	Negative	Negative
		Sensitivity	Medium	Low
		Magnitude	Minor	Minor
		Impact Significance	Minor	Negligible
	Human-wildlife Conflict	Type	Direct	Direct
		Duration	Temporary	Temporary
		Reversibility	Reversible	Reversible
		Spatial Extent	Localised	Localised
		Likelihood	Unlikely	Unlikely

Environmental Aspect	Environmental Impact	Initial Impact Prediction		Residual Impact Assessment
		Availability of embedded controls	Available	Available
		Nature	Negative	Negative
		Sensitivity	Low	Low
		Magnitude	Moderate	Minor
		Impact Significance	Minor	Negligible
	Roadkill	Type	Direct	Direct
		Duration	Temporary	Temporary
		Reversibility	Irreversible	Irreversible
		Spatial Extent	Localised	Localised
		Likelihood	Very Unlikely	Very Unlikely
		Availability of embedded controls	Available	Available
		Nature	Negative	Negative
		Sensitivity	Medium	Medium
		Magnitude	Negligible	Negligible
		Impact Significance	Negligible	Negligible
	Waste generation during construction and demolition works	Type	Direct and Indirect	Direct and Indirect
		Duration	Temporary	Temporary
		Reversibility	Reversible	Reversible
		Spatial Extent	Localised	Localised
		Likelihood	Likely	Likely
		Availability of embedded controls	Available	Available
		Nature	Negative	Negative
		Sensitivity	Low	Low
		Magnitude	Minor	Negligible
		Impact Significance	Negligible	Negligible

10 CONCLUSIONS AND RECOMMENDATIONS

The EIS has identified the potential sensitive receptors; studied baseline conditions of the fauna, flora, air quality and noise; identified and assessed potential environmental impacts associated with the construction and operation of the Project; and proposed mitigation measures as well as EMMP requirements to be implemented in the course of construction and operation of the Project.

The 1.45-hectare Site is located in the north of Singapore in the Mandai area at Lorong Lada Hitam. This project involves expunging part of Lorong Lada Hitam and widening it from its current dual one-lane carriage way to a dual two-lane carriage way. A total of 90 plant species were identified to be present, of which 41 (46%) are of conservation concern. Out of the 41 species that are of conservation concern, 2 species are extinct, 14 species are critically endangered, 9 species are endangered, and 16 species are vulnerable. A total of 97 species of fauna were recorded from the fauna transect surveys, camera trapping as well as through chance encounters, consisting of 34 birds, 9 mammals, 2 amphibians, 6 reptiles, 36 butterflies and 10 odonates. These represent a mixture of species typical of open habitats such as scrub and parkland, as well as species dependent on secondary forest. Noise levels recorded are generally within threshold levels.

The proposed road widening works will require minimal habitat clearance, excavation and cut-and-fill works during construction/demolition works, which are likely to cause minor to negligible environmental impacts to the biodiversity and other environmental aspects at the study area and immediate Site surroundings. Potential environmental impacts have been discussed in Sections 5 to 9. Key impacts identified due to Project with **Minor Initial Significance**, among others, are impacts to water quality from construction and demolition works, impacts to flora from habitat loss due to vegetation clearance, and impacts to fauna due to noise and potential human-wildlife conflict. Other impacts to air quality, and certain biodiversity aspects have been identified and assessed to have **Negligible** initial impacts.

A comprehensive proposal on mitigation measures and EMMP has been developed to minimise the identified impacts. The residual impacts after mitigation measures implementation are acceptable for all aspects. Monitoring requirements have also been identified during construction in order to ensure that mitigation measures are effective.

References

- Davison, G. W. H., Ng, P. K. L. & Ho, H. C. (Eds.) (2008). The Singapore Red Data Book: Threatened Plants and Animals of Singapore. 2nd Edition. Singapore: Nature Society (Singapore).
- Kight, C. & Swaddle, J. (2011). How and why environmental noise impacts animals: an integrative, mechanistic review. *Ecology Letters* 14:1052-1061.
- Lim, K., 2009. *The Avifauna Of Singapore*. Singapore: Nature Society Singapore.
- Morley, E., Jones, G. & Radford, A. (2014). The importance of invertebrates when considering the impacts of anthropogenic noise. *Proceedings of the Royal Society B: Biological Sciences* 281:20132683.
- National Environment Agency. (2018). *Singapore's Climate Information & Data*. Retrieved from <https://www.nea.gov.sg/weather/overview/singapore's-climate-information-data>
- Newport, J., Shorthouse, D. and Manning, A. (2014). The effects of light and noise from urban development on biodiversity: Implications for protected areas in Australia. *Ecological Management & Restoration*, 15(3), 204-214.
- Ngiam, R. and Cheong, L. (2016). The dragonflies of Singapore: An updated checklist and revision of the national conservation statuses. *Nature in Singapore*, 9, 149–163.
- Proppe, D., Sturdy, C. & St. Clair, C. (2013). Anthropogenic noise decreases urban songbird diversity and may contribute to homogenization. *Global Change Biology* 19:1075-1084.
- Shannon, G., McKenna, M., Angeloni, L., Crooks, K., Fristrup, K., Brown, E. & Warner, K. et al. (2015). A synthesis of two decades of research documenting the effects of noise on wildlife. *Biological Reviews* 91:982-1005.
- Yong, D., Lim, K., Lee, T. and Yap, F. (2018). *A Naturalist's Guide To The Birds Of Singapore*. 3rd ed. Singapore: John Beaufoy Pub (GB).

Appendices:

Appendix A – Flora Survey Report

Appendix B – Fauna Survey Report

Appendix C – Camera Trap Data

Appendix D – Noise Baseline Results

Appendix A: Flora Survey Report

EnvironSolutions and Consulting Pte Ltd

Baseline Flora Study for proposed Road Widening and Drainage Works

Lorong Lada Hitam / Mandai Road

Tony O'Dempsey
11/16/2021

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INTRODUCTION

Road widening and drainage works are proposed for Lorong Lada Hitam. The works are immediately adjacent to nature reserve which may be impacted. A flora study and report (this document) has been commissioned in support of an Environmental Impact Assessment to be undertaken over the affected area.

PROJECT LOCATION

The flora study site is located about the junction of Lorong Lada Hitam and Mandai Road and is centred at geographic coordinates: Latitude: 1° 24' 56" Longitude: 103° 47' 50". The study site is situated wholly within part of the Central Catchment Nature Reserve north of Mandai Road. The map (Figure 1) below illustrates the study site location.

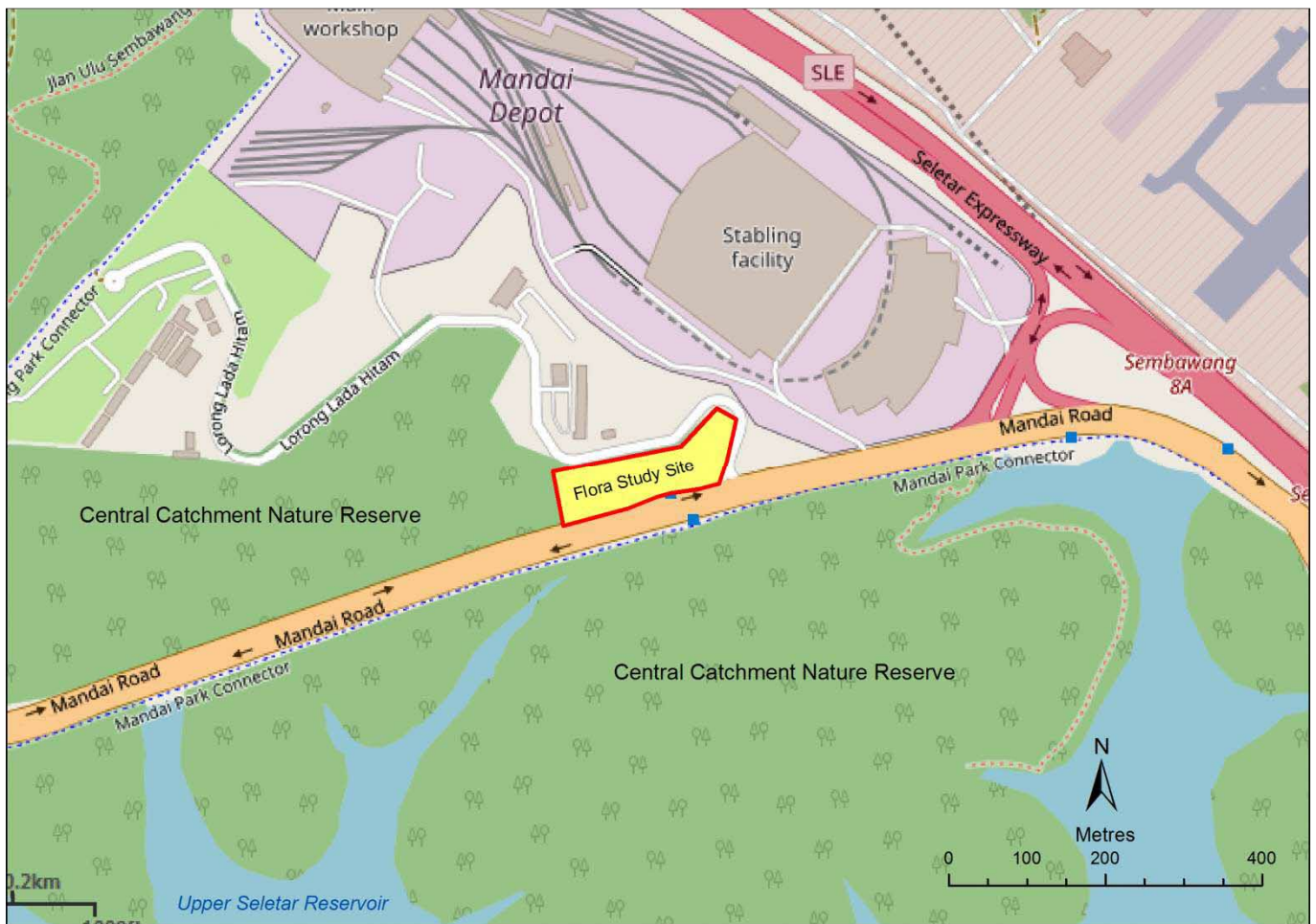


Figure 1: Project Locality Map.

LANDUSE HISTORY

The study site has been effectively protected since 1900, first as a water catchment reserve, and later as a nature reserve. The vegetation on the site has been allowed to regenerate unmolested for at least the past 120 years. Its proximity to primary forest has given opportunity for forest species to establish due to the distribution of seeds by wind and fauna activity. A limited amount of recent enrichment planting by NParks was noted during the survey.

LANDUSE SUMMARY

- | | |
|--------------|--|
| pre-1900 | The site lies immediately adjacent to the Sembawang Forest Reserve established c. 1884 by Nathaniel Cantley ¹ . Forest reserves were established to encompass good forest containing timber of commercial value. The location of the eastern boundary of the Sembawang forest reserve (Figure 2: 1924 Topographic Map) indicates that the Study site had no valuable timber at the time that the forest reserve was gazetted. We can deduce from the time period that the study site had been subject to gambier and pepper cultivation at some time prior to 1884 and that the site had been mostly cleared of original forest. The 1951 aerial photography (Figure 3) illustrates the stark difference in vegetation between the forest reserve and the study site with primary forest of the forest reserve abutting the western extent of the study area. It is also evident from the aerial photography that there had been substantial disturbance towards the western half of the site. This observation is significant in consideration of the floristic content of the site today. |
| 1900-1950 | <p>A Municipal Catchment Reserve including the watersheds of the Seletar and Kalang rivers was gazetted c. 1900. The study site being within the Sungei Seletar catchment would have been included within the municipal catchment and any activities on the site would have been curtailed at that time. The parts of the Sembawang Forest Reserve that coincided with the Sungei Seletar catchment were also considered to be part of the municipal catchment.</p> <p>Rubber (<i>Hevea brasiliensis</i>) was introduced as a commercial crop c. 1910 and as such the study site would never have been planted with rubber as it had previously been reserved as water catchment. It also is noted that the 1924 topographic map (Figure 2) shows that rubber plantations occurred immediately to the north of the study site, however no rubber is shown within the site. Despite this fact, almost half the site is dominated by rubber trees. It is hypothesised that the rubber trees dominating the western half of the study site had established themselves from adjoining rubber plantations to the north during the early 1900's. Henry Ridley is also known to have planted rubber for reforestation and fire break purpose during the early 1900's.</p> |
| 1951-present | The Central Catchment Nature Reserve was gazetted to coincide with the area of the municipal catchment. The land continued to function as a water catchment and in addition the management of the flora and fauna came under the control of the PWD parks and gardens department (later to be moved under the custodianship of the National Parks Board). |

¹ Nathaniel Cantley was the second superintendent of the Singapore Botanic Gardens and first superintendant of the Singapore Forestry Department which he established at the pleasure of the governor. He was responsible for establishing the first 14 forest reserves on Singapore Island including the Sembawang Forest Reserve.

The maps below (Figure 2 and Figure 3) illustrate the relationship between the study site and the various reserves:

MAPS & IMAGERY

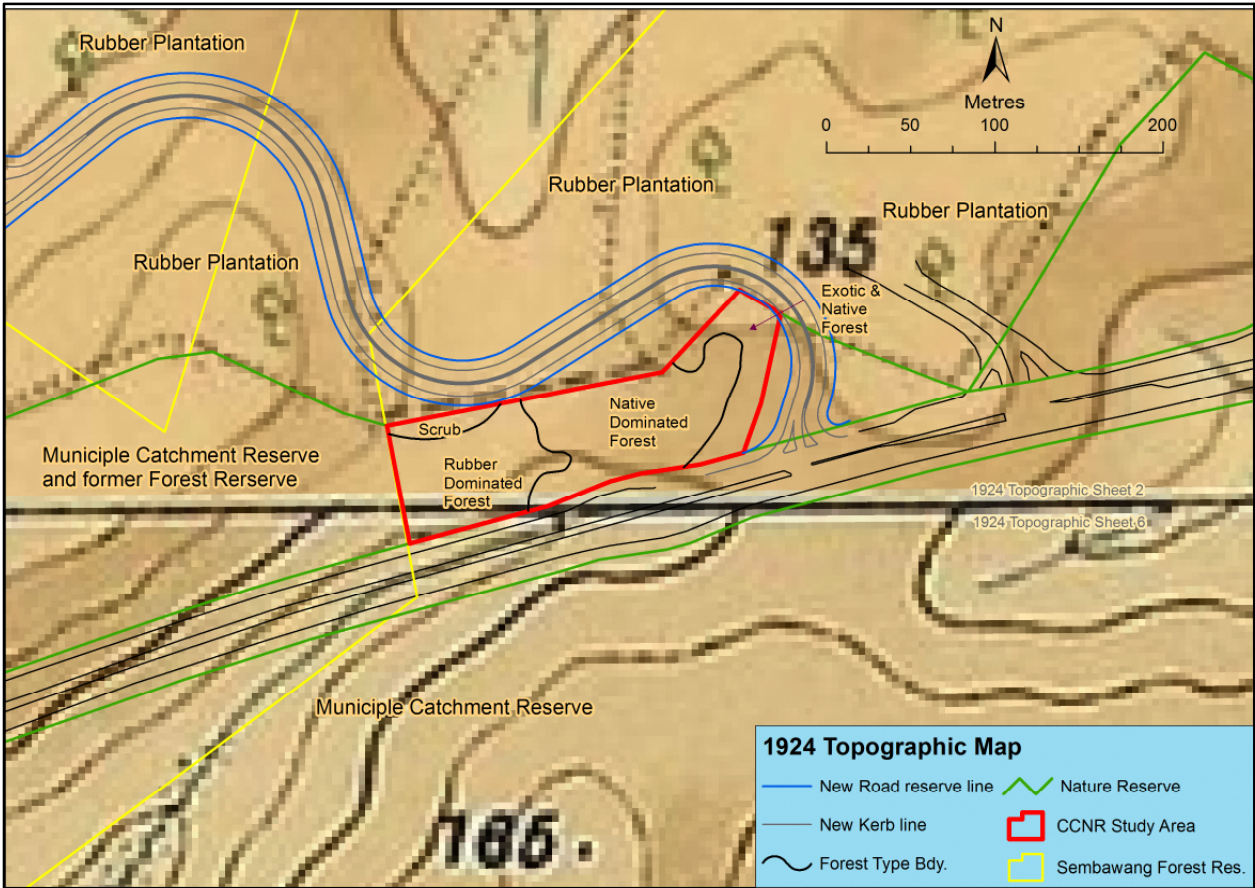


Figure 2: 1924 Topographic Map

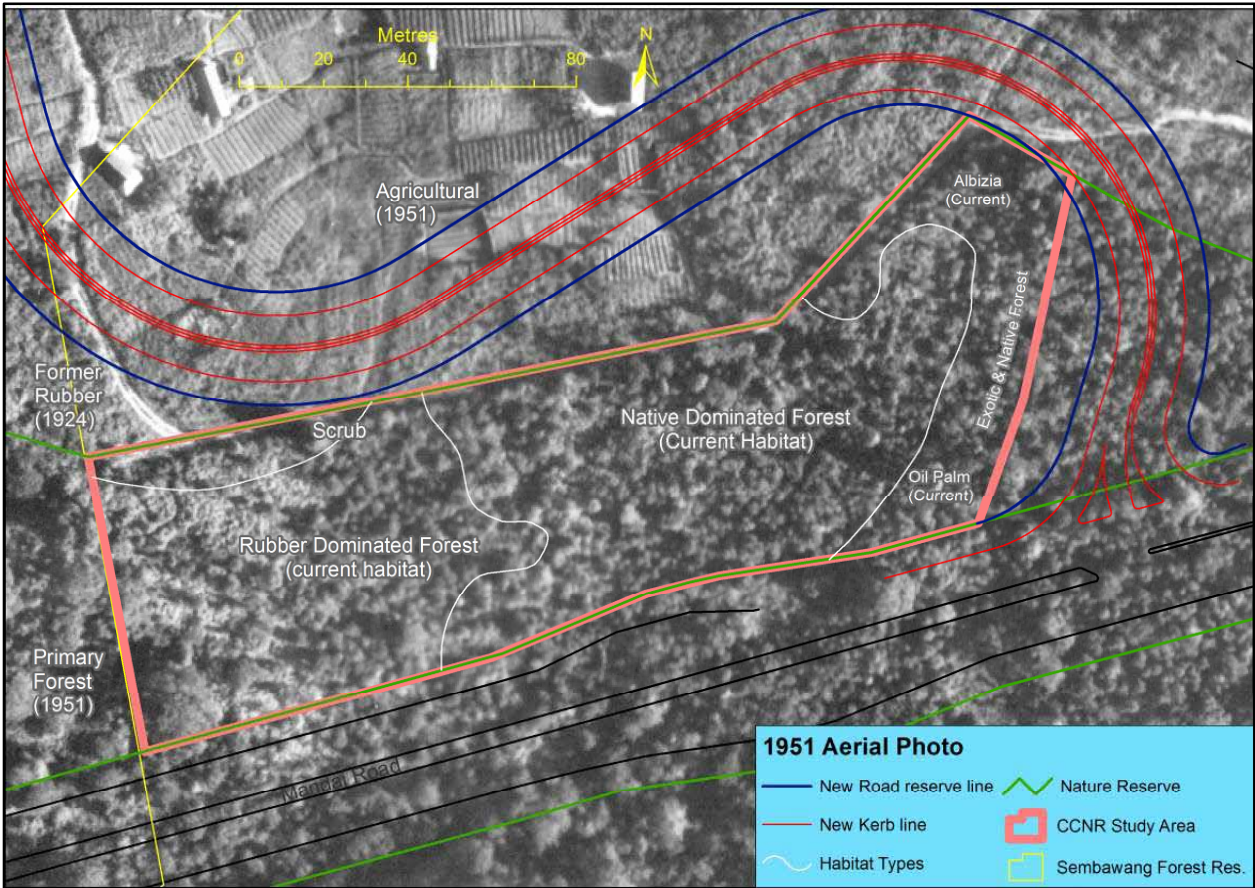


Figure 3: 1951 NAS Aerial Photography

FLORA ANALYSIS

METHODOLOGY

The trees above 30 cm were mapped and identified; in addition significant seedlings / saplings, shrubs, climbers and epiphytes were noted during the course of the flora study.

The specific method employed was as follows:

- Trees at or above 30 cm were surveyed using a survey grade RTK GPS,
- At the same time, the trees were tagged with a sequential number tag and the girth and height noted along with the coordinates and sequential tree number,
- A second pass was undertaken to identify species, the names of which were logged against the tree tag number,
- Species for which field identification is not possible are referred to the SING herbarium for expert opinion.
- A Tree Schedule map (A0 size PDF format) and tabulation (XL format) of individual trees along with girth, height, type and conservation status are provided as separate documents to this report.
- Arborist Lahiru Wijedasa was engaged to assist with on-site plant identification

SPECIES IDENTIFICATION

In general, most species that were encountered during the flora survey were not fertile and identifications were achieved by observation vegetative features. This can result in a degree of uncertainty for species that require fertile specimen's for reliable identification. Uncommon species were identified / verified with reference to the Biodiversity Online web site hosted by the [Lee Kong Chian Natural History Museum \(LKCNHM\)](#) as well as through consultation with various experts in the community. Sing Herbarium was consulted with respect to the identification of *Syzygium syzygioides* which was found to be prominent at the North East portion of the site.

CONVENTIONS

The species names and conservation status are sourced primarily from the Singapore Red Data Book (2nd Edition published 2008) however considering this book has become out of date, the Checklist of the Total Vascular Plant Flora of Singapore published by Raffles Museum of Biodiversity Research, National University of Singapore (2009) has been used as a secondary source.

The following species with conservation status of Critically Endangered or (Nationally) Extinct are considered to be persistent from cultivation and are indicated with [square brackets] in the species checklist:

Family	Species	Conservation Status	Comment
Myrtaceae	<i>Syzygium myrtifolium</i>	[Extinct]	Cultivated as urban hedge tree
Phyllanthaceae	<i>Baccaurea motleyana</i>	[Critically Endangered]	Rambai (Cultivated Fruit Tree)
Sapindaceae	<i>Nephelium lappaceum</i>	[Critically Endangered]	Rambutan (Cultivated Fruit Tree)

The conservation significance of these cultivated species shall be assessed as if they were common native species.

HABITAT CLASSIFICATION

The study area is dominated by four distinct floral habitats that are predicted on the sites landuse history, they are:

- 1) Rubber dominated forest which exists on the western half of the site
- 2) Native dominated forest featuring primary forest species exists on the eastern half of the site
- 3) Mixed native and exotic forest about the southern and eastern margins of the study site.
- 4) A small section of grass and scrub exists at the North West extent of the site

SPECIES DENSITY MAP

A kernel density algorithm was applied to the tree point data using conservation status as the scaling factor. The resulting heat map illustrates the areas where native species are concentrated in relation areas of naturalised and exotic species. The resulting heat map is illustrated as Figure 4 below.

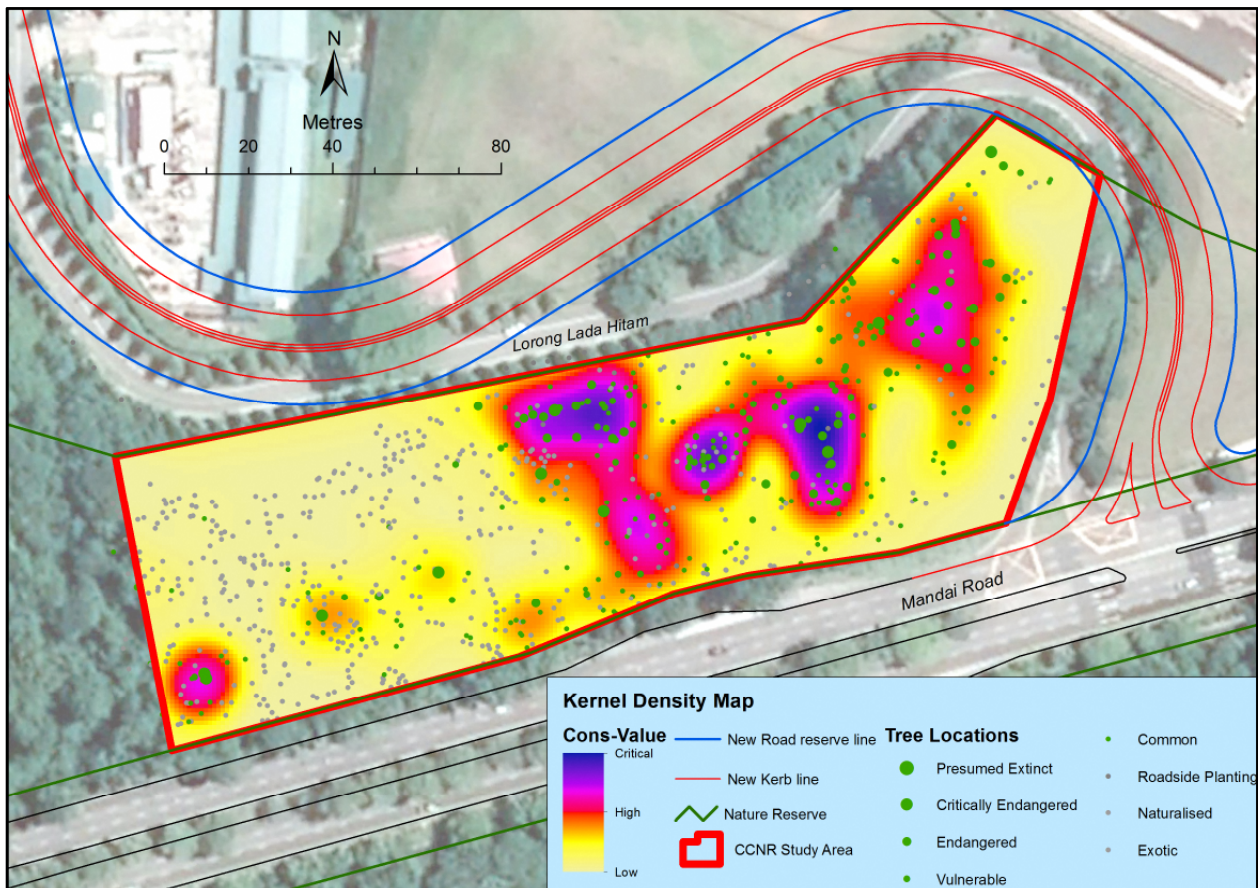


Figure 4: heat map showing concentration of native species against exotic and naturalised species.

FLORA HABITAT MAP

The generalised habitat classification map is derived from the heat map (Figure 4) and illustrates the broad habitat categories discussed above.

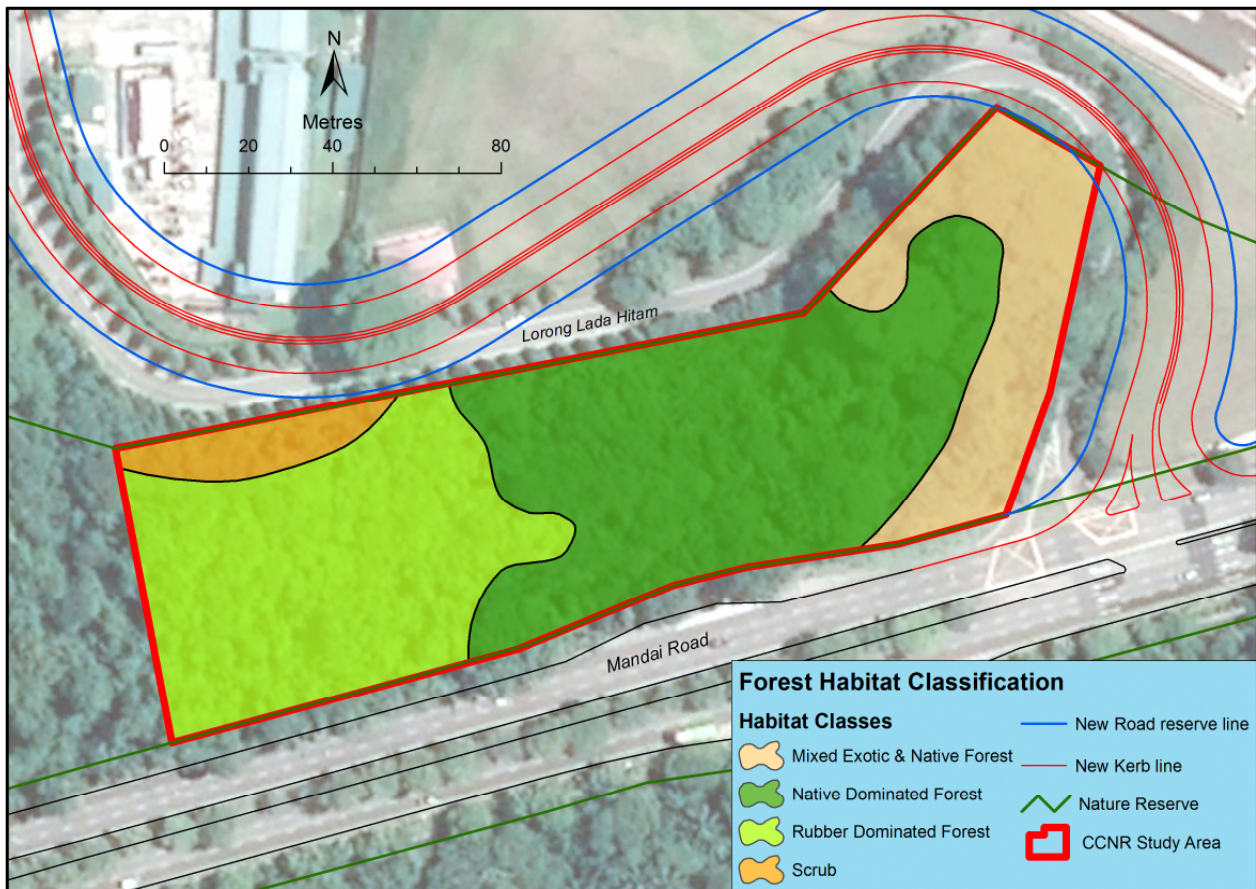


Figure 5: Flora Habitat Classification

PHOTO GALLERY

GENERAL SITE PHOTOS



Figure 6: View west along Mandai Road.



Figure 7: *Chrysophyllum cainito* planted at entrance to Lorong Lada Hitam.



Figure 8: Fallen Albizia tree from site.



Figure 9: Grass and scrub at North West end of site.

SPECIFIC SPECIES PHOTOS



Figure 10: *Agelaea macrophylla*



Figure 11: *Agrostistachys borneensis*



Figure 12: *Anisophyllea disticha*



Figure 13: *Artocarpus elasticus*



Figure 14: *Artocarpus cf nitidus*



Figure 15: *Artocarpus cf nitidus*



Figure 16: *Cnestis palala*



Figure 17: *Falcataria moluccana*



Figure 18: *Dillenia reticulata*



Figure 19: *Fibraurea tinctoria*



Figure 20: *Garcinia atroviridis*



Figure 21: *Horsfieldia sucosa*



Figure 22: *Knema malayana*



Figure 23: *Knema malayana*



Figure 24: *Leea angulata*



Figure 25: *Limacia scandens*



Figure 26: *Livistona rotundifolia*



Figure 27: *Oxyceros longiflorus*



Figure 28: *Pentace triptera*



Figure 29: *Phytocrene bracteata*



Figure 30: *Sandoricum koetjape*



Figure 31: *Shorea leprosula*



Figure 32: *Syzygium grande* (Albino seedling)



Figure 33: *Xanthophyllum eurhynchum*



Figure 34: *Syzygium syzygioides*



Figure 35: *Syzygium syzygioides*



Figure 36: *Xerospermum noronhianum*



Figure 37: *Xerospermum noronhianum*

SPECIES CHECKLIST

Family	Species	Status	Type	Count	Comment
Acanthaceae	<i>Asystasia gangetica</i>	Naturalised	Herb	1	
Anacardiaceae	<i>Camptosperma auriculata</i>	Common	Tree	3	
Anisophyllaceae	<i>Anisophyllea disticha</i>	Common	Shrub	1	
Annonaceae	<i>Phaeanthus ophthalmicus</i>	Vulnerable	Shrub	1	
Apocynaceae	<i>Alstonia angustiloba</i>	Common	Tree	2	
Apocynaceae	<i>Hoya verticillata</i>	Common	Epiphyte	1	
Araceae	<i>Syngonium podophyllum</i>	Naturalised	Climber	1	
Araliaceae	<i>Polyscion diversifolia</i>	Common	Tree	2	
Arecaceae	<i>Caryota mitis</i>	Common	Tree	14	many seedlings throughout
Arecaceae	<i>Elaeis guineensis</i>	Exotic	Tree	63	cluster of mature trees near Mandai road
Arecaceae	<i>Oncosperma tigillaria</i>	Vulnerable	Shrub	5	
Arecaceae	<i>Plectocomia elongata</i>	Vulnerable	Climber	1	
Bignoniaceae	<i>Spathodea campanulata</i>	Naturalised	Tree	3	
Cannabaceae	<i>Gironniera nervosa</i>	Common	Tree	16	
Celastraceae	<i>Bhesa paniculata</i>	Common	Tree	1	
Clusiaceae	<i>Calophyllum soulattri</i>	Critically Endangered	Tree	1	
Clusiaceae	<i>Garcinia atroviridis</i>	Critically Endangered	Tree	1	Enrichment planting by NParks
Clusiaceae	<i>Garcinia parvifolia</i>	Common	Tree	1	
Connaraceae	<i>Agelaea macrophylla</i>	Critically Endangered	Climber	1	
Connaraceae	<i>Cnestis palala</i>	Common	Climber	1	
Convolvulaceae	<i>Erycibe tomentosa</i>	Common	Climber	1	
Dilleniaceae	<i>Dillenia reticulata</i>	Critically Endangered	Tree	1	Some seedlings about
Dilleniaceae	<i>Dillenia suffruticosa</i>	Common	Shrub	8	
Dipterocarpaceae	<i>Shorea leprosula</i>	Vulnerable	Tree	2	
Elaeocarpaceae	<i>Elaeocarpus ferrugineus</i>	Common	Tree	2	Near Mandai Rd

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Family	Species	Status	Type	Count	Comment
Euphorbiaceae	<i>Acalypha siamensis</i>	Exotic	Shrub	1	
Euphorbiaceae	<i>Agrostistachys borneensis</i>	Common	Tree	2	
Euphorbiaceae	<i>Claoxylon indicum</i>	Common	Tree	14	
Euphorbiaceae	<i>Endospermum diadenum</i>	Vulnerable	Tree	1	
Euphorbiaceae	<i>Hevea brasiliensis</i>	Naturalised	Tree	418	Rubber trees dominate the western half of the study site.
Euphorbiaceae	<i>Macaranga gigantea</i>	Common	Tree	2	
Euphorbiaceae	<i>Manihot carthagenesis</i>	Exotic	Tree	1	
Fabaceae	<i>Bauhinia semibifida</i>	Vulnerable	Climber	1	
Fabaceae	<i>Falcataria moluccana</i>	Naturalised	Tree	10	
Fabaceae	<i>Pterocarpus indicus</i>	Exotic	Tree	1	
Gentianaceae	<i>Cyrtophyllum fragrans</i>	Common	Tree	10	
Gnetaceae	<i>[Gnetum gnemon]</i>	[Critically Endangered]	Tree	29	Roadside Tree planted along Lor Lada Hitam.
Hypericaceae	<i>Cratoxylum cochinchinense</i>	Endangered	Tree	1	Enrichment planting
Icacinaceae	<i>Phytocrene bracteata</i>	Vulnerable	Climber	3	
Lauraceae	<i>Cinnamomum iners</i>	Common	Tree	26	
Lauraceae	<i>Lindera lucida</i>	Vulnerable	Tree	1	
Lauraceae	<i>Litsea elliptica</i>	Common	Tree	10	
Lauraceae	<i>Litsea firma</i>	Common	Tree	2	
Malvaceae	<i>Pentace triptera</i>	Endangered	Tree	2	
Melastomataceae	<i>Memecylon sp</i>	Critically Endangered	Tree	1	(presumed CR)
Meliaceae	<i>Aphanamixis polystachya</i>	Endangered	Tree	4	Many seedlings and saplings about mother trees
Meliaceae	<i>Sandoricum koetjape</i>	Endangered	Tree	5	
Menispermaceae	<i>Limacia scandens</i>	Vulnerable	Climber	3	found throughout
Moraceae	<i>Artocarpus elasticus</i>	Common	Tree	9	cluster of large trees
Moraceae	<i>Artocarpus heterophyllus</i>	Exotic	Tree	2	
Moraceae	<i>Artocarpus cf nitidus</i>	Critically Endangered	Tree	1	
Moraceae	<i>Ficus fistulosa</i>	Common	Tree	1	

Family	Species	Status	Type	Count	Comment
Moraceae	<i>Ficus variegata</i>	Common	Tree	23	
Myrsinaceae	<i>Ardisia sanguinolenta</i>	Common	Shrub	1	Syn: A colorata
Myrsicaceae	<i>Horsfieldia sucosa</i>	Endangered	Tree	2	found as small trees
Myrsicaceae	<i>Knema cf malayana</i>	Endangered	Tree	1	found as small trees/saplings
Myrtaceae	<i>Syzygium grande</i>	Common	Tree	10	found as mature trees some at end of life
Myrtaceae	<i>Syzygium lineatum</i>	Common	Tree	2	new name is <i>S. cerasiforme</i>
Myrtaceae	<i>Syzygium myrtifolium</i>	Extinct	Tree	2	found as seedlings
Myrtaceae	<i>Syzygium syzygioides</i>	Vulnerable	Tree	21	ID by SING herbarium
Myrtaceae	<i>Syzygium polyanthum</i>	Vulnerable	Tree	39	cluster of mature trees
Ochnaceae	<i>Campylospermum serratum</i>	Common	Tree	1	
Olacaceae	<i>Ochanostachys amentacea</i>	Vulnerable	Tree	4	
Phyllanthaceae	<i>Baccaurea motleyana</i>	[Critically Endangered]	Tree	2	Presumed persistent from cultivation
Phyllanthaceae	<i>Bridelia stipularis</i>	Vulnerable	shrub	1	
Phyllanthaceae	<i>Phyllanthus amarus</i>	Exotic	Herb	1	
Piperaceae	<i>Piper flavimarginatum</i>	Critically Endangered	Climber	1	found throughout
Piperaceae	<i>Piper ribesoides</i>	Extinct	Climber	1	
Poaceae	<i>Saccharum officinarum</i>	Exotic	Herv	1	
Polygalaceae	<i>Xanthophyllum eurhynchum</i>	Vulnerable	Shrub	2	
Polypodiaceae	<i>Pyrrosia longifolia</i>	Common	Epiphyte	1	
Rhizophoraceae	<i>Carallia brachiata</i>	Endangered	Tree	2	
Rhizophoraceae	<i>Gynotroches axillaris</i>	Common	Tree	2	
Rhizophoraceae	<i>Pellacalyx axillaris</i>	Endangered	Tree	2	
Rosaceae	<i>Prunus polystachya</i>	Common	Tree	2	
Rubiaceae	<i>Oxyceros longiflorus</i>	Vulnerable	Climber	1	found occasionally throughout
Rubiaceae	<i>Timonius wallichianus</i>	Common	Tree	7	
Sapindaceae	<i>Nephelium lappaceum</i>	[Critically Endangered]	Tree	11	Presumed persistent from cultivation
Sapindaceae	<i>Pometia pinnata</i>	Endangered	Tree	6	

Family	Species	Status	Type	Count	Comment
Sapindaceae	<i>Xerospermum noronhianum</i>	Critically Endangered	Tree	1	
Sapotaceae	<i>Chrysophyllum cainito</i>	Exotic	Tree	36	Roadside Tree planted along Lor Lada Hitam
Sapotaceae	<i>Palaquium obovatum</i>	Vulnerable	Tree	6	Seedlings also found
Simaroubaceae	<i>Eurycoma longifolia</i>	Critically Endangered	Tree	1	
Smilacaceae	<i>Smilax setosa</i>	Common	Climber	many	Found throughout – more so within rubber area
Vitaceae	<i>Leea angulata</i>	Critically Endangered	Tree	2	Found as saplings
Vitaceae	<i>Leea indica</i>	Common	Tree	1	Many seedlings

TREE SCHEDULE

REF	TREE_ID	Girth (cm)	Height (m)	Species	Status	Type
1	P01	90	10	<i>Cyrtophyllum fragrans</i>	Common	Tree
2	P02	44	5	<i>Dillenia suffruticosa</i>	Common	Shrub
3	P03	270	5	<i>Elaeis guineensis</i>	Exotic	Tree
4	P04	66	8	<i>Hevea brasiliensis</i>	Naturalised	Tree
5	P05	43	16	<i>Pentace triptera</i>	Endangered	Tree
6	P06	48	10	<i>Nephelium lappaceum</i>	[Critically Endangered]	Tree
7	P07	55	10	<i>Litsea elliptica</i>	Common	Tree
8	P08	350	25	<i>Falcataria moluccana</i>	Naturalised	Tree
9	P09	300	25	<i>Falcataria moluccana</i>	Naturalised	Tree
10	P10	47	10	<i>Hevea brasiliensis</i>	Naturalised	Tree
11	P11	38	10	<i>Hevea brasiliensis</i>	Naturalised	Tree
12	P12	321	25	<i>Falcataria moluccana</i>	Naturalised	Tree
13	P13	100	20	<i>Syzygium syzygioides</i>	Vulnerable	Tree
14	P14	66	20	<i>Syzygium syzygioides</i>	Vulnerable	Tree
15	P15	55	15	<i>Syzygium syzygioides</i>	Vulnerable	Tree
16	P16	86	20	<i>Syzygium syzygioides</i>	Vulnerable	Tree
17	P17	73	20	<i>Syzygium syzygioides</i>	Vulnerable	Tree
18	P18	34	8	<i>Syzygium syzygioides</i>	Vulnerable	Tree
19	P19	89	25	<i>Falcataria moluccana</i>	Naturalised	Tree
20	P20	127	25	<i>Falcataria moluccana</i>	Naturalised	Tree
21	P21	180	15	<i>Hevea brasiliensis</i>	Naturalised	Tree
22	P22	69	18	<i>Syzygium grande</i>	Common	Tree
23	P23	33	6	<i>Cinnamomum iners</i>	Common	Tree
24	P24	500	25	<i>Pterocarpus indicus</i>	Exotic	Tree
25	P25	240	5	<i>Elaeis guineensis</i>	Exotic	Tree
26	P26	30	10	<i>Caryota mitis</i>	Common	Tree
27	P27	47	10	<i>Hevea brasiliensis</i>	Naturalised	Tree

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28	P28	35	8	<i>Caryota mitis</i>	Common	Tree
29	P29	36	8	<i>Caryota mitis</i>	Common	Tree
30	P30	52	8	<i>Syzygium syzygioides</i>	Vulnerable	Tree
31	P31	50	15	<i>Syzygium syzygioides</i>	Vulnerable	Tree
32	P32	134	20	<i>Syzygium syzygioides</i>	Vulnerable	Tree
33	P33	119	25	<i>Syzygium syzygioides</i>	Vulnerable	Tree
34	P34	120	4	<i>Elaeis guineensis</i>	Exotic	Tree
35	P35	42	6	<i>Ficus variegata</i>	Common	Tree
36	P36	31	6	<i>Ficus variegata</i>	Common	Tree
37	P37	49	8	<i>Ficus variegata</i>	Common	Tree
38	P38	300	25	<i>Spathodea campanulata</i>	Naturalised	Tree
39	P39	122	22	<i>Syzygium syzygioides</i>	Vulnerable	Tree
40	P40	43	8	<i>Syzygium syzygioides</i>	Vulnerable	Tree
41	P41	204	6	<i>Elaeis guineensis</i>	Exotic	Tree
42	P42	90	15	<i>Syzygium syzygioides</i>	Vulnerable	Tree
43	P43	35	10	<i>Ficus variegata</i>	Common	Tree
44	P44	49	12	<i>Claoxylon indicum</i>	Common	Tree
45	P45	52	6	<i>Ficus variegata</i>	Common	Tree
46	P46	52	8	<i>Ficus variegata</i>	Common	Tree
47	P47	31	5	<i>Falcataria moluccana</i>	Naturalised	Tree
48	P48	500	10	<i>Elaeis guineensis</i>	Exotic	Tree
49	P49	550	12	<i>Elaeis guineensis</i>	Exotic	Tree
50	P50	400	5	<i>Elaeis guineensis</i>	Exotic	Tree
51	P51	50	6	<i>Cinnamomum iners</i>	Common	Tree
52	P52	53	8	<i>Ficus variegata</i>	Common	Tree
53	P53	31	6	<i>Cinnamomum iners</i>	Common	Tree
54	P54	200	10	<i>Elaeis guineensis</i>	Exotic	Tree
55	P55	164	6	<i>Elaeis guineensis</i>	Exotic	Tree
56	P56	250	12	<i>Elaeis guineensis</i>	Exotic	Tree
57	P57	300	10	<i>Elaeis guineensis</i>	Exotic	Tree

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58	P58	32	5	<i>Caryota mitis</i>	Common	Tree
59	P59	300	10	<i>Elaeis guineensis</i>	Exotic	Tree
60	P60	31	6	<i>Ficus variegata</i>	Common	Tree
61	P61	300	12	<i>Elaeis guineensis</i>	Exotic	Tree
62	P62	29	6	<i>Ficus variegata</i>	Common	Tree
63	P63	70	14	<i>Claoxylon indicum</i>	Common	Tree
64	P64	99	10	<i>Ficus variegata</i>	Common	Tree
65	P65	205	25	<i>Artocarpus elasticus</i>	Common	Tree
66	P66	40	6	<i>Cinnamomum iners</i>	Common	Tree
67	P67	40	10	<i>Shorea leprosula</i>	Vulnerable	Tree
68	P68	36	12	<i>Pometia pinnata</i>	Endangered	Tree
69	P69	10	5	<i>Artocarpus elasticus</i>	Common	Tree
70	P70	23	12	<i>Pometia pinnata</i>	Endangered	Tree
71	P71	180	25	<i>Artocarpus elasticus</i>	Common	Tree
72	P72	220	25	<i>Artocarpus elasticus</i>	Common	Tree
73	P73	39	16	<i>Artocarpus elasticus</i>	Common	Tree
74	P74	155	10	<i>Pometia pinnata</i>	Endangered	Tree
75	P75	90	20	<i>Camptosperma auriculata</i>	Common	Tree
76	P76	44	12	<i>Pellacalyx axillaris</i>	Endangered	Tree
77	P77	43	5	<i>Ficus variegata</i>	Common	Tree
78	P78	92	35	<i>Carallia brachiata</i>	Endangered	Tree
79	P79	36	15	<i>Baccaurea motleyana</i>	[Critically Endangered]	Tree
80	P80	63	20	<i>Shorea leprosula</i>	Vulnerable	Tree
81	P81	31	10	<i>Palaquium obovatum</i>	Vulnerable	Tree
82	P82	49	8	<i>Artocarpus elasticus</i>	Common	Tree
83	P83	91	20	<i>Syzygium polyanthum</i>	Vulnerable	Tree
84	P84	119	20	<i>Syzygium polyanthum</i>	Vulnerable	Tree
85	P85	350	14	<i>Elaeis guineensis</i>	Exotic	Tree
86	P86	300	8	<i>Elaeis guineensis</i>	Exotic	Tree
87	P87	41	10	<i>Litsea elliptica</i>	Common	Tree

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88	P88	38	6	<i>Syzygium syzygioides</i>	Vulnerable	Tree
89	P89	200	25	<i>Syzygium grande</i>	Common	Tree
90	P90	123	20	<i>Syzygium syzygioides</i>	Vulnerable	Tree
91	P91	49	18	<i>Cyrtophyllum fragrans</i>	Common	Tree
92	P92	62	16	<i>Syzygium syzygioides</i>	Vulnerable	Tree
93	P93	40	12	<i>Syzygium syzygioides</i>	Vulnerable	Tree
94	P94	45	16	<i>Cyrtophyllum fragrans</i>	Common	Tree
95	P95	86	16	<i>Syzygium syzygioides</i>	Vulnerable	Tree
96	P96	124	25	<i>Syzygium syzygioides</i>	Vulnerable	Tree
97	P97	37	18	<i>Syzygium syzygioides</i>	Vulnerable	Tree
98	P98	220	25	<i>Falcataria moluccana</i>	Naturalised	Tree
99	P99	63	16	<i>Syzygium syzygioides</i>	Vulnerable	Tree
100	P100	52	10	<i>Cyrtophyllum fragrans</i>	Common	Tree
101	P101	66	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
102	P102	39	14	<i>Timonius wallichianus</i>	Common	Tree
103	P103	55	14	<i>Cyrtophyllum fragrans</i>	Common	Tree
104	P104	68	10	<i>Cyrtophyllum fragrans</i>	Common	Tree
105	P105	73	10	<i>Caryota mitis</i>	Common	Tree
106	P106	36	10	<i>Timonius wallichianus</i>	Common	Tree
107	P107	350	15	<i>Elaeis guineensis</i>	Exotic	Tree
108	P108	500	30	<i>Falcataria moluccana</i>	Naturalised	Tree
109	P109	52	10	<i>Timonius wallichianus</i>	Common	Tree
110	P110	52	14	<i>Macaranga gigantea</i>	Common	Tree
111	P111	55	14	<i>Syzygium polyanthum</i>	Vulnerable	Tree
112	P112	92	16	<i>Syzygium polyanthum</i>	Vulnerable	Tree
113	P113	54	14	<i>Macaranga gigantea</i>	Common	Tree
114	P114	136	20	<i>Syzygium polyanthum</i>	Vulnerable	Tree
115	P115	121	20	<i>Pometia pinnata</i>	Endangered	Tree
116	P116	170	30	<i>Artocarpus elasticus</i>	Common	Tree
117	P117	46	8	<i>Cinnamomum iners</i>	Common	Tree

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118	P118	48	16	<i>Dead</i>	Dead	
119	P119	62	14	<i>Artocarpus elasticus</i>	Common	Tree
120	P120	34	6	<i>Cinnamomum iners</i>	Common	Tree
121	P121	284	10	<i>Elaeis guineensis</i>	Exotic	Tree
122	P122	36	6	<i>Claoxylon indicum</i>	Common	Tree
123	P123	189	10	<i>Elaeis guineensis</i>	Exotic	Tree
124	P124	189	12	<i>Elaeis guineensis</i>	Exotic	Tree
125	P125	189	14	<i>Elaeis guineensis</i>	Exotic	Tree
126	P126	160	8	<i>Elaeis guineensis</i>	Exotic	Tree
127	P127	58	12	<i>Elaeis guineensis</i>	Exotic	Tree
128	P128	126	16	<i>Elaeis guineensis</i>	Exotic	Tree
129	P129	33	10	<i>Cinnamomum iners</i>	Common	Tree
130	P130	32	8	<i>Cinnamomum iners</i>	Common	Tree
131	P131	49	14	<i>Pometia pinnata</i>	Endangered	Tree
132	P132	40	14	<i>Cyrtophyllum fragrans</i>	Common	Tree
133	P133	83	16	<i>Sandoricum koetjape</i>	Endangered	Tree
134	P134	69	18	<i>Elaeis guineensis</i>	Exotic	Tree
135	P135	41	16	<i>Dillenia reticulata</i>	Critically Endangered	Tree
136	P136	20	1	<i>Oncosperma tigillaria</i>	Vulnerable	Shrub
137	P137	162	20	<i>Syzygium polyanthum</i>	Vulnerable	Tree
138	P138	43	12	<i>Xanthophyllum eurhynchum</i>	Vulnerable	Shrub
139	P139	59	18	<i>Syzygium polyanthum</i>	Vulnerable	Tree
140	P140	59	18	<i>Syzygium polyanthum</i>	Vulnerable	Tree
141	P141	40	14	<i>Syzygium polyanthum</i>	Vulnerable	Tree
142	P142	105	20	<i>Syzygium polyanthum</i>	Vulnerable	Tree
143	P143	52	14	<i>Syzygium polyanthum</i>	Vulnerable	Tree
144	P144	36	12	<i>Hevea brasiliensis</i>	Naturalised	Tree
145	P145	142	20	<i>Syzygium polyanthum</i>	Vulnerable	Tree
146	P146	180	8	<i>Elaeis guineensis</i>	Exotic	Tree
147	P147	89	20	<i>Syzygium polyanthum</i>	Vulnerable	Tree

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148	P148	50	16	<i>Polyscion diversifolia</i>	Common	Tree
149	P149	36	13	<i>Syzygium polyanthum</i>	Vulnerable	Tree
150	P150	50	14	<i>Polyscion diversifolia</i>	Common	Tree
151	P151	45	8	<i>Claoxylon indicum</i>	Common	Tree
152	P152	35	12	<i>Syzygium polyanthum</i>	Vulnerable	Tree
153	P153	43	14	<i>Syzygium polyanthum</i>	Vulnerable	Tree
154	P154	33	10	<i>Claoxylon indicum</i>	Common	Tree
155	P155	189	12	<i>Elaeis guineensis</i>	Exotic	Tree
156	P156	90	14	<i>Artocarpus heterophyllus</i>	Exotic	Tree
157	P157	150	6	<i>Elaeis guineensis</i>	Exotic	Tree
158	P158	30	8	<i>Litsea elliptica</i>	Common	Tree
159	P159	101	18	<i>Cyrtophyllum fragrans</i>	Common	Tree
160	P160	89	18	<i>Cyrtophyllum fragrans</i>	Common	Tree
161	P161	180	12	<i>Elaeis guineensis</i>	Exotic	Tree
162	P162	51	14	<i>Cyrtophyllum fragrans</i>	Common	Tree
163	P163	91	20	<i>Campnosperma auriculata</i>	Common	Tree
164	P164	43	18	<i>Syzygium polyanthum</i>	Vulnerable	Tree
165	P165	220	25	<i>Artocarpus elasticus</i>	Common	Tree
166	P166	108	20	<i>Syzygium polyanthum</i>	Vulnerable	Tree
167	P167	168	25	<i>Syzygium polyanthum</i>	Vulnerable	Tree
168	P168	64	12	<i>Litsea elliptica</i>	Common	Tree
169	P169	216	16	<i>Elaeis guineensis</i>	Exotic	Tree
170	P170	48	12	<i>Ficus variegata</i>	Common	Tree
171	P171	40	12	<i>Claoxylon indicum</i>	Common	Tree
172	P172	42	12	<i>Caryota mitis</i>	Common	Tree
173	P173	65	10	<i>Claoxylon indicum</i>	Common	Tree
174	P174	210	12	<i>Elaeis guineensis</i>	Exotic	Tree
175	P175	48	12	<i>Caryota mitis</i>	Common	Tree
176	P176	38	14	<i>Claoxylon indicum</i>	Common	Tree
177	P177	69	16	<i>Syzygium polyanthum</i>	Vulnerable	Tree

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178	P178	98	14	<i>Syzygium polyanthum</i>	Vulnerable	Tree
179	P179	67	12	<i>Syzygium polyanthum</i>	Vulnerable	Tree
180	P180	94	20	<i>Syzygium polyanthum</i>	Vulnerable	Tree
181	P181	63	20	<i>Syzygium polyanthum</i>	Vulnerable	Tree
182	P182	45	14	<i>Litsea elliptica</i>	Common	Tree
183	P183	31	13	<i>Syzygium polyanthum</i>	Vulnerable	Tree
184	P184	30	10	<i>Claoxylon indicum</i>	Common	Tree
185	P185	30	4	<i>Elaeis guineensis</i>	Exotic	Tree
186	P186	30	4	<i>Caryota mitis</i>	Common	Tree
187	P187	220	14	<i>Elaeis guineensis</i>	Exotic	Tree
188	P188	200	14	<i>Elaeis guineensis</i>	Exotic	Tree
189	P189	210	14	<i>Elaeis guineensis</i>	Exotic	Tree
190	P190	56	12	<i>Ficus variegata</i>	Common	Tree
191	P191	150	8	<i>Elaeis guineensis</i>	Exotic	Tree
192	P192	200	12	<i>Elaeis guineensis</i>	Exotic	Tree
193	P193	54	12	<i>Caryota mitis</i>	Common	Tree
194	P194	37	6	<i>Nephelium lappaceum</i>	[Critically Endangered]	Tree
195	P195	62	14	<i>Ficus variegata</i>	Common	Tree
196	P196	200	14	<i>Elaeis guineensis</i>	Exotic	Tree
197	P197	42	16	<i>Ficus variegata</i>	Common	Tree
198	P198	108	14	<i>Elaeis guineensis</i>	Exotic	Tree
199	P199	56	16	<i>Camptosperma auriculata</i>	Common	Tree
200	P200	196	16	<i>Elaeis guineensis</i>	Exotic	Tree
201	P201	48	18	<i>Claoxylon indicum</i>	Common	Tree
202	P202	89	20	<i>Claoxylon indicum</i>	Common	Tree
203	P203	180	18	<i>Elaeis guineensis</i>	Exotic	Tree
204	P204	190	18	<i>Oncosperma tigillaria</i>	Vulnerable	Shrub
205	P205	70	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
206	P206	109	25	<i>Syzygium polyanthum</i>	Vulnerable	Tree
207	P207	30	16	<i>Bhesa paniculata</i>	Common	Tree

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208	P208	68	18	<i>Syzygium polyanthum</i>	Vulnerable	Tree
209	P209	68	16	<i>Syzygium polyanthum</i>	Vulnerable	Tree
210	P210	54	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
211	P211	120	25	<i>Hevea brasiliensis</i>	Naturalised	Tree
212	P212	180	5	<i>Elaeis guineensis</i>	Exotic	Tree
213	P213	138	22	<i>Syzygium grande</i>	Common	Tree
214	P214	160	5	<i>Elaeis guineensis</i>	Exotic	Tree
215	P215	120	4	<i>Elaeis guineensis</i>	Exotic	Tree
216	P216	102	5	<i>Elaeis guineensis</i>	Exotic	Tree
217	P217	100	4	<i>Elaeis guineensis</i>	Exotic	Tree
218	P218	400	30	<i>Syzygium grande</i>	Common	Tree
219	P219	120	14	<i>Elaeis guineensis</i>	Exotic	Tree
220	P220	120	8	<i>Elaeis guineensis</i>	Exotic	Tree
221	P221	188	16	<i>Elaeis guineensis</i>	Exotic	Tree
222	P222	41	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
223	P223	178	25	<i>Litsea elliptica</i>	Common	Tree
224	P224	65	20	<i>Litsea elliptica</i>	Common	Tree
225	P225	39	15	<i>Cinnamomum iners</i>	Common	Tree
226	P226	60	18	<i>Baccaurea motleyana</i>	[Critically Endangered]	Tree
227	P227	100	14	<i>Elaeis guineensis</i>	Exotic	Tree
228	P228	100	6	<i>Nephelium lappaceum</i>	[Critically Endangered]	Tree
229	P229	138	22	<i>Hevea brasiliensis</i>	Naturalised	Tree
230	P230	30	14	<i>Claoxylon indicum</i>	Common	Tree
231	P231	46	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
232	P232	100	16	<i>Elaeis guineensis</i>	Exotic	Tree
233	P233	88	10	<i>Palaquium obovatum</i>	Vulnerable	Tree
234	P234	134	25	<i>Syzygium polyanthum</i>	Vulnerable	Tree
235	P235	94	16	<i>Cinnamomum iners</i>	Common	Tree
236	P236	69	16	<i>Syzygium polyanthum</i>	Vulnerable	Tree
237	P237	63	16	<i>Ficus variegata</i>	Common	Tree

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238	P238	106	20	<i>Litsea firma</i>	Common	Tree
239	P239	33	14	<i>Nephelium lappaceum</i>	[Critically Endangered]	Tree
240	P240	68	16	<i>Nephelium lappaceum</i>	[Critically Endangered]	Tree
241	P241	61	12	<i>Litsea elliptica</i>	Common	Tree
242	P242	189	10	<i>Elaeis guineensis</i>	Exotic	Tree
243	P243	58	8	<i>Cinnamomum iners</i>	Common	Tree
244	P244	71	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
245	P245	49	14	<i>Ochanostachys amentacea</i>	Vulnerable	Tree
246	P246	33	12	<i>Hevea brasiliensis</i>	Naturalised	Tree
247	P247	30	12	<i>Hevea brasiliensis</i>	Naturalised	Tree
248	P248	216	25	<i>Syzygium grande</i>	Common	Tree
249	P249	62	18	<i>Ochanostachys amentacea</i>	Vulnerable	Tree
250	P250	48	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
251	P251	42	16	<i>Garcinia parvifolia</i>	Common	Tree
252	P252	48	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
253	P253	101	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
254	P254	44	14	<i>Cinnamomum iners</i>	Common	Tree
255	P255	43	14	<i>Prunus polystachya</i>	Common	Tree
256	P256	47	12	<i>Hevea brasiliensis</i>	Naturalised	Tree
257	P257	34	14	<i>Syzygium polyanthum</i>	Vulnerable	Tree
258	P258	37	14	<i>Syzygium polyanthum</i>	Vulnerable	Tree
259	P259	108	22	<i>Aphanamixis polystachya</i>	Endangered	Tree
260	P260	49	12	<i>Sandoricum koetjape</i>	Endangered	Tree
261	P261	36	14	<i>Syzygium polyanthum</i>	Vulnerable	Tree
262	P262	53	14	<i>Timonius wallichianus</i>	Common	Tree
263	P263	43	14	<i>Syzygium polyanthum</i>	Vulnerable	Tree
264	P264	58	10	<i>Cinnamomum iners</i>	Common	Tree
265	P265	38	12	<i>Ficus variegata</i>	Common	Tree
266	P266	31	2	<i>Nephelium lappaceum</i>	[Critically Endangered]	Tree
267	P267	61	14	<i>Spathodea campanulata</i>	Naturalised	Tree

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268	P268	40	12	<i>Aphanamixis polystachya</i>	Endangered	Tree
269	P269	62	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
270	P270	79	14	<i>Gironniera nervosa</i>	Common	Tree
271	P271	106	20	<i>Syzygium polyanthum</i>	Vulnerable	Tree
272	P272	34	8	<i>Syzygium polyanthum</i>	Vulnerable	Tree
273	P273	31	13	<i>Palaquium obovatum</i>	Vulnerable	Tree
274	P274	128	20	<i>Nephelium lappaceum</i>	[Critically Endangered]	Tree
275	P275	37	15	<i>Timonius wallichianus</i>	Common	Tree
276	P276	76	16	<i>Prunus polystachya</i>	Common	Tree
277	P277	45	14	<i>Cinnamomum iners</i>	Common	Tree
278	P278	75	20	<i>Ochanostachys amentacea</i>	Vulnerable	Tree
279	P279	132	20	<i>Syzygium grande</i>	Common	Tree
280	P280	180	8	<i>Elaeis guineensis</i>	Exotic	Tree
281	P281	58	10	<i>Alstonia angustiloba</i>	Common	Tree
282	P282	39	12	<i>Hevea brasiliensis</i>	Naturalised	Tree
283	P283	30	8	<i>Cinnamomum iners</i>	Common	Tree
284	P284	160	25	<i>Syzygium grande</i>	Common	Tree
285	P285	94	25	<i>Cinnamomum iners</i>	Common	Tree
286	P286	41	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
287	P287	53	16	<i>Litsea elliptica</i>	Common	Tree
288	P288	49	10	<i>Hevea brasiliensis</i>	Naturalised	Tree
289	P289	49	16	<i>Sandoricum koetjape</i>	Endangered	Tree
290	P290	58	10	<i>Pometia pinnata</i>	Endangered	Tree
291	P291	38	12	<i>Ficus variegata</i>	Common	Tree
292	P292	51	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
293	P293	34	14	<i>Cinnamomum iners</i>	Common	Tree
294	P294	85	20	<i>Pentace triptera</i>	Endangered	Tree
295	P295	47	14	<i>Sandoricum koetjape</i>	Endangered	Tree
296	P296	180	30	<i>Nephelium lappaceum</i>	[Critically Endangered]	Tree
297	P297	54	16	<i>Pentace triptera</i>	Endangered	Tree

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298	P298	110	25	<i>Syzygium polyanthum</i>	Vulnerable	Tree
299	P299	42	15	<i>Sandoricum koetjape</i>	Endangered	Tree
300	P300	420	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
301	P301	86	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
302	P302	54	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
303	P303	41	16	<i>Xanthophyllum eurhynchum</i>	Vulnerable	Shrub
304	P304	43	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
305	P305	120	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
306	P306	188	20	<i>Syzygium grande</i>	Common	Tree
307	P307	32	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
308	P308	110	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
309	P309	31	4	<i>Hevea brasiliensis</i>	Naturalised	Tree
310	P310	550	20	<i>Oncosperma tigillaria</i>	Vulnerable	Shrub
311	P311	68	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
312	P312	73	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
313	P313	37	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
314	P314	32	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
315	P315	102	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
316	P316	30	12	<i>Hevea brasiliensis</i>	Naturalised	Tree
317	P317	45	6	<i>Hevea brasiliensis</i>	Naturalised	Tree
318	P318	89	4	<i>Hevea brasiliensis</i>	Naturalised	Tree
319	P319	49	12	<i>Hevea brasiliensis</i>	Naturalised	Tree
320	P320	142	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
321	P321	33	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
322	P322	60	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
323	P323	35	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
324	P324	108	12	<i>Hevea brasiliensis</i>	Naturalised	Tree
325	P325	39	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
326	P326	71	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
327	P327	77	22	<i>Syzygium polyanthum</i>	Vulnerable	Tree

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328	P328	58	5	<i>Hevea brasiliensis</i>	Naturalised	Tree
329	P329	52	10	<i>Ficus variegata</i>	Common	Tree
330	P330	252	25	<i>Falcataria moluccana</i>	Naturalised	Tree
331	P331	148	25	<i>Falcataria moluccana</i>	Naturalised	Tree
332	P332	62	6	<i>Aphanamixis polystachya</i>	Endangered	Tree
333	P333	240	10	<i>Elaeis guineensis</i>	Exotic	Tree
334	P334	180	10	<i>Elaeis guineensis</i>	Exotic	Tree
335	P335	65	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
336	P336	43	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
337	P337	31	16	<i>Ficus variegata</i>	Common	Tree
338	P338	76	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
339	P339	35	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
340	P340	95	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
341	P341	74	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
342	P342	186	25	<i>Hevea brasiliensis</i>	Naturalised	Tree
343	P343	42	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
344	P344	37	6	<i>Cinnamomum iners</i>	Common	Tree
345	P345	73	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
346	P346	152	25	<i>Hevea brasiliensis</i>	Naturalised	Tree
347	P347	78	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
348	P348	53	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
349	P349	45	12	<i>Hevea brasiliensis</i>	Naturalised	Tree
350	P350	51	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
351	P351	43	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
352	P352	183	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
353	P353	39	18	<i>Dead</i>	Dead	
354	P354	68	18	<i>Dead</i>	Dead	
355	P355	58	16	<i>Cratoxylum cochinchinense</i>	Endangered	Tree
356	P356	160	20	<i>Alstonia angustiloba</i>	Common	Tree
357	P357	36	14	<i>Hevea brasiliensis</i>	Naturalised	Tree

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358	P358	33	10	<i>Hevea brasiliensis</i>	Naturalised	Tree
359	P359	96	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
360	P360	33	12	<i>Hevea brasiliensis</i>	Naturalised	Tree
361	P361	54	20	<i>Ochanostachys amentacea</i>	Vulnerable	Tree
362	P362	39	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
363	P363	46	16	<i>Girroniera nervosa</i>	Common	Tree
364	P364	71	14	<i>Litsea elliptica</i>	Common	Tree
365	P365	118	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
366	P366	37	12	<i>Hevea brasiliensis</i>	Naturalised	Tree
367	P367	100	12	<i>Cinnamomum iners</i>	Common	Tree
368	P368	83	22	<i>Hevea brasiliensis</i>	Naturalised	Tree
369	P369	52	12	<i>Cinnamomum iners</i>	Common	Tree
370	P370	30	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
371	P371	30	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
372	P372	47	12	<i>Cinnamomum iners</i>	Common	Tree
373	P373	48	12	<i>Cinnamomum iners</i>	Common	Tree
374	P374	65	22	<i>Syzygium grande</i>	Common	Tree
375	P375	114	22	<i>Syzygium grande</i>	Common	Tree
376	P376	120	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
377	P377	60	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
378	P378	46	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
379	P379	36	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
380	P380	30	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
381	P381	84	22	<i>Hevea brasiliensis</i>	Naturalised	Tree
382	P382	110	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
383	P383	116	22	<i>Hevea brasiliensis</i>	Naturalised	Tree
384	P384	76	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
385	P385	33	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
386	P386	96	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
387	P387	76	14	<i>Hevea brasiliensis</i>	Naturalised	Tree

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388	P388	128	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
389	P389	38	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
390	P390	71	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
391	P391	47	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
392	P392	52	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
393	P393	51	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
394	P394	61	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
395	P395	30	3	<i>Oncosperma tigillaria</i>	Vulnerable	Shrub
396	P396	46	13	<i>Hevea brasiliensis</i>	Naturalised	Tree
397	P397	67	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
398	P398	66	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
399	P399	183	6	<i>Elaeis guineensis</i>	Exotic	Tree
400	P400	52	15	<i>Hevea brasiliensis</i>	Naturalised	Tree
401	P401	35	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
402	P402	133	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
403	P403	114	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
404	P404	30	12	<i>Hevea brasiliensis</i>	Naturalised	Tree
405	P405	56	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
406	P406	200	12	<i>Elaeis guineensis</i>	Exotic	Tree
407	P407	72	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
408	P408	120	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
409	P409	220	12	<i>Elaeis guineensis</i>	Exotic	Tree
410	P410	33	12	<i>Hevea brasiliensis</i>	Naturalised	Tree
411	P411	103	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
412	P412	34	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
413	P413	32	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
414	P414	62	21	<i>Hevea brasiliensis</i>	Naturalised	Tree
415	P415	186	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
416	P416	102	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
417	P417	34	14	<i>Hevea brasiliensis</i>	Naturalised	Tree

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418	P418	66	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
419	P419	56	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
420	P420	110	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
421	P421	67	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
422	P422	35	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
423	P423	46	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
424	P424	152	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
425	P425	84	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
426	P426	72	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
427	P427	69	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
428	P428	42	20	<i>Cinnamomum iners</i>	Common	Tree
429	P429	79	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
430	P430	88	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
431	P431	82	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
432	P432	36	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
433	P433	130	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
434	P434	47	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
435	P435	48	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
436	P436	34	14	<i>Timonius wallichianus</i>	Common	Tree
437	P437	38	10	<i>Hevea brasiliensis</i>	Naturalised	Tree
438	P438	90	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
439	P439	56	12	<i>Dead</i>	Dead	
440	P440	92	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
441	P441	56	16	<i>Palaquium obovatum</i>	Vulnerable	Tree
442	P442	134	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
443	P443	100	16	<i>Gironniera nervosa</i>	Common	Tree
444	P444	34	15	<i>Hevea brasiliensis</i>	Naturalised	Tree
445	P445	120	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
446	P446	56	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
447	P447	34	16	<i>Hevea brasiliensis</i>	Naturalised	Tree

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448	P448	76	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
449	P449	48	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
450	P450	33	12	<i>Ficus variegata</i>	Common	Tree
451	P451	38	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
452	P452	96	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
453	P453	59	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
454	P454	62	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
455	P455	160	12	<i>Elaeis guineensis</i>	Exotic	Tree
456	P456	88	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
457	P457	48	12	<i>Hevea brasiliensis</i>	Naturalised	Tree
458	P458	47	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
459	P459	63	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
460	P460	92	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
461	P461	39	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
462	P462	59	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
463	P463	30	16	<i>Cinnamomum iners</i>	Common	Tree
464	P464	52	16	<i>Cinnamomum iners</i>	Common	Tree
465	P465	152	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
466	P466	90	25	<i>Hevea brasiliensis</i>	Naturalised	Tree
467	P467	114	24	<i>Hevea brasiliensis</i>	Naturalised	Tree
468	P468	76	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
469	P469	62	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
470	P470	72	22	<i>Hevea brasiliensis</i>	Naturalised	Tree
471	P471	70	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
472	P472	58	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
473	P473	58	16	<i>Gironniera nervosa</i>	Common	Tree
474	P474	37	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
475	P475	30	12	<i>Gironniera nervosa</i>	Common	Tree
476	P476	37	14	<i>Gironniera nervosa</i>	Common	Tree
477	P477	157	18	<i>Hevea brasiliensis</i>	Naturalised	Tree

Baseline flora study for Proposed Road Widening at Lorong Lada Hitam

478	P478	47	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
479	P479	68	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
480	P480	34	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
481	P481	82	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
482	P482	140	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
483	P483	42	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
484	P484	38	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
485	P485	32	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
486	P486	64	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
487	P487	33	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
488	P488	44	16	<i>Gironniera nervosa</i>	Common	Tree
489	P489	32	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
490	P490	60	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
491	P491	32	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
492	P492	36	14	<i>Timonius wallichianus</i>	Common	Tree
493	P493	31	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
494	P494	84	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
495	P495	47	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
496	P496	84	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
497	P497	37	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
498	P498	36	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
499	P499	30	8	<i>Gironniera nervosa</i>	Common	Tree
500	P500	31	12	<i>Hevea brasiliensis</i>	Naturalised	Tree
501	P501	35	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
502	P502	33	12	<i>Hevea brasiliensis</i>	Naturalised	Tree
503	P503	33	16	<i>Endospermum diadenum</i>	Vulnerable	Tree
504	P504	51	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
505	P505	52	15	<i>Hevea brasiliensis</i>	Naturalised	Tree
506	P506	48	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
507	P507	67	20	<i>Pellacalyx axillaris</i>	Endangered	Tree

Baseline flora study for Proposed Road Widening at Lorong Lada Hitam

508	P508	45	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
509	P509	82	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
510	P510	35	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
511	P511	33	12	<i>Hevea brasiliensis</i>	Naturalised	Tree
512	P512	56	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
513	P513	53	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
514	P514	108	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
515	P515	38	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
516	P516	37	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
517	P517	73	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
518	P518	41	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
519	P519	73	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
520	P520	92	5	<i>Hevea brasiliensis</i>	Naturalised	Tree
521	P521	120	25	<i>Hevea brasiliensis</i>	Naturalised	Tree
522	P522	33	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
523	P523	35	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
524	P524	70	25	<i>Hevea brasiliensis</i>	Naturalised	Tree
525	P525	142	25	<i>Hevea brasiliensis</i>	Naturalised	Tree
526	P526	30	12	<i>Caryota mitis</i>	Common	Tree
527	P527	63	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
528	P528	63	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
529	P529	33	12	<i>Hevea brasiliensis</i>	Naturalised	Tree
530	P530	36	10	<i>Hevea brasiliensis</i>	Naturalised	Tree
531	P531	32	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
532	P532	67	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
533	P533	107	22	<i>Hevea brasiliensis</i>	Naturalised	Tree
534	P534	102	25	<i>Hevea brasiliensis</i>	Naturalised	Tree
535	P535	63	25	<i>Hevea brasiliensis</i>	Naturalised	Tree
536	P536	30	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
537	P537	44	16	<i>Hevea brasiliensis</i>	Naturalised	Tree

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538	P538	95	22	<i>Hevea brasiliensis</i>	Naturalised	Tree
539	P539	78	25	<i>Hevea brasiliensis</i>	Naturalised	Tree
540	P540	40	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
541	P541	51	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
542	P542	143	22	<i>Hevea brasiliensis</i>	Naturalised	Tree
543	P543	44	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
544	P544	80	22	<i>Hevea brasiliensis</i>	Naturalised	Tree
545	P545	31	25	<i>Hevea brasiliensis</i>	Naturalised	Tree
546	P546	45	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
547	P547	49	22	<i>Hevea brasiliensis</i>	Naturalised	Tree
548	P548	44	10	<i>Hevea brasiliensis</i>	Naturalised	Tree
549	P549	76	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
550	P550	30	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
551	P551	44	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
552	P552	48	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
553	P553	76	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
554	P554	150	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
555	P555	58	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
556	P556	32	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
557	P557	40	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
558	P558	70	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
559	P559	57	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
560	P560	58	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
561	P561	32	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
562	P562	50	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
563	P563	37	5	<i>Hevea brasiliensis</i>	Naturalised	Tree
564	P564	50	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
565	P565	88	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
566	P566	30	10	<i>Cinnamomum iners</i>	Common	Tree
567	P567	33	16	<i>Hevea brasiliensis</i>	Naturalised	Tree

Baseline flora study for Proposed Road Widening at Lorong Lada Hitam

568	P568	56	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
569	P569	125	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
570	P570	47	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
571	P571	40	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
572	P572	33	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
573	P573	136	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
574	P574	59	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
575	P575	102	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
576	P576	59	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
577	P577	37	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
578	P578	45	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
579	P579	41	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
580	P580	138	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
581	P581	47	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
582	P582	122	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
583	P583	78	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
584	P584	41	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
585	P585	110	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
586	P586	82	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
587	P587	55	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
588	P588	84	14	Dead	Dead	
589	P589	40	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
590	P590	98	14	<i>Syzygium lineatum</i>	Common	Tree
591	P591	105	16	<i>Gironniera nervosa</i>	Common	Tree
592	P592	90	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
593	P593	41	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
594	P594	36	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
595	P595	36	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
596	P596	50	6	<i>Hevea brasiliensis</i>	Naturalised	Tree
597	P597	42	14	<i>Gironniera nervosa</i>	Common	Tree

Baseline flora study for Proposed Road Widening at Lorong Lada Hitam

598	P598	150	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
599	P599	176	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
600	P600	158	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
601	P601	42	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
602	P602	47	12	<i>Gironniera nervosa</i>	Common	Tree
603	P603	50	12	<i>Gironniera nervosa</i>	Common	Tree
604	P604	54	16	<i>Gynotroches axillaris</i>	Common	Tree
605	P605	51	18	<i>Gynotroches axillaris</i>	Common	Tree
606	P606	280	20	<i>Oncosperma tigillaria</i>	Vulnerable	Shrub
607	P607	202	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
608	P608	54	14	<i>Gironniera nervosa</i>	Common	Tree
609	P609	164	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
610	P610	43	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
611	P611	37	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
612	P612	84	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
613	P613	45	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
614	P614	88	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
615	P615	80	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
616	P616	46	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
617	P617	72	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
618	P618	30	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
619	P619	75	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
620	P620	115	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
621	P621	78	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
622	P622	82	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
623	P623	132	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
624	P624	6	2	<i>Plectocomia elongata</i>	Vulnerable	Climber
625	P625	33	16	<i>Gironniera nervosa</i>	Common	Tree
626	P626	115	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
627	P627	63	7	<i>Hevea brasiliensis</i>	Naturalised	Tree

Baseline flora study for Proposed Road Widening at Lorong Lada Hitam

628	P628	53	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
629	P629	194	22	<i>Hevea brasiliensis</i>	Naturalised	Tree
630	P630	30	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
631	P631	36	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
632	P632	104	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
633	P633	44	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
634	P634	132	23	<i>Hevea brasiliensis</i>	Naturalised	Tree
635	P635	134	22	<i>Hevea brasiliensis</i>	Naturalised	Tree
636	P636	71	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
637	P637	41	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
638	P638	70	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
639	P639	152	2	<i>Hevea brasiliensis</i>	Naturalised	Tree
640	P640	92	20	<i>Gironniera nervosa</i>	Common	Tree
641	P641	209	20	<i>Dead</i>	Dead	
642	P642	65	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
643	P643	92	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
644	P644	39	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
645	P645	33	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
646	P646	81	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
647	P647	33	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
648	P648	36	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
649	P649	37	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
650	P650	60	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
651	P651	67	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
652	P652	117	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
653	P653	135	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
654	P654	120	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
655	P655	43	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
656	P656	55	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
657	P657	39	14	<i>Hevea brasiliensis</i>	Naturalised	Tree

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658	P658	34	12	<i>Hevea brasiliensis</i>	Naturalised	Tree
659	P659	65	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
660	P660	38	10	<i>Hevea brasiliensis</i>	Naturalised	Tree
661	P661	35	4	<i>Hevea brasiliensis</i>	Naturalised	Tree
662	P662	35	8	<i>Hevea brasiliensis</i>	Naturalised	Tree
663	P663	36	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
664	P664	88	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
665	P665	41	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
666	P666	31	12	<i>Hevea brasiliensis</i>	Naturalised	Tree
667	P667	31	12	<i>Hevea brasiliensis</i>	Naturalised	Tree
668	P668	36	12	<i>Hevea brasiliensis</i>	Naturalised	Tree
669	P669	34	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
670	P670	209	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
671	P671	32	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
672	P672	98	16	<i>Macaranga gigantea</i>	Common	Tree
673	P673	30	10	<i>Hevea brasiliensis</i>	Naturalised	Tree
674	P674	88	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
675	P675	40	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
676	P676	73	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
677	P677	51	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
678	P678	51	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
679	P679	88	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
680	P680	53	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
681	P681	91	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
682	P682	36	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
683	P683	85	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
684	P684	80	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
685	P685	49	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
686	P686	55	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
687	P687	82	18	<i>Hevea brasiliensis</i>	Naturalised	Tree

Baseline flora study for Proposed Road Widening at Lorong Lada Hitam

688	P688	63	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
689	P689	81	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
690	P690	73	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
691	P691	65	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
692	P692	30	14	<i>Syzygium lineatum</i>	Common	Tree
693	P693	50	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
694	P694	36	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
695	P695	80	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
696	P696	31	12	<i>Hevea brasiliensis</i>	Naturalised	Tree
697	P697	45	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
698	P698	42	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
699	P699	30	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
700	P700	61	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
701	P701	37	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
702	P702	36	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
703	P703	54	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
704	P704	40	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
705	P705	42	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
706	P706	30	12	<i>Hevea brasiliensis</i>	Naturalised	Tree
707	P707	30	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
708	P708	60	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
709	P709	54	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
710	P710	43	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
711	P711	37	12	<i>Hevea brasiliensis</i>	Naturalised	Tree
712	P712	92	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
713	P713	63	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
714	P714	79	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
715	P715	43	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
716	P716	72	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
717	P717	62	14	<i>Hevea brasiliensis</i>	Naturalised	Tree

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718	P718	57	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
719	P719	38	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
720	P720	38	12	<i>Hevea brasiliensis</i>	Naturalised	Tree
721	P721	58	14	<i>Girroniera nervosa</i>	Common	Tree
722	P722	63	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
723	P723	34	12	<i>Hevea brasiliensis</i>	Naturalised	Tree
724	P724	33	12	<i>Hevea brasiliensis</i>	Naturalised	Tree
725	P725	31	12	<i>Hevea brasiliensis</i>	Naturalised	Tree
726	P726	30	12	<i>Hevea brasiliensis</i>	Naturalised	Tree
727	P727	136	22	<i>Hevea brasiliensis</i>	Naturalised	Tree
728	P728	36	10	<i>Hevea brasiliensis</i>	Naturalised	Tree
729	P729	35	12	<i>Hevea brasiliensis</i>	Naturalised	Tree
730	P730	133	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
731	P731	38	10	<i>Hevea brasiliensis</i>	Naturalised	Tree
732	P732	33	12	<i>Hevea brasiliensis</i>	Naturalised	Tree
733	P733	36	10	<i>Hevea brasiliensis</i>	Naturalised	Tree
734	P734	142	25	<i>Hevea brasiliensis</i>	Naturalised	Tree
735	P735	30	12	<i>Hevea brasiliensis</i>	Naturalised	Tree
736	P736	74	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
737	P737	63	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
738	P738	76	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
739	P739	128	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
740	P740	140	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
741	P741	45	16	<i>Campylospermum serratum</i>	Common	Tree
742	P742	96	18	<i>Hevea brasiliensis</i>	Naturalised	Tree
743	P743	47	12	<i>Xerospermum noronhianum</i>	Critically Endangered	Tree
744	P744	132	20	<i>Hevea brasiliensis</i>	Naturalised	Tree
745	P745	47	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
746	P746	43	12	<i>Hevea brasiliensis</i>	Naturalised	Tree
747	P747	51	14	<i>Hevea brasiliensis</i>	Naturalised	Tree

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748	P748	48	14	<i>Hevea brasiliensis</i>	Naturalised	Tree
749	P749	159	8	<i>Chrysophyllum cainito</i>	Exotic	Tree
750	P750	88	8	<i>Chrysophyllum cainito</i>	Exotic	Tree
751	P751	171	8	<i>Chrysophyllum cainito</i>	Exotic	Tree
752	P752	217	8	<i>Chrysophyllum cainito</i>	Exotic	Tree
753	P753	108	8	<i>Chrysophyllum cainito</i>	Exotic	Tree
754	P754	166	8	<i>Chrysophyllum cainito</i>	Exotic	Tree
755	P755	85	8	<i>Chrysophyllum cainito</i>	Exotic	Tree
756	P756	83	8	<i>Chrysophyllum cainito</i>	Exotic	Tree
757	P757	126	8	<i>Chrysophyllum cainito</i>	Exotic	Tree
758	P758	78	8	<i>Chrysophyllum cainito</i>	Exotic	Tree
759	P759	63	8	<i>Chrysophyllum cainito</i>	Exotic	Tree
760	P760	79	8	<i>Chrysophyllum cainito</i>	Exotic	Tree
761	P761	82	8	<i>Chrysophyllum cainito</i>	Exotic	Tree
762	P762	124	8	<i>Chrysophyllum cainito</i>	Exotic	Tree
763	P763	154	12	<i>Chrysophyllum cainito</i>	Exotic	Tree
764	P764	138	8	<i>Chrysophyllum cainito</i>	Exotic	Tree
765	P765	97	8	<i>Chrysophyllum cainito</i>	Exotic	Tree
766	P766	105	8	<i>Chrysophyllum cainito</i>	Exotic	Tree
767	P767	115	8	<i>Chrysophyllum cainito</i>	Exotic	Tree
768	P768	112	8	<i>Chrysophyllum cainito</i>	Exotic	Tree
769	P769	73	8	<i>Chrysophyllum cainito</i>	Exotic	Tree
770	P770	145	8	<i>Chrysophyllum cainito</i>	Exotic	Tree
771	P771	45	8	<i>Chrysophyllum cainito</i>	Exotic	Tree
772	P772	139	8	<i>Chrysophyllum cainito</i>	Exotic	Tree
773	P773	171	8	<i>Chrysophyllum cainito</i>	Exotic	Tree
774	P774	67	8	<i>Chrysophyllum cainito</i>	Exotic	Tree
775	P775	92	8	<i>Chrysophyllum cainito</i>	Exotic	Tree
776	P776	129	8	<i>Chrysophyllum cainito</i>	Exotic	Tree
777	P777	157	8	<i>Chrysophyllum cainito</i>	Exotic	Tree

Baseline flora study for Proposed Road Widening at Lorong Lada Hitam

778	P778	114	8	<i>Chrysophyllum cainito</i>	Exotic	Tree
779	P779	162	10	<i>Chrysophyllum cainito</i>	Exotic	Tree
780	P780	94	8	<i>Chrysophyllum cainito</i>	Exotic	Tree
781	P781	80	8	<i>Chrysophyllum cainito</i>	Exotic	Tree
782	P782	177	8	<i>Chrysophyllum cainito</i>	Exotic	Tree
783	P783	138	8	<i>Chrysophyllum cainito</i>	Exotic	Tree
784	P784	117	8	<i>[Gnetum gnemon]</i>	[Critically Endangered]	Tree
785	P785	122	16	<i>[Gnetum gnemon]</i>	[Critically Endangered]	Tree
786	P786	148	16	<i>[Gnetum gnemon]</i>	[Critically Endangered]	Tree
787	P787	165	16	<i>[Gnetum gnemon]</i>	[Critically Endangered]	Tree
788	P788	140	16	<i>[Gnetum gnemon]</i>	[Critically Endangered]	Tree
789	P789	160	16	<i>[Gnetum gnemon]</i>	[Critically Endangered]	Tree
790	P790	120	16	<i>[Gnetum gnemon]</i>	[Critically Endangered]	Tree
791	P791	120	16	<i>[Gnetum gnemon]</i>	[Critically Endangered]	Tree
792	P792	170	16	<i>[Gnetum gnemon]</i>	[Critically Endangered]	Tree
793	P793	165	16	<i>[Gnetum gnemon]</i>	[Critically Endangered]	Tree
794	P794	155	16	<i>[Gnetum gnemon]</i>	[Critically Endangered]	Tree
795	P795	160	16	<i>[Gnetum gnemon]</i>	[Critically Endangered]	Tree
796	P796	120	16	<i>[Gnetum gnemon]</i>	[Critically Endangered]	Tree
797	P797	100	16	<i>[Gnetum gnemon]</i>	[Critically Endangered]	Tree
798	P798	135	16	<i>[Gnetum gnemon]</i>	[Critically Endangered]	Tree
799	P799	120	16	<i>[Gnetum gnemon]</i>	[Critically Endangered]	Tree
800	P800	140	16	<i>[Gnetum gnemon]</i>	[Critically Endangered]	Tree
801	P801	190	16	<i>[Gnetum gnemon]</i>	[Critically Endangered]	Tree
802	P802	155	16	<i>[Gnetum gnemon]</i>	[Critically Endangered]	Tree
803	P803	150	16	<i>[Gnetum gnemon]</i>	[Critically Endangered]	Tree
804	P804	150	16	<i>[Gnetum gnemon]</i>	[Critically Endangered]	Tree
805	P805	140	16	<i>[Gnetum gnemon]</i>	[Critically Endangered]	Tree
806	P806	125	16	<i>[Gnetum gnemon]</i>	[Critically Endangered]	Tree
807	P807	110	16	<i>[Gnetum gnemon]</i>	[Critically Endangered]	Tree

Baseline flora study for Proposed Road Widening at Lorong Lada Hitam

808	P808	110	16	<i>[Gnetum gnemon]</i>	[Critically Endangered]	Tree
809	P809	110	16	<i>[Gnetum gnemon]</i>	[Critically Endangered]	Tree
810	P810	105	16	<i>[Gnetum gnemon]</i>	[Critically Endangered]	Tree
811	P811	90	16	<i>[Gnetum gnemon]</i>	[Critically Endangered]	Tree
812	P812	135	16	<i>[Gnetum gnemon]</i>	[Critically Endangered]	Tree
813	P813	135	16	<i>Chrysophyllum cainito</i>	Exotic	Tree
814	P814	75	6	<i>Ficus variegata</i>	Common	Tree
815	P815	30	8	<i>Caryota mitis</i>	Common	Tree
817	P817	40	10	<i>Caryota mitis</i>	Common	Tree
818	P818	40	10	<i>Caryota mitis</i>	Common	Tree
819	P819	30	5	<i>Spathodea campanulata</i>	Naturalised	Tree
821	P821	70	8	<i>Caryota mitis</i>	Common	Tree
823	P823	48	10	<i>Ficus variegata</i>	Common	Tree
825	P825	37	4	<i>Ficus fistulosa</i>	Common	Tree
826	P826	80	6	<i>Elaeis guineensis</i>	Exotic	Tree
827	P827	70	6	<i>Elaeis guineensis</i>	Exotic	Tree
828	P828	100	6	<i>Elaeis guineensis</i>	Exotic	Tree
831	P831	45	10	<i>Macaranga gigantea</i>	Common	Tree
832	P832	60	12	<i>Macaranga gigantea</i>	Common	Tree
833	P833	60	2	<i>Elaeis guineensis</i>	Exotic	Tree
835	P835	30	6	<i>Claoxylon indicum</i>	Common	Tree
836	P836	80	10	<i>Hevea brasiliensis</i>	Naturalised	Tree
838	P838	40	5	<i>Claoxylon indicum</i>	Common	Tree
839	P839	50	4	<i>Dillenia suffruticosa</i>	Common	Shrub
840	P840	125	4	<i>Dillenia suffruticosa</i>	Common	Shrub
841	P841	50	6	<i>Hevea brasiliensis</i>	Naturalised	Tree
842	P842	30	5	<i>Dillenia suffruticosa</i>	Common	Shrub
843	P843	65	6	<i>Dillenia suffruticosa</i>	Common	Shrub
844	P844	60	5	<i>Dillenia suffruticosa</i>	Common	Shrub
845	P845	30	4	<i>Dillenia suffruticosa</i>	Common	Shrub

Baseline flora study for Proposed Road Widening at Lorong Lada Hitam

846	P846	30	4	<i>Dillenia suffruticosa</i>	Common	Shrub
847	P847	50	16	<i>Hevea brasiliensis</i>	Naturalised	Tree
848	P848	200	16	<i>Elaeis guineensis</i>	Exotic	Tree
850	P850	30	10	<i>Hevea brasiliensis</i>	Naturalised	Tree
851	P851			<i>Hevea brasiliensis</i>	Naturalised	Tree
852	P852			<i>Hevea brasiliensis</i>	Naturalised	Tree
853	P853			<i>Hevea brasiliensis</i>	Naturalised	Tree
854	P854			<i>Hevea brasiliensis</i>	Naturalised	Tree
855	GPS1			<i>Acalypha siamensis</i>	Exotic	Shrub
856	GPS2			<i>Aphanamixis polystachya</i>	Endangered	Tree
857	GPS3			<i>Artocarpus heterophyllus</i>	Exotic	Tree
858	GPS4			<i>Asystasia gangetica</i>	Naturalised	Herb
859	GPS5			<i>Bauhinia semibifida</i>	Vulnerable	Climber
860	GPS6			<i>Bridelia stipularis</i>	Vulnerable	shrub
861	GPS8			<i>Erycibe tomentosa</i>	Common	Climber
862	GPS9			<i>Hoya verticillata</i>	Common	Epiphyte
863	GPS10			<i>Leea indica</i>	Common	Tree
864	GPS11			<i>Manihot carthagenesis</i>	Exotic	Tree
865	GPS13			<i>Phytocrene bracteata</i>	Vulnerable	Climber
866	GPS14			<i>Pyrrosia longifolia</i>	Common	Epiphyte
867	GPS15			<i>Saccharum officinarum</i>	Exotic	Herv
868	GPS16			<i>Syngonium podophyllum</i>	Naturalised	Climber
869	GPS17			<i>Syzygium polyanthum</i>	Vulnerable	Tree
870	GPS18			<i>Litsea firma</i>	Common	Tree
871	GPS19			<i>Horsfieldia sucosa</i>	Endangered	Tree
872	GPS20			<i>Piper ribesioides</i>	Extinct	Climber
873	GPS21			<i>Lindera lucida</i>	Vulnerable	Tree
874	GPS22			<i>Cnestis palala</i>	Common	Climber
875	GPS23			<i>Palaquium obovatum</i>	Vulnerable	Tree
876	GPS24			<i>Garcinia atroviridis</i>	Critically Endangered	Tree

Baseline flora study for Proposed Road Widening at Lorong Lada Hitam

877	GPS25			<i>Carallia brachiata</i>	Endangered	Tree
878	GPS26			<i>Phytocrene bracteata</i>	Vulnerable	Climber
879	GPS27			<i>Knema cf malayana</i>	Endangered	Tree
880	GPS28			<i>Artocarpus cf nitidus</i>	Critically Endangered	Tree
881	GPS29			<i>Leea angulata</i>	Critically Endangered	Tree
882	GPS30			<i>Leea angulata</i>	Critically Endangered	Tree
883	GPS31			<i>Phyllanthus amarus</i>	Exotic	Herb
884	GPS32			<i>Calophyllum soulattri</i>	Critically Endangered	Tree
885	GPS33			<i>Eurycoma longifolia</i>	Critically Endangered	Tree
886	GPS34			<i>Memecylon sp</i>	Critically Endangered	Tree
887	GPS35			<i>Agrostistachys borneensis</i>	Common	Tree
888	GPS36			<i>Ardisia sanguinolenta</i>	Common	Shrub
889	GPS41			<i>Syzygium myrtifolium</i>	Extinct	Tree
890	GPS42			<i>Limacia scandens</i>	Vulnerable	Climber
891	GPS43			<i>Limacia scandens</i>	Vulnerable	Climber
892	GPS44			<i>Syzygium myrtifolium</i>	Extinct	Tree
893	GPS45			<i>Phytocrene bracteata</i>	Vulnerable	Climber
894	GPS47			<i>Palaquium obovatum</i>	Vulnerable	Tree
895	GPS49			<i>Piper flavimarginatum</i>	Critically Endangered	Climber
896	GPS50			<i>Limacia scandens</i>	Vulnerable	Climber
897	GPS51			<i>Horsfieldia sucosa</i>	Endangered	Tree
898	GPS52			<i>Agelaea macrophylla</i>	Critically Endangered	Climber
899	GPS53			<i>Oxyceros longiflorus</i>	Vulnerable	Climber
900	GPS54			<i>Anisophyllea disticha</i>	Common	Shrub
901	GPS55			<i>Phaeanthus ophthalmicus</i>	Vulnerable	Shrub
902	GPS56			<i>Agrostistachys borneensis</i>	Common	Tree
903	GPS57			<i>Elaeocarpus ferrugineus</i>	Common	Tree
904	GPS58			<i>Elaeocarpus ferrugineus</i>	Common	Tree

Appendix B: Fauna Survey Report

Fauna Surveys at Lorong Lada Hitam

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SURVEY DETAILS

Dates of Surveys: July and August 2020

Surveyor Name: Ivan Kwan, Lim Hong Yao

Methodology: Transect surveys were conducted along Lorong Lada Hitam and Mandai Road, along the boundary of the study area, as well as along a route within the middle of the study area. These surveys targeted the following fauna groups:

- Amphibians;
- Reptiles;
- Birds;
- Mammals;
- Butterflies; and
- Odonates (Damselflies and Dragonflies).

Two diurnal and two nocturnal transect surveys were carried out, which relied on observational detection. All species from the target fauna groups seen or heard during the surveys were recorded, with the specific location tied to the closest transect reference point (spaced 50 m apart, Figure 1). In addition, whenever one of the survey personnel was on site, notable records of species not detected during the transect surveys were added as incidental records.

Four camera traps were placed in the forest to record vertebrate activity in the absence of humans.

Location: The surveys were carried out within the eastern corner of the forest patch north of the Central Catchment Nature Reserve and Mandai Road. This small forest patch is bordered to the north and east by Lorong Lada Hitam, and to the south by Mandai Road. The western edge of the study area is contiguous with a much larger area of forest and secondary woodland that extends west to Jalan Ulu Sembawang and the Ulu Sembawang Park Connector.

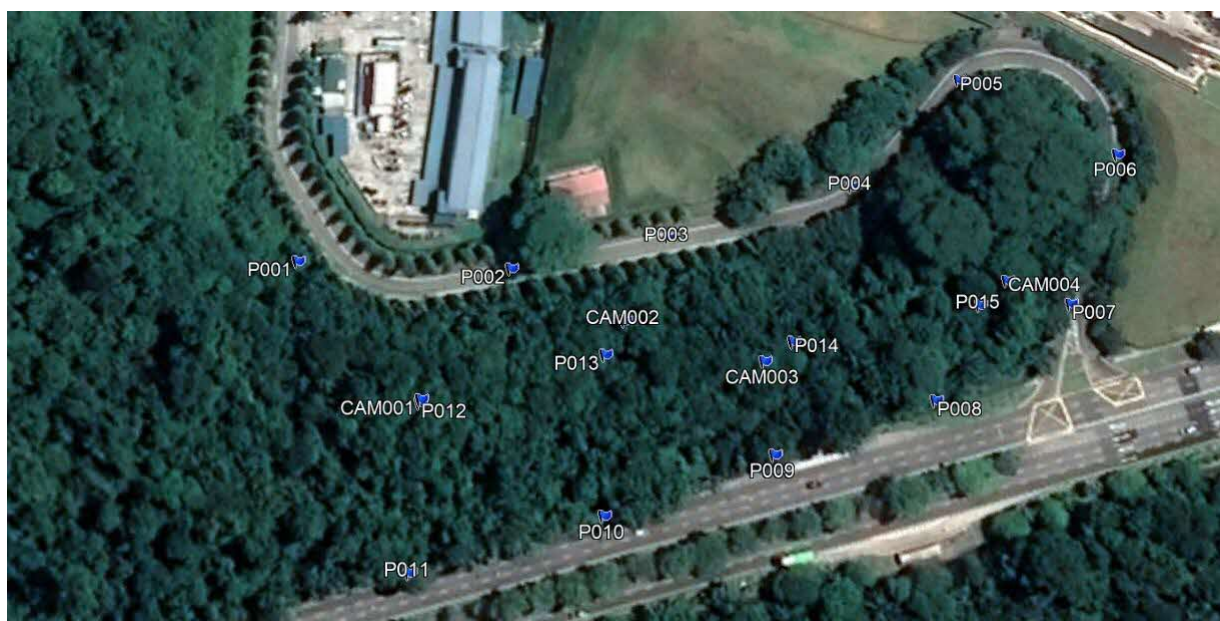


Fig. 1: Map showing the survey area. There are 15 transect reference points, spaced approximately 50 metres apart (P001 to P015), and four camera trap locations (C001 to C004).

Survey findings: The transect surveys and camera traps recorded two species of amphibians, six species of reptiles, nine species of mammals, 34 species of birds, 36 species of butterflies, and 10 species of odonates. These represent a mixture of species typical of more open habitats such as scrub and parkland, as well as species more dependent on mature forest. However, it is worth noting that many species that would be expected to occur in similar habitats were not recorded.

AMPHIBIANS

Common Name	Scientific Name
RHACOPHORIDAE	
Four-lined Tree Frog	<i>Polypedates leucomystax</i>
MICROHYLIDAE	
Banded Bullfrog	<i>Kaloula pulchra</i>

ANURA

Family Rhacophoridae

Four-lined Tree Frog (*Polypedates leucomystax*)

This is a widespread and common species that can be found in both forests and urban areas throughout Singapore. One individual was heard calling from dense vegetation next to the drain along Lorong Lada Hitam.

Family Microhylidae

Banded Bullfrog (*Kaloula pulchra*)

This is a widespread and common non-native species that can be found in both forests and urban areas throughout Singapore. Two individuals were seen on the trunks of roadside trees along Lorong Lada Hitam during one of the nocturnal transect surveys. Incidental records include one seen in the forest during the day, and three individuals on a single tree trunk along Lorong Lada Hitam at night.

Comments

Only two amphibian species were recorded, both of which are adapted to live in disturbed areas. Other amphibians commonly seen in other areas alongside the Four-lined Tree Frog and Banded Bullfrog, such as the Asian Toad (*Duttaphrynus melanostictus*), Field Frog (*Fejervarya limnocharis*), Painted Chorus Frog (*Microhyla butleri*), and Dark-sided Chorus Frog (*Microhyla heymonsi*), were not recorded during the surveys. Similarly, species readily detected in areas of forest and secondary woodland elsewhere in the Mandai area, such as the Black-eyed Litter Frog (*Leptobrachium nigrops*), Copper-cheeked Frog (*Chalcorana labialis*) and Malayan Giant Frog (*Limnonectes blythii*), were not found.

One possible factor to account for the apparent absence of so many frog species would be the absence of suitable breeding habitat such as ponds, streams, or waterlogged, marshy grassland. In other forest patches, even discarded receptacles such as large buckets and tubs can collect water and are utilised by amphibians. Although there was a short stretch of drain alongside Lorong Lada Hitam that contained water, it was very shallow, and no tadpoles were seen. It is possible that nearby patches of forest and secondary woodland with such breeding sites contain greater diversity and abundance of frogs. Another possibility is that some of these frog species may

actually be present, but were simply not detected during the survey period. If surveys were done after a period of heavy rain, which might lead to more water in the drain, or the creation of temporary breeding sites in grassy areas and tree holes, it is possible that more frogs would be detected.



Fig. 2: Banded Bullfrog (*Kaloula pulchra*), seen on a roadside tree.

REPTILES

Common Name	Scientific Name
GEKKONIDAE	
Spotted House Gecko	<i>Gekko monarchus</i>
Spiny-tailed House Gecko	<i>Hemidactylus frenatus</i>
AGAMIDAE	
Changeable Lizard	<i>Calotes versicolor</i>
COLUBRIDAE	
Oriental Whip Snake	<i>Ahaetulla prasina</i>
VIPERIDAE	
Wagler's Pit-viper	<i>Tropidolaemus wagleri</i>
ELAPIDAE	
Equatorial Spitting Cobra	<i>Naja sumatrana</i>

SQUAMATA

Family Gekkonidae

Spotted House Gecko (*Gekko monarchus*)

This is a widespread and common species that can be found in forests, woodland, and parks, as well as on buildings and other manmade structures close to forests. Multiple individuals of this species were seen on the railings and walls of the drain along Lorong Lada Hitam.

Spiny-tailed House Gecko (*Hemidactylus frenatus*)

This is a very common and widespread commensal species that can be found in a wide variety of habitats, including urban areas. Two individuals were seen on the railings and walls of the drain along Lorong Lada Hitam.

Family Agamidae

Changeable Lizard (*Calotes versicolor*)

This non-native species is common and widespread, and is mostly found in open habitats such as scrub, grassland, and urban areas. The three records of this species are from the tall grass and roadside vegetation along Lorong Lada Hitam and Mandai Road.

Family Colubridae

Oriental Whip Snake (*Ahaetulla prasina*)

This is a widespread and common species found in secondary forest, parks, and other wooded habitats. A juvenile individual was seen resting in a shrub at the forest edge along Lorong Lada Hitam.

Family Viperidae

Wagler's Pit-viper (*Tropidolaemus wagleri*)

An adult female was sighted coiled up in a small tree in the forest edge along Lorong Lada Hitam. This species is restricted to forest habitats, and is listed as Endangered in the Singapore Red Data Book 2008.

Family Elapidae

Equatorial Spitting Cobra (*Naja sumatrana*)

This is a widespread and common species that can be found in a wide variety of habitats, including forests, grassland, and some urban areas. A juvenile was seen within the drain along Lorong Lada Hitam.

Comments

The reptile species recorded mostly comprise species that are tolerant of disturbed habitats, and readily occur in secondary woodland – the only forest-dependent one is the Wagler's Pit-viper. However, several species which are known to be present in other patches of secondary woodland and former plantation habitat in the Mandai area were not detected. These include the Malayan Box Terrapin (*Cuora amboinensis*), lizards such as the Green Crested Lizard (*Bronchocela cristatella*), Sumatran Gliding Lizard (*Draco sumatranus*), Many-lined Sun Skink (*Eutropis multifasciata*), and Clouded Monitor (*Varanus nebulosus*), and snakes such as the Reticulated Python (*Malayopython reticulatus*), Sunbeam Snake (*Xenopeltis unicolor*), Striped Bronzeback (*Dendrelaphis caudolineatus*), Painted Bronzeback (*Dendrelaphis pictus*), Paradise Tree Snake (*Chrysopelea paradisi*), Common Malayan Racer (*Coelognathus flavolineatus*), Common Wolf Snake (*Lycodon capucinus*), Striped Kukri Snake (*Oligodon octolineatus*), and White-spotted Slug Snake (*Pareas margaritophorus*).

The sighting of a Wagler's Pit-viper suggests that despite the isolation from the Central Catchment Nature Reserve and proximity to a major road, enough habitat remains for forest-dependent species to persist. However, most of the reptiles that are known to rely on mature forest habitats, and which have been recorded in other parts of the Mandai area, were not detected. These include the Spiny Hill Terrapin (*Heosemys spinosa*), lizards such as the Black-bearded Gliding Lizard (*Draco melanopogon*), Yellow-striped Tree Skink (*Lipinia vittigera*), Striped Sun Skink (*Eutropis rugifera*), Peninsular Rock Gecko (*Cnemaspis peninsularis*), and snakes such as the Twin-barred Tree Snake (*Chrysopelea pelias*), Kopstein's Bronzeback (*Dendrelaphis kopsteini*),

Elegant Bronzeback (*Dendrelaphis formosus*), Gold-ringed Cat Snake (*Boiga dendrophila*), Red-tailed Racer (*Gonyosoma oxycephalum*), White-bellied Rat Snake (*Ptyas fusca*), Dwarf Reed Snake (*Pseudorabdion longiceps*), and Blue Malaysian Coral Snake (*Calliophis bivirgata*).

It is possible that increased survey effort will lead to detection of some of these reptile species. However, it is also possible that isolation from the forests of the Central Catchment Nature Reserve, as well as the proximity to Mandai Road, has led to these species being rare or even absent from the study area.



Fig. 3: Juvenile Oriental Whip Snake (*Ahaetulla prasina*) resting in a shrub along the forest edge.



Fig. 4: Adult female Wagler's Pit-viper (*Tropidolaemus wagleri*) in a small tree along the forest edge.



Fig. 4: Juvenile Equatorial Spitting Cobra (*Naja sumatrana*) in concrete drain along the road.

BIRDS

Common Name	Scientific Name
PHASIANIDAE	
Red Junglefowl / Domestic Chicken	<i>Gallus gallus</i>
COLUMBIDAE	
Rock Dove	<i>Columba livia</i>
Spotted Dove	<i>Spilopelia chinensis</i>
Common Emerald Dove	<i>Chalcophaps indica</i>
Zebra Dove	<i>Geopelia striata</i>
Pink-necked Green Pigeon	<i>Treron vernans</i>
STRIGIDAE	
Sunda Scops Owl	<i>Otus lempiji</i>
CAPRIMULGIDAE	
Large-tailed Nightjar	<i>Caprimulgus macrurus</i>
APODIDAE	
Swiftlet	<i>Aerodramus</i> sp.
ALCEDINIDAE	
White-throated Kingfisher	<i>Halcyon smyrnensis</i>
Collared Kingfisher	<i>Todiramphus chloris</i>
MEGALAIMIDAE	
Lineated Barbet	<i>Psilopogon lineatus</i>
PICIDAE	
Laced Woodpecker	<i>Picus vittatus</i>
Common Flameback	<i>Dinopium javanense</i>
PSITTACULIDAE	
Long-tailed Parakeet	<i>Psittacula longicauda</i>
Blue-crowned Hanging Parrot	<i>Loriculus galgulus</i>
AEGITHINIDAE	
Common Iora	<i>Aegithina tiphia</i>
ORIOOLIDAE	
Black-naped Oriole	<i>Oriolus chinensis</i>
DICRURIDAE	
Greater Racket-tailed Drongo	<i>Dicrurus paradiseus</i>
CORVIDAE	
House Crow	<i>Corvus splendens</i>
Large-billed Crow	<i>Corvus macrorhynchos</i>
PYCNONOTIDAE	
Yellow-vented Bulbul	<i>Pycnonotus goiavier</i>

CISTICOLIDAE	
Common Tailorbird	<i>Orthotomus sutorius</i>
Dark-necked Tailorbird	<i>Orthotomus atroregularis</i>
Rufous-tailed Tailorbird	<i>Orthotomus sericeus</i>
ZOSTEROPIDAE	
Swinhoe's White-eye	<i>Zosterops simplex</i>
TIMALIIDAE	
Pin-striped Tit-babbler	<i>Mixornis gularis</i>
STURNIDAE	
Asian Glossy Starling	<i>Aplonis panayensis</i>
Javan Myna	<i>Acridotheres javanicus</i>
DICAEIDAE	
Orange-bellied Flowerpecker	<i>Dicaeum trigonostigma</i>
Scarlet-backed Flowerpecker	<i>Dicaeum cruentatum</i>
NECTARINIIDAE	
Olive-backed Sunbird	<i>Cinnyris jugularis</i>
Crimson Sunbird	<i>Aethopyga siparaja</i>
PASSERIDAE	
Eurasian Tree Sparrow	<i>Passer montanus</i>

GALLIFORMES

Family Phasianidae

Red Junglefowl / Domestic Chicken (*Gallus gallus*)

This is a widespread but uncommon species that is usually found in forest and woodland habitats, although it is also present in some parks and urban areas. Multiple individuals, including adult males, females, and a hen accompanied by three chicks, were recorded by the camera traps. There is also one domestic rooster in the area, heard calling from within the forest during one of the diurnal transect surveys, as well as one incidental record, and also recorded on three separate instances by the CT01 camera trap.

This species is listed as Endangered in the Singapore Red Data Book 2008, although it has become more widespread in recent years, and is now more commonly seen across Singapore. However, it is likely that many of the populations of Red Junglefowl in mainland Singapore have hybridised with domestic chickens.

COLUMBIFORMES

Family Columbidae

Rock Dove (*Columba livia*)

A very common non-native human commensal, this species is widespread and is usually seen in urban areas. 10 birds were seen along Lorong Lada Hitam during one of the diurnal transect surveys, and an aggregation of 20 birds was seen near the junction with Mandai Road, scavenging food that was apparently left for stray dogs.

Spotted Dove (*Spilopelia chinensis*)

This is a common and very widespread species that can be found in many different habitats, including secondary scrub, parks, and urban areas. There are three records from the diurnal transect surveys, and one was photographed by the CT04 camera trap.

Common Emerald Dove (*Chalcophaps indica*)

This is a common and widespread species that is usually found in forest and woodland habitats. There is one record of an individual seen during a transect survey, and an incidental sighting, but the bulk of records are from the camera traps. At least three individuals are present, since the camera traps have recorded an adult male, an adult female, and a juvenile.

Zebra Dove (*Geopelia striata*)

This is a common and very widespread species that can be found in many different habitats, including secondary scrub, parks, and urban areas. An individual was heard calling during one of the transect surveys.

Pink-necked Green Pigeon (*Treron vernans*)

This is a common and very widespread species that can be found in a wide variety of habitats, including forests and urban areas. One individual was seen during a diurnal transect survey, while three individuals were seen roosting in a tree at the forest edge along Lorong Lada Hitam during one of the nocturnal transect surveys.

STRIGIFORMES

Family Strigidae

Sunda Scops Owl (*Otus lempiji*)

This is a common and widespread species that can be found in forests and woodland, and occasionally in parks. One individual was photographed by the CT01 camera trap, having apparently swooped to the ground to catch an insect.

CAPRIMULGIFORMES

Family Caprimulgidae

Large-tailed Nightjar (*Caprimulgus macrurus*)

This is a common and widespread species that can be found in forests, woodland, secondary scrub, and parks. There are two records of individual birds being seen along Lorong Lada Hitam during the nocturnal transect surveys.

APODIFORMES

Family Apodidae

Swiftlet (*Aerodramus* sp.)

Two species of swiftlets from the genus *Aerodramus* have been recorded from Singapore. Identification to the species level can be challenging, since it requires comparison of subtle differences in the plumage, and the taxonomy is still in a state of flux. Germain's Swiftlet (*Aerodramus germaini*), sometimes lumped with the Edible-nest Swiftlet (*Aerodramus fuciphagus*), is apparently more common than the Black-nest Swiftlet (*Aerodramus maximus*).

CORACIIFORMES

Family Alcedinidae

White-throated Kingfisher (*Halcyon smyrnensis*)

This is a widespread and common species that inhabits a wide variety of wooded habitats. Two individuals were recorded from the forest edge during one of the diurnal transect surveys.

Collared Kingfisher (*Todiramphus chloris*)

This is a widespread and very common species that inhabits a wide variety of wooded habitats, as well as urban areas. One individual was heard along Lorong Lada Hitam during one of the diurnal transect surveys.

PICIFORMES

Family Megalaimidae

Lineated Barbet (*Psilopogon lineatus*)

This is a widespread and common non-native species that inhabits woodland and secondary scrub. One individual was seen in a roadside tree along Lorong Lada Hitam during a diurnal transect survey.

Family Picidae

Laced Woodpecker (*Picus vittatus*)

This is a widespread and common non-native species that inhabits a wide variety of wooded habitats. There are two records from the forest edge along Lorong Lada Hitam during the diurnal transect surveys.

Common Flameback (*Dinopium javanense*)

This is a widespread and common non-native species that inhabits a wide variety of wooded habitats, as well as some urban areas. There are two records from the forest edge along Lorong Lada Hitam during the diurnal transect surveys.

PSITTACIFORMES

Family Psittaculidae

Long-tailed Parakeet (*Psittacula longicauda*)

This is a widespread and common species found in forests, woodland, and some parks. Three individuals were heard calling while passing over the forest during a diurnal transect survey. The Long-tailed Parakeet is listed as Vulnerable in the IUCN Red List due to habitat loss in other parts of its range.

Blue-crowned Hanging Parrot (*Loriculus galgulus*)

This is a widespread and common species found in a wide variety of habitats, including forests and urban areas. One individual was heard calling along Lorong Lada Hitam during a diurnal transect survey. The Blue-crowned Hanging Parrot is listed as Endangered in the Singapore Red Data Book 2008, although it appears to have become more common and widespread in recent years.

PASSERIFORMES

Family Aegithinidae

Common Iora (*Aegithina tiphia*)

This is a widespread and common species found in a wide variety of habitats, including secondary forests and urban areas. One individual was heard calling along Lorong Lada Hitam during a diurnal transect survey.

Family Oriolidae

Black-naped Oriole (*Oriolus chinensis*)

This is a widespread and very common species found in a wide variety of habitats, including secondary forests and urban areas. There are five records from the roadside vegetation and forest edge along Lorong Lada Hitam.

Family Dicruridae

Greater Racket-tailed Drongo (*Dicrurus paradiseus*)

This is a widespread and common species found in forests and woodlands. There are two records, one from the forest edge along Lorong Lada Hitam, and one heard within the forest.

Family Corvidae

House Crow (*Corvus splendens*)

This is a widespread and very common non-native human commensal, mostly found in urban areas, as well as parks, secondary scrub, and mangroves. One individual was heard calling along Lorong Lada Hitam during a diurnal transect survey.

Large-billed Crow (*Corvus macrorhynchos*)

This is a widespread and common species found in forests and woodlands. There are two records, one from the forest edge along Lorong Lada Hitam, and one heard within the forest.

Family Pycnonotidae

Yellow-vented Bulbul (*Pycnonotus goiavier*)

This is a widespread and very common species that is found in a wide variety of habitats, including secondary forests and urban areas. Many individuals were recorded from the roadside vegetation and forest edge along Lorong Lada Hitam and Mandai Road.

Family Cisticolidae

Common Tailorbird (*Orthotomus sutorius*)

This is a widespread and very common species that is found in a wide variety of habitats, including secondary forests and urban areas. Many individuals were recorded from the roadside vegetation and forest edge along Lorong Lada Hitam and Mandai Road. There are four records, three from the forest edge along Lorong Lada Hitam, one from the forest edge along Mandai Road, and one heard within the forest.

Dark-necked Tailorbird (*Orthotomus atrogularis*)

This is a widespread and common species found in forests, woodlands and scrub. There is one record of an individual heard calling from the forest edge along Lorong Lada Hitam during a diurnal transect survey, and one incidental record of an individual heard from within the forest.

Rufous-tailed Tailorbird (*Orthotomus sericeus*)

This is a widespread and common species found in forests, woodlands and scrub. Two individuals were heard calling from the forest edge along Lorong Lada Hitam during a diurnal transect survey.

Family Timaliidae

Pin-striped Tit-babbler (*Mixornis gularis*)

This is a widespread and common species found in forests, woodlands and scrub. Many individuals were recorded from the forest edge along Lorong Lada Hitam and Mandai Road, and were also heard within the forest.

Family Zosteropidae

Swinhoe's White-eye (*Zosterops simplex*)

This is a widespread and common species that is found in a wide variety of habitats, including secondary forests and urban areas. Several individuals were recorded from the roadside vegetation and forest edge along Lorong Lada Hitam.

Family Sturnidae

Asian Glossy Starling (*Aplonis panayensis*)

This is a widespread and very common species that is found in a wide variety of habitats, including secondary forests and urban areas. Many individuals were recorded along Lorong Lada Hitam, as well as within the forest. Some individuals were seen scavenging food that was apparently left for stray dogs.

Javan Myna (*Acridotheres javanicus*)

This is a widespread and very common non-native species that is found in a wide variety of habitats, including secondary forests and urban areas. Many individuals were recorded along Lorong Lada Hitam, and some were seen scavenging food that was apparently left for stray dogs. The Javan Myna is one of the most common birds in Singapore, although it is listed as Vulnerable in the IUCN Red List due to trapping for the bird trade in its native range.

Family Dicaeidae

Orange-bellied Flowerpecker (*Dicaeum trigonostigma*)

This is a widespread and common species that inhabits forests and woodlands. There are four records from the diurnal transect surveys, three of them from 5th August alone.

Scarlet-backed Flowerpecker (*Dicaeum cruentatum*)

This is a widespread and common species that is found in a wide variety of habitats, including secondary forests and urban areas. One individual was seen along Lorong Lada Hitam during a diurnal transect survey.

Family Nectariniidae

Olive-backed Sunbird (*Cinnyris jugularis*)

This is a very widespread and common species that is found in a wide variety of habitats, including secondary forests and urban areas. There are four records from the roadside vegetation and forest edge along Lorong Lada Hitam and Mandai Road

Crimson Sunbird (*Aethopyga siparaja*)

This is a very widespread and common species that inhabits forests, scrub, mangroves, and some parks. There are five records from the forest edge along Lorong Lada Hitam as well as within the forest.

Family Passeridae

Eurasian Tree Sparrow (*Passer montanus*)

This is a very common human commensal that is typically found in urban areas. There are two records from the roadside vegetation along Lorong Lada Hitam, including four individuals seen scavenging food that was apparently left for stray dogs.

Comments

All the bird species detected are considered resident in Singapore. No migratory species were recorded, since the surveys were carried out during the months of July and August, outside of the peak season for migratory birds. If the same surveys were to be conducted later in the year, it is likely that additional species of birds, comprising passage migrants and winter visitors, would be detected. These include members of the following families: the bee-eaters (F. Meropidae), pittas (F. Pittidae), shrikes (F. Laniidae), paradise flycatchers (Monarchidae), leaf warblers (F. Phylloscopidae), thrushes (F. Turdidae), Old World flycatchers (F. Muscicapidae), and wagtails (F. Motacillidae). No members of these families were recorded during the surveys, but migratory representatives are known to occur in similar areas of forest and secondary woodland in the Mandai area during the migratory bird season.

A number of bird species that are readily encountered in other areas of forest and secondary woodland elsewhere in the vicinity of the Central Catchment Nature Reserve were not detected. These include species such as the Thick-billed Green Pigeon (*Treron curvirostra*), Red-legged Crane (*Rallina fasciata*), Brown Hawk Owl (*Ninox scutulata*), Spotted Wood Owl (*Strix seloputo*), Banded Woodpecker (*Chrysophlegma miniaceum*), Rufous Woodpecker (*Micropternus brachyurus*), Red-crowned Barbet (*Psilopogon rafflesii*), Olive-winged Bulbul (*Pycnonotus*

plumosus), Asian Red-eyed Bulbul (*Pycnonotus brunneus*), Straw-headed Bulbul (*Pycnonotus zeylanicus*), Abbott's Babbler (*Malacocincla abbotti*), Short-tailed Babbler (*Malacocincla malaccensis*), White-crested Laughingthrush (*Garrulax leucolophus*), Common Hill Myna (*Gracula religiosa*), Blue-winged Leafbird (*Chloropsis cochinchinensis*), Asian Fairy Bluebird (*Irena puella*), White-rumped Shama (*Copsychus malabaricus*), Van Hasselt's Sunbird (*Leptocoma brasiliana*), and Little Spiderhunter (*Arachnothera longirostris*).

Entire families which would be expected to occur within the study area were not represented at all. For instance, Accipitridae, or birds of prey, were not recorded, even though species such as the Changeable Hawk-eagle (*Nisaetus cirrhatus*), Crested Goshawk (*Accipiter trivirgatus*) are known from similar habitats in the Mandai area. Similarly, the Cuculidae, or cuckoos, were also not represented. Species such as the Banded Bay Cuckoo (*Cacomantis sonneratii*), Plaintive Cuckoo (*Cacomantis merulinus*), Asian Drongo-cuckoo (*Surniculus lugubris*), Chestnut-bellied Malkoha (*Phaenicophaeus sumatranus*), and Greater Coucal (*Centropus sinensis*) are known from other forest and secondary woodland patches in the Mandai area.

Several bird species that are quite readily detected in open woodland and parkland environments were not recorded. These include the Oriental Dollarbird (*Eurystomus orientalis*), Coppersmith Barbet (*Psilopogon haemacephala*), Asian Koel (*Eudynamys scolopacea*), Red-breasted Parakeet (*Psittacula alexandri*), Pied Triller (*Lalage nigra*), Pacific Swallow (*Hirundo tahitica*), Common Myna (*Acridotheres tristis*), Oriental Magpie-robin (*Copsychus saularis*), Brown-throated Sunbird (*Anthreptes malacensis*), and Scaly-breasted Munia (*Lonchura punctulata*).

One possibility is that the surveys only covered a very small area of the entire forest patch between Lorong Lada Hitam and Mandai Road, or that the study area itself lacked specific food resources which would attract certain bird species and increase their chances of detection. It could also be that other forest patches in the immediate vicinity, such as the Central Catchment Nature Reserve, are simply more attractive and provide better habitat for some bird species. It may also be simply due to the small number of surveys that were carried out, and that some of these apparently "missing" species would be detected if more surveys were done.



Fig. 5: Adult male Red Junglefowl (*Gallus gallus*) recorded on camera trap.



Fig. 6: Common Emerald Dove (*Chalcophaps indica*) recorded on camera trap.

MAMMALS

Common Name	Scientific Name
TUPAIIDAE	
Common Treeshrew	<i>Tupaia glis</i>
CYNOCEPHALIDAE	
Malayan Colugo	<i>Galeopterus variegatus</i>
CERCOPITHECIDAE	
Long-tailed Macaque	<i>Macaca fascicularis</i>
SCIURIDAE	
Plantain Squirrel	<i>Callosciurus notatus</i>
Slender Squirrel	<i>Sundasciurus tenuis</i>
MURIDAE	
Rat	<i>Rattus</i> sp.
PTEROPODIDAE	
Lesser Dog-faced Fruit Bat	<i>Cynopterus brachyotis</i>
CANIDAE	
Domestic Dog	<i>Canis lupus familiaris</i>
SUIDAE	
Wild Boar	<i>Sus scrofa</i>

SCANDENTIA

Family Tupaiidae

Common Treeshrew (*Tupaia glis*)

This is a common and widespread species that occurs in forest and woodland habitats. This species was not recorded during the transect surveys, but was recorded on four separate occasions on the camera traps.

DERMOPTERA

Family Cynocephalidae

Malayan Colugo (*Galeopterus variegatus*)

This is a forest-dependent species, with a distribution mostly restricted to the Bukit Timah and Central Catchment Nature Reserve, as well as surrounding patches of secondary forest and woodland. One individual was seen in a tree close to the forest edge along Lorong Lada Hitam during one of the night surveys.

PRIMATES

Family Cercopithecidae

Long-tailed Macaque (*Macaca fascicularis*)

This is a common and widespread species that occurs in a variety of forest and woodland habitats, and also sometimes enters parks and urban areas. A troop containing at least 10 individuals appears to be present within the study area, based on sightings during the transect surveys, as well as the camera traps. It is unclear whether this is part of the same troop present on the opposite side of Mandai Road, along the edge of the Central Catchment Nature Reserve, or a separate troop.

Although the Long-tailed Macaque is not listed in the Singapore Red Data Book 2008, the species as a whole has recently been classified as Vulnerable in the IUCN Red List due to threats such as hunting and persecution in other parts of its range.

RODENTIA

Family Sciuridae

Plantain Squirrel (*Callosciurus notatus*)

This is a common and widespread species that can be found in forests, secondary scrub and woodland, and parks and urban areas. Several individuals were seen during the diurnal transect surveys, and were also photographed by the camera traps.

Slender Squirrel (*Sundasciurus tenuis*)

This species was recorded twice during the diurnal transect surveys, including a sighting of a pair. Unlike the Plantain Squirrel, the Slender Squirrel is more heavily dependent on forest and woodland habitats.

Family Muridae

Rat (*Rattus* sp.)

One rat was seen at the forest edge along Lorong Lada Hitam during the nocturnal transect surveys, with one incidental sighting close to the junction with Mandai Road. In addition, there were several records from the camera traps.

There are at least four members of the genus *Rattus* in Singapore, and identification of rats in the field can be difficult, especially when sightings are brief and do not permit close examination of subtle morphological differences. The disturbed habitat and proximity to built up areas suggests that the rat species present is likely to be the common and widespread Oriental House Rat (*Rattus tanezumi*), a commensal species that is usually recorded in urban and agricultural areas, but has also been known to utilise forest edges. However, the possibility of the presence of Malaysian Wood Rat (*Rattus tiomanicus*), a species usually found in secondary forest and scrub, cannot be completely discounted.

CHIROPTERA

Family Pteropodidae

Lesser Dog-faced Fruit Bat (*Cynopterus brachyotis*)

This is a common and widespread species that can be found in a wide variety of habitats, including urban areas. There were three records of this species during the night surveys.

CARNIVORA

Family Canidae

Domestic Dog (*Canis lupus familiaris*)

This is an introduced species, and free-living populations can include pets that are allowed to roam, strays that rely on humans for food, as well as feral dogs. Based on sightings during the transect surveys, as well as photographs from the camera traps, a group of at least four strays appears to be resident in the study area. These dogs are provisioned with food and water, which several other species (Long-tailed Macaque, Rock Dove, Asian Glossy Starling, Javan Myna, Eurasian Tree Sparrow) have been seen exploiting.

ARTIODACTYLA

Family Suidae

Wild Boar or Eurasian Wild Pig (*Sus scrofa*)

This is a widespread and common species that inhabits forests, woodland, and secondary scrub, with some populations living near urban areas showing signs of becoming habituated due to feeding by humans. Signs of wild boar presence in the form of digging and tracks were found during the transect surveys. However, there were no sightings during the transect surveys. The camera traps were able to record the presence of Wild Boar, with some captures indicating at least four to five individuals in close association. Some of these captures were of piglets, suggesting that there is recent breeding in the area.

Comments

The mammal fauna features mostly species that can be expected to be present in forest and woodland areas within and around the Central Catchment Nature Reserve, such as the Common Treeshrew, Malayan Colugo, Long-tailed Macaque, Plantain Squirrel, Slender Squirrel, Lesser Dog-faced Fruit Bat, and Wild Boar. However, several other species that are known to be present in other forest patches in the Mandai area were not recorded, which could indicate their absence. These include the Horsfield's Flying Squirrel (*Iomys horsfieldii*), Annandale's Rat (*Sundamys annandalei*), Sunda Pangolin (*Manis javanica*), Sumatran Palm Civet (*Paradoxurus musangus*), Lesser Mousedeer (*Tragulids kanchil*), and Sambar Deer (*Rusa unicolor*). While absence of

records during the study period does not necessarily indicate that these mammal species are truly absent from the study area, when present, these species are not difficult to detect during targeted nocturnal surveys, can leave physical evidence in the form of tracks or droppings, and even in the absence of human observers, can be readily detected by camera traps.

In addition, mist nets, harp traps or bat detectors were not employed to carry out targeted surveys of bats. As such, it is almost certain that the mammal species list in this report omits most of the bat species which might potentially occur within the study area. Similarly, targeted trapping of small mammals was not carried out, which would have allowed for closer examination and identification of any rodents captured by the traps. As a result, while the rats are not conclusively identified to the species level, it remains possible that more than one species of rat is present within the survey area.



Fig. 7: Long-tailed Macaque (*Macaca fascicularis*) female with young, recorded on camera trap.



Fig. 8: Plantain Squirrel (*Callosciurus notatus*) feeding in forest.



Fig. 9: Rat (*Rattus* sp.), tentatively identified as an Oriental House Rat (*Rattus tanezumi*), recorded on camera trap.



Fig. 10: Piglets of Wild Boar (*Sus scrofa*) recorded on camera trap.

LEPIDOPTERA (BUTTERFLIES)

Common Name	Scientific Name
PAPILIONIDAE	
Common Mime	<i>Chilasa clytia clytia</i>
Lime Butterfly	<i>Papilio demoleus malayanus</i>
Common Mormon	<i>Papilio polytes romulus</i>
PIERIDAE	
Anderson's Grass Yellow	<i>Eurema andersonii andersonii</i>
Grass Yellow (unidentified)	<i>Eurema sp.</i>
Striped Albatross	<i>Appias libythea olferna</i>
Painted Jezebel	<i>Delias hyparete metarete</i>
Psyche	<i>Leptosia nina malayana</i>
NYMPHALIDAE	
Striped Blue Crow	<i>Euploea mulciber mulciber</i>
Common Palmfly	<i>Elymnias hypermnestra agina</i>
Common Evening Brown	<i>Melanitis leda leda</i>
Dark Brand Bush Brown	<i>Mycalesis mineus macromalayana</i>
Burmese Bush Brown	<i>Mycalesis perseoides perseoides</i>
Dingy Bush Brown	<i>Mycalesis perseus cepheus</i>
Long Brand Bush Brown	<i>Mycalesis visala phamis</i>
Bush Brown (unidentified)	<i>Mycalesis sp.</i>
Dark Grass Brown	<i>Orsotriaena medus cinerea</i>
Malayan Five Ring	<i>Ypthima horsfieldii humei</i>
Palm King	<i>Amathusia phidippus phidippus</i>
Common Faun	<i>Faunis canens arcesilas</i>
Peacock Pansy	<i>Junonia almana javana</i>
Chocolate Pansy	<i>Junonia hedonia ida</i>
Malay Baron	<i>Euthalia monina monina</i>
Malayan Lascar	<i>Lasippa tiga siaka</i>
Knight	<i>Lebadea martha parkeri</i>
Archduke	<i>Lexias pardalis dirteana</i>
Sailor (unidentified)	<i>Neptis sp.</i>
Malay Viscount	<i>Tanaecia peleia peleia</i>
LYCAENIDAE	
Common Hedge Blue	<i>Acytolepis puspa lambi</i>
Elbowed Pierrot	<i>Caleta elna elvira</i>
Common Caerulean	<i>Jamides celeno aelianus</i>
Branded Imperial	<i>Eooxylides tharis distant</i>
HESPERIIDAE	
Full Stop Swift	<i>Caltoris cormasa</i>
Chestnut Bob	<i>Iambrix salsala salsala</i>
Small Branded Swift	<i>Pelopidas mathias mathias</i>
Chequered Lancer	<i>Plastingia naga</i>
Lesser Dart	<i>Potanthus omaha omaha</i>
Yellow Grass Dart	<i>Taractrocera archias quinta</i>

Family Papilionidae

Common Mime (*Chilasa clytia clytia*)

This is a forest-dependent species that is common within the nature reserves. One individual was sighted at the forest edge along Lorong Lada Hitam.

Lime Butterfly (*Papilio demoleus malayanus*)

This is a widespread and common species that can be found in both forests and urban areas. One individual was sighted at the forest edge along Mandai Road.

Common Mormon (*Papilio polytes romulus*)

This is a widespread and common species that can be found in both forests and urban areas. There is an incidental sighting within the forest.

Family Pieridae

Anderson's Grass Yellow (*Eurema andersonii andersonii*)

There is an incidental sighting of this forest-dependent species from the forest edge along Lorong Lada Hitam.

Grass Yellow (unidentified) (*Eurema* sp.)

Six different species of Grass Yellow have been recorded from Singapore, and identification to the species level can be challenging, since it usually requires close examination of the patterns on the wings. The most common species in Singapore, widespread and often encountered in both forests and urban areas, are the Common Grass Yellow (*Eurema hecabe contubernalis*), Three Spot Grass Yellow (*Eurema blanda snelleni*), and Chocolate Grass Yellow (*Eurema sari sodalis*), while the Anderson's Grass Yellow and Forest Grass Yellow (*Eurema simulatrix tecmessa*) are more typically found in forest habitats. The No Brand Grass Yellow (*Eurema brigitta senna*) is listed as Nationally Extinct in the Singapore Red Data Book 2008, although it was rediscovered in an area of open wasteland in northern Singapore in 2006.

All three records came from roadside vegetation along Lorong Lada Hitam.

Striped Albatross (*Appias libythea olferna*)

This is a widespread and common species that inhabits open areas. There are multiple records of this species from roadside vegetation, along both Lorong Lada Hitam and Mandai Road. 11 individuals were recorded on 5th August alone.

Painted Jezebel (*Delias hyparete metarete*)

This is a widespread and common species that can be found in both forests and urban areas. There is an incidental sighting within the forest.

Psyche (*Leptosia nina malayana*)

This is a widespread and common species that can be found in both urban areas and forest fringes. There are two records from roadside vegetation along Lorong Lada Hitam.

Family Nymphalidae

Striped Blue Crow (*Euploea mulciber mulciber*)

This is a widespread and common species that can be found in both forests and urban areas. One individual was sighted at the forest edge along Lorong Lada Hitam.

Common Palmfly (*Elymnias hypermnestra agina*)

This is a widespread and common species that can be found in a variety of habitats. Three individuals were sighted at the forest edge along Lorong Lada Hitam.

Common Evening Brown (*Melanitis leda leda*)

This is a moderately rare species that is usually seen around grass patches, thickets, and dense vegetation. There is an incidental sighting within the forest.

Dark Brand Bush Brown (*Mycalesis mineus macromalayana*)

This is a widespread and common species that can be found in both forests and urban areas. An individual was seen resting on vegetation within the forest during one of the nocturnal transect surveys.

Burmese Bush Brown (*Mycalesis perseoides perseoides*)

This is a widespread and common species that can be found in grassy areas. There are two records from roadside vegetation along Lorong Lada Hitam.

Dingy Bush Brown (*Mycalesis perseus cepheus*)

This is a widespread and moderately common species that can be found in grassy areas. There are two records from roadside vegetation along Lorong Lada Hitam.

Long Brand Bush Brown (*Mycalesis visala phamis*)

This is a widespread and moderately common species that can be found in grassy areas. There are three records from roadside vegetation along Lorong Lada Hitam.

Bush Brown (unidentified) (*Mycalesis* sp.)

Six different species of Bush Brown have been recorded from Singapore, and identification to the species level can be challenging, since it requires close examination of the patterns on the wings. In addition to the Dark Brand Bush Brown, Burmese Bush Brown, Dingy Bush Brown, and Long Brand Bush Brown, the rare Purple Bush Brown is known to occur in forests of the Central Catchment Nature Reserve. The individuals seen during the surveys were not Malayan Bush Browns (*Mycalesis fusca fusca*), since that species is morphologically very distinctive.

There are three records of unidentified Bush Browns from roadside vegetation, along both Lorong Lada Hitam and Mandai Road.

Dark Grass Brown (*Orsotriaena medus cinerea*)

Easily confused with the Bush Browns (*Mycalesis* sp.), this is a widespread and common species that can be found in grassy areas. There are three records of this species from roadside vegetation along Lorong Lada Hitam, although one such record involved a butterfly found resting during a nocturnal transect survey.

Malayan Five-ring (*Ypthima horsfieldii humei*)

This is a common species that inhabits grassy areas close to forests. There are three records of this species from roadside vegetation, along both Lorong Lada Hitam and Mandai Road, as well as one record within the forest.

Palm King (*Amathusia phidippus phidippus*)

This is a widespread but moderately rare species that can be found in both forests and urban areas. There is one record from the forest edge along Lorong Lada Hitam.

Common Faun (*Faunis canens arcesilas*)

This is a common species that can be found in forests. There is an incidental sighting within the forest.

Peacock Pansy (*Junonia almana javana*)

This is a widespread and common species that can be found in both forests and urban areas. One individual was sighted at the forest edge along Mandai Road.

Chocolate Pansy (*Junonia hedonia ida*)

This is a widespread and common species that can be found in both forests and urban areas. 7 individuals were recorded from roadside vegetation and forest edge along both Lorong Lada Hitam and Mandai Road on 5th August alone.

Malay Baron (*Euthalia monina monina*)

This is a forest-dependent species that is common within the nature reserves. One individual was sighted at the forest edge along Lorong Lada Hitam.

Malayan Lascar (*Lasippa tiga siaka*)

This is a forest-dependent species that is common within the nature reserves. One individual was sighted at the forest edge along Lorong Lada Hitam, while there is an incidental sighting within the forest.

Knight (*Lebadea martha parkeri*)

This is a widespread and common species that can be found in both forests and urban areas. There is an incidental sighting at the forest edge along Lorong Lada Hitam.

Archduke (*Lexias pardalis dirteana*)

This is a forest-dependent species that is common within the nature reserves. One individual was sighted at the forest edge along Lorong Lada Hitam.

Sailor (unidentified) (*Neptis* sp.)

Three different species of Sailor have been recorded from Singapore, and identification to the species level can be challenging, since it requires close examination of the patterns on the wings. The Burmese Sailor (*Neptis leucoporos cresina*) is a forest-dependent species, while the Common Sailor (*Neptis hylas papaja*) is more typically found in forest fringes and sometimes in urban areas. There is also potential for confusion with the very similar Short-banded Sailor (*Phaedyra columella singa*), a widespread and common species that can be found in both forests and urban areas. There is one record from the forest edge along Lorong Lada Hitam. The individual seen was not a Chocolate Sailor (*Neptis harita harita*), since that species is morphologically very distinctive.

Malay Viscount (*Tanaecia pelea pelea*)

This is a forest-dependent species that is common within the nature reserves. There are two records from the forest edge along Lorong Lada Hitam.

Family Lycaenidae

Common Hedge Blue (*Acytoplepis puspa lambi*)

This is a forest-dependent species that is common within the nature reserves, but is also sometimes encountered in urban areas. There is an incidental sighting at the forest edge along Mandai Road.

Elbowed Pierrot (*Caleta elna elvira*)

This is a forest-dependent species that is common within the nature reserves. One individual was sighted at the forest edge along Lorong Lada Hitam.

Common Caerulean (*Jamides celeno aelianus*)

This is a widespread and common species that can be found in forest edges, wastelands, and urban gardens. There are four records from the forest edge along Lorong Lada Hitam, including a total of five individuals encountered on 5th August, and one sighting of an individual resting in the vegetation during a nocturnal transect survey. During another nocturnal transect survey, two individuals were sighted resting within the forest.

Branded Imperial (*Eooxylides tharis distant*)

This is a forest-dependent species that is common within the nature reserves. One individual was sighted at the forest edge along Lorong Lada Hitam. One individual was sighted at the forest edge along Mandai Road, while there are two separate sightings of an individual found resting within the forest during nocturnal transect surveys.

Family HesperIIDae

Full Stop Swift (*Caltores cormasa*)

This is a widespread and moderately common species that can be found in both forests and urban areas. There is an incidental sighting from the forest edge along Mandai Road.

Chestnut Bob (*Iambrix salsala salsala*)

This is a widespread and common species that can be found in open habitats, such as forest edges, clearings, secondary growth, and urban areas. There are four records of this species from roadside vegetation, along both Lorong Lada Hitam and Mandai Road, including four individuals sighted on 5th August.

Small Branded Swift (*Pelopidas mathias mathias*)

This is a widespread and common species that can be found in urban areas. There are two records from the roadside vegetation along Lorong Lada Hitam, and one record from within the forest.

Chequered Lancer (*Plastingia naga*)

This is a widespread and moderately common species that can be found in both forests and urban areas. There is an incidental sighting from the forest.

Lesser Dart (*Potanthus omaha omaha*)

This is a widespread and common species that can be found in both forests and urban areas. One individual was sighted at the forest edge along Lorong Lada Hitam.

Yellow Grass Dart (*Taractrocera archias quinta*)

This is a moderately common species that is mostly found within and around forests. Two individuals were sighted at the forest edge along Lorong Lada Hitam.

Comments

The butterfly species recorded during the surveys comprise a mixture of forest-dependent species and those that prefer more open habitats, as well as those that can be found in both forests and urban areas. It is also notable that some apparently common species, including both forest-dependent and open-country species, were not recorded. It is important to note that the presence of butterflies within a certain area is influenced by the presence of suitable host plants for the caterpillars, as well as flowering plants that provide nectar for the adults.



Fig. 11: Psyche (*Leptosia nina malayana*) seen on roadside vegetation.



Fig. 12: Common Evening Brown (*Melanitis leda leda*) seen in forest.

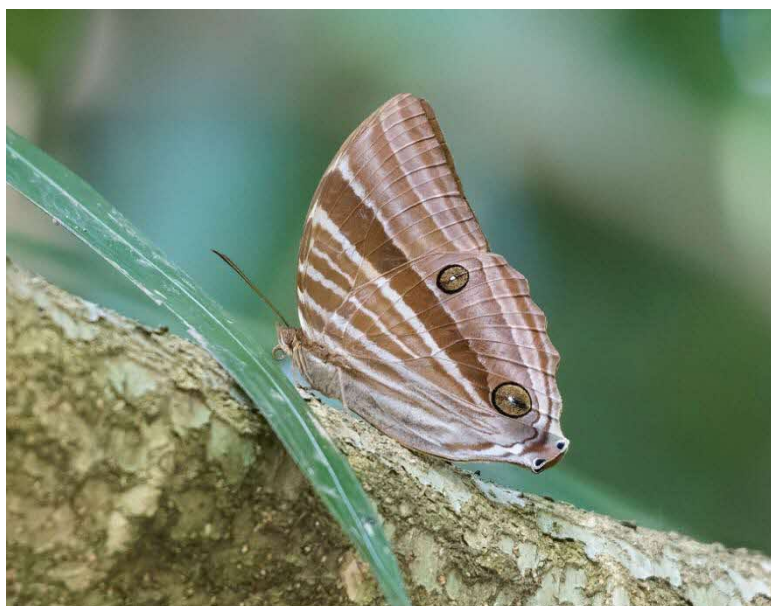


Fig. 13: Palm King (*Amathusia phidippus phidippus*) seen along forest edge.



Fig. 14: Malayan Lascar (*Lasippa tiga siaka*) seen within forest.



Fig. 15: Male Knight (*Lebadea martha parkeri*) seen along forest edge.



Fig. 16: Malay Viscount (*Tanaecia pelea pelea*) seen along forest edge.



Fig. 17: Common Caerulean (*Jamides celeno aelianus*) seen along forest edge.



Fig. 18: Full Stop Swift (*Caltoris cormasa*) seen along forest edge.

ODONATA (DRAGONFLIES & DAMSELFLIES)

Common Name	Scientific Name
PLATYCNEMIDIDAE	
Collared Threadtail	<i>Prodasineura collaris</i>
Threadtail (unidentified)	<i>Prodasineura</i> sp.
LIBELLULIDAE	
Dark-tipped Forest Skimmer	<i>Cratilla metallica</i>
Common Parasol	<i>Neurothemis fluctuans</i>
Spine-tufted Skimmer	<i>Orthetrum chrysis</i>
Common Blue Skimmer	<i>Orthetrum glaucum</i>
Variegated Green Skimmer	<i>Orthetrum sabina</i>
Scarlet Skimmer	<i>Orthetrum testaceum</i>
Wandering Glider	<i>Pantala flavescens</i>
Common Redbolt	<i>Rhodothemis rufa</i>
Treehugger	<i>Tyriobapta torrida</i>

ZYGOPTERA (DAMSELFLIES)

Family Platycnemididae

Collared Threadtail (*Prodasineura collaris*)

An individual of this forest-dependent damselfly was seen at the forest edge along Lorong Lada Hitam. This species is classified as Endangered in the Singapore Red Data Book 2008, but is Least Concern in the IUCN Red List.

Threadtail (unidentified) (*Prodasineura* sp.)

An unidentified species of Threadtail was seen at the forest edge along Lorong Lada Hitam. However, it could not be conclusively identified. It could be another example of a Collared Threadtail, or a representative of one of the other threadtail species known to occur locally. Threadtails are forest-dependent damselflies, and in addition to the Collared Threadtail, three more species are known from Singapore: the widespread and common Orange-striped Threadtail (*Prodasineura humeralis*) and Crescent Threadtail (*Prodasineura notostigma*), and Interrupted Threadtail (*Prodasineura interrupta*), which is rarer and more restricted in distribution, and is listed as Critically Endangered in the Singapore Red Data Book 2008.

ANISOPTERA (DRAGONFLIES)

Family Libellulidae

Dark-tipped Forest Skimmer (*Cratilla metallica*)

There is an incidental record of this forest-dependent dragonfly within the forest.

Common Parasol (*Neurothemis fluctuans*)

An individual of this widespread and common species was seen resting on roadside vegetation along Lorong Lada Hitam during one of the nocturnal transect surveys.

Spine-tufted Skimmer (*Orthetrum chrysis*)

There are two records of this widespread and common species from the forest edge, one along Lorong Lada Hitam, and the other along Mandai Road.

Blue Skimmer (*Orthetrum glaucum*)

There are four records of this widespread and common species from roadside vegetation along Lorong Lada Hitam, including one mating pair.

Variegated Green Skimmer (*Orthetrum sabina*)

This widespread and common species was seen once on roadside vegetation along Lorong Lada Hitam.

Scarlet Skimmer (*Orthetrum testaceum*)

This widespread and common species was seen once on roadside vegetation along Lorong Lada Hitam.

Wandering Glider (*Pantala flavescens*)

Three individuals of this widespread and common species were recorded in one morning at the same location on roadside vegetation along Lorong Lada Hitam.

Common Redbolt (*Rhodothemis rufa*)

There is one record of this widespread and common species from the forest edge along Lorong Lada Hitam.

Treehugger (*Tyriobapta torrida*)

An individual of this forest-dependent dragonfly was seen at the same location within the forest on two separate diurnal transect surveys.

Comments

The odonates recorded during the surveys were a mixture of forest-dependent species, such as the Collared Threadtail, Dark-tipped Forest Skimmer, and Treehugger, with the rest comprising species more typical of open areas. The waterlogged stretch of drain along Lorong Lada Hitam contained libellulid dragonfly nymphs, although it was impossible to determine which species they belonged to. It is possible that the odonate species recorded during the transect surveys may not be breeding within the study area, but were simply using the area to rest or forage. Much like with the amphibians, the apparent lack of breeding habitats may account for the low diversity and abundance of damselflies and dragonflies detected, and that surveys after heavy rain might yield different results.



Fig. 19: Collared Threadtail (*Prodasineura collaris*) seen along forest edge.



Fig. 20: Mating pair of Blue Skimmer (*Orthetrum glaucum*) seen on roadside vegetation.



Fig. 21: Male Scarlet Skimmer (*Orthetrum testaceum*) seen on roadside vegetation.



Fig. 22: Male Treehugger (*Tyriobapta torrida*) seen within forest.

Species of conservation concern

Seven species listed in the Singapore Red Data Book 2008 or IUCN Red List were recorded at the site. These comprise one reptile, four birds, one mammal, and one odonate. All are present in forest habitats elsewhere within and around the Central Catchment Nature Reserve. Although respectively listed as Endangered and Critically Endangered, the Red Junglefowl and Blue-crowned Hanging Parrot are now considered a lot more widespread and abundant, and their status according to the Singapore Red Data Book 2008 might not reflect the current situation. The Long-tailed Parakeet, Javan Myna and Long-tailed Macaque are widespread and common in Singapore, and are not listed in the Singapore Red Data Book 2008; in fact, the Javan Myna is an introduced species that is often considered a pest in urban areas. Their inclusion in the IUCN Red List is due to threats that populations face in other parts of their native range, such as habitat loss and hunting.

Common Name	Scientific Name	Singapore Red Data Book 2008	IUCN Red List
Wagler's Pit-viper	<i>Tropidolaemus wagleri</i>	Endangered	Least Concern
Red Junglefowl	<i>Gallus gallus</i>	Endangered	Least Concern
Long-tailed Parakeet	<i>Psittacula longicauda</i>	Not listed	Vulnerable
Blue-crowned Hanging Parrot	<i>Loriculus galgulus</i>	Endangered	Least Concern
Javan Myna	<i>Acridotheres javanicus</i>	Not listed	Vulnerable
Long-tailed Macaque	<i>Macaca fascicularis</i>	Not listed	Vulnerable
Collared Threadtail	<i>Prodasineura collaris</i>	Endangered	Least Concern

Additional comments on fauna diversity within study area

Despite the proximity to the forests of the Central Catchment Nature Reserve, as well as being contiguous with a larger forest patch, many species known to be present or even common in similar patches of forest and secondary woodland in the Mandai area were not detected within the study area. While absence of records during the study period does not necessarily indicate that these supposedly 'missing' species are truly absent from the study area, when present, these species are often not difficult to detect during targeted surveys, whether through sightings, auditory evidence such as birdsong and frog calls, or physical evidence in the form of tracks or droppings. Even in the absence of human observers, some of the more cryptic species can be readily detected by camera traps. This has happened here, with the camera traps capturing images of species not recorded or recorded only a few times during the transect surveys, such as the Red Junglefowl, Common Emerald Dove, Sunda Scops Owl, Common Treeshrew, and Wild Boar.

The study area is separated from the Central Catchment Nature Reserve by Mandai Road. While this does not present a major obstacle for a number of highly mobile bird, bat, and insect species, the significant gap in forest cover, as well as the constant danger posed by vehicles, poses an insurmountable barrier for most terrestrial species. While there has been a lot of attention paid to incidents in the Mandai area involving vehicular collisions with certain mammal species (such as Sunda Pangolin, Wild Boar, and Sambar Deer), it is likely that many more incidents involving less conspicuous or charismatic fauna have taken place unnoticed and unreported over the years.

Because it is bordered on three sides by roads, with the noise and numerous passing vehicles, it is possible that the study area may be marginal habitat for a number of forest-dependent species, which could still be present in quieter areas within the larger forest patch between Mandai Road and Lorong Lada Hitam.

Another possible influence is the apparently resident pack of stray dogs. This may account for the absence of certain species of mammals, birds, and larger reptiles, whether through active predation and harassment, or causing potential prey species to completely avoid the area. More observation would be needed to determine whether the dogs are completely dependent on humans for sustenance, or whether they chase and harass any of the wildlife.

Finally, the lack of records for many species may simply be the result of the small number of surveys conducted, as well as the time of the year. Surveys conducted during the migratory bird season or after heavy rain may reveal additional species that were not detected during this short survey period.

Nonetheless, the presence of some forest-dependent species indicates that enough habitat still remains, allowing these species to persist just outside the fringes of the Central Catchment Nature Reserve.

Appendix C: Camera Trap Data

Date	Time	File name	Common name	Scientific name	Count	Comments
2020-07-20	18:03:40	07200012.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-07-20	19:27:22	07200013.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-07-21	10:05:18	07210014.MP4	Red Junglefowl	<i>Gallus gallus domesticus</i>	1	Domestic male
2020-07-21	17:30:40	07210015.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-07-21	19:31:02	07210016.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-07-21	19:40:30	07210018.MP4	Sunda Scops Owl	<i>Otus lempiji</i>	1	Feeding on insect on ground
2020-07-22	19:15:30	07220019.MP4	Squirrel sp.	Sciuridae sp.	1	only tail
2020-07-23	9:59:20	07230020.MP4	Common Emerald Dove	<i>Chalcophaps indica</i>	1	male
2020-07-24	5:20:04	07250026.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-07-25	19:06:50	07250027.MP4	Red Junglefowl	<i>Gallus gallus domesticus</i>	1	domestic male
2020-07-26	16:34:40	07260028.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-07-26	0:06:22	07270030.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-07-27	9:20:48	07270031.MP4	Long-tailed Macaque	<i>Macaca fascicularis</i>	1	Lip deformed
2020-07-27	9:49:00	07270033.MP4	Long-tailed Macaque	<i>Macaca fascicularis</i>	5	1 baby
2020-07-27	9:56:12	07270035.MP4	Long-tailed Macaque	<i>Macaca fascicularis</i>	2	
2020-07-28	10:14:00	07280039.MP4	Long-tailed Macaque	<i>Macaca fascicularis</i>	3	1 baby
2020-07-28	17:50:38	07280040.MP4	Red Junglefowl	<i>Gallus gallus</i>	1	female
2020-07-28	18:35:24	07280041.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-07-28	6:59:50	07290042.MP4	Plantain Squirrel	<i>Callosciurus notatus</i>	1	
2020-07-29	17:12:50	07290043.MP4	Wild Pig	<i>Sus scrofa</i>	1	female
2020-07-30	10:54:52	07300044.MP4	Long-tailed Macaque	<i>Macaca fascicularis</i>	1	investigating camera
2020-07-30	21:41:58	07300045.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-07-30	6:48:16	07310046.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-07-31	16:57:24	07310047.MP4	Common Emerald Dove	<i>Chalcophaps indica</i>	1	female
2020-07-31	20:40:18	07310048.MP4	Wild Pig	<i>Sus scrofa</i>	1	male
2020-07-31	7:59:30	08010049.MP4	Red Junglefowl	<i>Gallus gallus</i>	1	female
2020-08-02	11:05:30	08020051.MP4	Long-tailed Macaque	<i>Macaca fascicularis</i>	3	
2020-08-02	23:55:20	08020053.MP4	Wild Pig	<i>Sus scrofa</i>	1	male
2020-08-03	8:05:24	08030054.MP4	Dog	<i>Canis lupus familiaris</i>	1	
2020-08-03	8:06:50	08030055.MP4	Dog	<i>Canis lupus familiaris</i>	1	
2020-08-03	8:08:04	08030056.MP4	Dog	<i>Canis lupus familiaris</i>	1	
2020-08-03	8:14:42	08030057.MP4	Dog	<i>Canis lupus familiaris</i>	1	4 different individuals in a row
2020-08-03	11:14:52	08030058.MP4	Common Emerald Dove	<i>Chalcophaps indica</i>	1	male
2020-08-03	11:39:16	08030059.MP4	Long-tailed Macaque	<i>Macaca fascicularis</i>	1	juvenile
2020-08-03	14:21:58	08030062.MP4	Wild Pig	<i>Sus scrofa</i>	2	1 juvenile
2020-08-03	15:22:38	08030063.MP4	Wild Pig	<i>Sus scrofa</i>	3	2 juveniles
2020-08-03	16:50:22	08030065.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-05	8:31:02	08050066.MP4	Wild Pig	<i>Sus scrofa</i>	3	1 juvenile
2020-08-05	16:34:36	08050067.MP4	Wild Pig	<i>Sus scrofa</i>	2	
2020-08-06	8:26:30	08060070.MP4	Wild Pig	<i>Sus scrofa</i>	3	2 juveniles
2020-08-06	9:37:30	08060073.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-06	11:38:50	08060074.MP4	Wild Pig	<i>Sus scrofa</i>	3	2 juveniles
2020-08-07	16:28:34	08070075.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-07	16:39:26	08070076.MP4	Red Junglefowl	<i>Gallus gallus domesticus</i>	1	domestic male
2020-08-07	18:33:28	08070077.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-07	22:07:42	08070078.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-07	1:58:08	08080079.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-08	10:14:14	08080082.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-08	12:59:18	08080084.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-08	13:00:20	08080085.MP4	Wild Pig	<i>Sus scrofa</i>	2	2 juveniles
2020-08-08	17:57:58	08080086.MP4	Wild Pig	<i>Sus scrofa</i>	4	2 juveniles
2020-08-08	18:53:12	08080087.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-08	18:53:54	08080088.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-09	10:01:22	08090094.MP4	Long-tailed Macaque	<i>Macaca fascicularis</i>	5	1 investigating camera
2020-08-09	13:20:46	08090096.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-09	15:02:54	08090097.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-09	17:28:10	08090098.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-09	2:16:28	08100099.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-10	8:03:54	08100100.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-10	11:57:38	08100101.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-11	9:59:06	08110102.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-11	10:00:04	08110103.MP4	Wild Pig	<i>Sus scrofa</i>	2	2 juveniles
2020-08-11	10:18:56	08110105.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-11	10:54:36	08110107.MP4	Long-tailed Macaque	<i>Macaca fascicularis</i>	10	
2020-08-11	15:16:10	08110109.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-11	15:50:56	08110110.MP4	Wild Pig	<i>Sus scrofa</i>	2	2 juveniles
2020-08-11	19:03:04	08110111.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-12	17:13:54	08120114.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-13	18:24:54	08130115.MP4	Wild Pig	<i>Sus scrofa</i>	3	2 juveniles, 1 suckling
2020-08-14	13:07:28	08140117.MP4	Red Junglefowl	<i>Gallus gallus</i>	1	male
2020-08-14	13:43:20	08140118.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-14	16:22:38	08140119.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-14	19:11:10	08140120.MP4	Wild Pig	<i>Sus scrofa</i>	2	1 juvenile
2020-08-15	11:58:42	08150121.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-16	13:13:26	08160122.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-16	16:52:26	08160123.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-16	21:02:04	08160124.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-17	10:03:24	08170125.MP4	Dog	<i>Canis lupus familiaris</i>	2	
2020-08-17	17:07:46	08170126.MP4	Wild Pig	<i>Sus scrofa</i>	1	

2020-08-17	17:22:26	08170127.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-17	18:57:06	08170128.MP4	Common Treeshrew	<i>Tupaia glis</i>	1	
2020-08-18	11:11:12	08180129.MP4	Wild Pig	<i>Sus scrofa</i>	1	1 juvenile
2020-08-18	1:13:40	08190130.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-07-20	19:01:52	07200012.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-07-20	6:55:02	07210013.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-07-21	11:20:46	07210014.MP4	Red Junglefowl	<i>Gallus gallus</i>	1	male
2020-07-21	14:18:46	07210015.MP4	Wild Pig	<i>Sus scrofa</i>	2	
2020-07-21	20:18:28	07210017.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-07-21	1:13:26	07220018.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-07-24	13:44:36	07240022.MP4	Wild Pig	<i>Sus scrofa</i>	1	1 juvenile
2020-07-24	17:20:56	07240023.MP4	Wild Pig	<i>Sus scrofa</i>	1	1 juvenile
2020-07-24	18:33:58	07240024.MP4	Red Junglefowl	<i>Gallus gallus</i>	1	female
2020-07-24	21:08:14	07240025.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-07-25	8:55:42	07250026.MP4	Red Junglefowl	<i>Gallus gallus</i>	1	female
2020-07-25	14:14:22	07250027.MP4	Red Junglefowl	<i>Gallus gallus</i>	1	male
2020-07-26	17:48:02	07260028.MP4	Red Junglefowl	<i>Gallus gallus</i>	1	female
2020-07-27	18:58:06	07270029.MP4	Red Junglefowl	<i>Gallus gallus</i>	1	female
2020-07-29	15:08:42	07290030.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-07-31	11:34:48	07310031.MP4	Long-tailed Macaque	<i>Macaca fascicularis</i>	1	
2020-07-31	11:35:32	07310032.MP4	Long-tailed Macaque	<i>Macaca fascicularis</i>	1	
2020-07-31	11:47:00	07310033.MP4	Long-tailed Macaque	<i>Macaca fascicularis</i>	1	
2020-07-31	11:51:22	07310034.MP4	Long-tailed Macaque	<i>Macaca fascicularis</i>	1	
2020-07-31	11:51:22	07310034.MP4	Plantain Squirrel	<i>Callosciurus notatus</i>	1	
2020-07-31	11:52:48	07310035.MP4	Long-tailed Macaque	<i>Macaca fascicularis</i>	2	
2020-07-31	22:19:36	07310037.MP4	Wild Pig	<i>Sus scrofa</i>	2	
2020-08-01	18:57:02	08010038.MP4	Red Junglefowl	<i>Gallus gallus</i>	1	female
2020-08-01	20:14:50	08010039.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-01	4:00:56	08020040.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-01	4:03:18	08020041.MP4	Wild Pig	<i>Sus scrofa</i>	3	2 juveniles
2020-08-02	8:12:42	08020042.MP4	Dog	<i>Canis lupus familiaris</i>	1	
2020-08-02	9:57:50	08020045.MP4	Long-tailed Macaque	<i>Macaca fascicularis</i>	1	
2020-08-02	10:28:34	08020049.MP4	Long-tailed Macaque	<i>Macaca fascicularis</i>	2	
2020-08-02	10:52:24	08020053.MP4	Long-tailed Macaque	<i>Macaca fascicularis</i>	3	
2020-08-03	8:12:40	08030054.MP4	Dog	<i>Canis lupus familiaris</i>	1	
2020-08-03	10:53:38	08030056.MP4	Long-tailed Macaque	<i>Macaca fascicularis</i>	1	
2020-08-03	11:01:54	08030059.MP4	Long-tailed Macaque	<i>Macaca fascicularis</i>	2	
2020-08-03	11:08:00	08030063.MP4	Common Treeshrew	<i>Tupaia glis</i>	1	
2020-08-03	11:45:32	08030069.MP4	Dog	<i>Canis lupus familiaris</i>	1	
2020-08-03	12:20:26	08030070.MP4	Wild Pig	<i>Sus scrofa</i>	2	
2020-08-03	15:25:54	08030071.MP4	Wild Pig	<i>Sus scrofa</i>	3	
2020-08-03	19:20:50	08030074.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-03	19:55:54	08030075.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-04	17:11:18	08040076.MP4	Wild Pig	<i>Sus scrofa</i>	3	2 juveniles
2020-08-04	7:23:48	08050078.MP4	Long-tailed Macaque	<i>Macaca fascicularis</i>	3	2 juveniles
2020-08-05	17:11:32	08050080.MP4	Wild Pig	<i>Sus scrofa</i>	2	
2020-08-05	21:02:20	08050081.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-06	9:22:02	08060083.MP4	Long-tailed Macaque	<i>Macaca fascicularis</i>	2	
2020-08-06	9:29:00	08060085.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-07	16:28:06	08070087.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-08	14:00:26	08080088.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-08	21:47:20	08080089.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-09	13:31:28	08090092.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-09	13:40:06	08090093.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-09	18:22:46	08090094.MP4	Plantain Squirrel	<i>Callosciurus notatus</i>	1	
2020-08-09	2:02:38	08100095.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-09	7:41:40	08100096.MP4	Wild Pig	<i>Sus scrofa</i>	3	2 juveniles
2020-08-10	12:07:10	08100101.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-10	19:34:40	08100102.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-11	9:44:36	08110109.MP4	Long-tailed Macaque	<i>Macaca fascicularis</i>	3	
2020-08-11	10:00:00	08110122.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-11	10:30:52	08110128.MP4	Wild Pig	<i>Sus scrofa</i>	3	2 juveniles
2020-08-11	15:19:00	08110130.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-11	18:49:36	08110131.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-12	9:21:36	08120133.MP4	Dog	<i>Canis lupus familiaris</i>	1	
2020-08-12	12:32:22	08120134.MP4	Red Junglefowl	<i>Gallus gallus</i>	1	male
2020-08-12	12:41:52	08120135.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-12	14:47:54	08120136.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-12	14:48:42	08120137.MP4	Wild Pig	<i>Sus scrofa</i>	2	2 juveniles
2020-08-12	21:39:32	08120140.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-13	9:03:32	08130142.MP4	Red Junglefowl	<i>Gallus gallus</i>	1	female
2020-08-13	13:03:46	08130143.MP4	Wild Pig	<i>Sus scrofa</i>	3	2 juveniles
2020-08-13	18:18:30	08130146.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-13	20:49:30	08130147.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-14	12:29:18	08140149.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-14	13:49:58	08140151.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-14	17:40:06	08140152.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-15	10:48:08	08150154.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-15	11:52:36	08150155.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-15	18:40:34	08150156.MP4	Wild Pig	<i>Sus scrofa</i>	4	2 juveniles

2020-08-15	19:54:10	08150157.MP4	Wild Pig	<i>Sus scrofa</i>	3	2 juveniles
2020-08-16	9:54:54	08160158.MP4	Long-tailed Macaque	<i>Macaca fascicularis</i>	1	
2020-08-16	10:06:24	08160162.MP4	Long-tailed Macaque	<i>Macaca fascicularis</i>	2	
2020-08-16	13:35:00	08160168.MP4	Wild Pig	<i>Sus scrofa</i>	2	
2020-08-16	14:02:16	08160169.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-16	0:34:34	08170171.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-16	7:19:22	08170172.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-17	17:18:08	08170179.MP4	Wild Pig	<i>Sus scrofa</i>	3	2 juveniles
2020-08-17	19:33:20	08170181.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-18	10:23:02	08180183.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-18	10:59:08	08180184.MP4	Wild Pig	<i>Sus scrofa</i>	1	1 juvenile
2020-08-18	21:49:08	08180185.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-18	23:00:26	08180186.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-18	0:09:34	08190187.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-07-21	15:13:22	07210015.MP4	Common Emerald Dove	<i>Chalcophaps indica</i>	1	
2020-07-21	19:54:32	07210021.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-07-21	21:07:34	07210022.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-07-21	0:20:44	07220024.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-07-23	11:04:44	07230026.MP4	Common Emerald Dove	<i>Chalcophaps indica</i>	1	female
2020-07-23	18:02:10	07230029.MP4	Common Emerald Dove	<i>Chalcophaps indica</i>	1	male
2020-07-24	4:30:36	07250031.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-07-25	15:48:20	07250034.MP4	Common Emerald Dove	<i>Chalcophaps indica</i>	1	female
2020-07-25	7:06:18	07260035.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-07-25	7:14:34	07260036.MP4	Dog	<i>Canis lupus familiaris</i>	1	
2020-07-26	8:50:02	07260037.MP4	Long-tailed Macaque	<i>Macaca fascicularis</i>	1	
2020-07-26	19:30:50	07260039.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-07-27	9:15:02	07270040.MP4	Dog	<i>Canis lupus familiaris</i>	1	
2020-07-27	9:51:32	07270041.MP4	Common Emerald Dove	<i>Chalcophaps indica</i>	1	female
2020-07-31	9:45:30	07310046.MP4	Dog	<i>Canis lupus familiaris</i>	1	
2020-07-31	10:23:16	07310047.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-07-31	21:00:54	07310048.MP4	Wild Pig	<i>Sus scrofa</i>	5	
2020-07-31	22:46:12	07310049.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-01	2:39:24	08020050.MP4	Common Emerald Dove	<i>Chalcophaps indica</i>	1	
2020-08-02	8:38:52	08020054.MP4	Dog	<i>Canis lupus familiaris</i>	1	
2020-08-02	10:37:28	08020055.MP4	Long-tailed Macaque	<i>Macaca fascicularis</i>	1	
2020-08-02	7:47:38	08030057.MP4	Common Emerald Dove	<i>Chalcophaps indica</i>	1	male
2020-08-02	7:49:20	08030058.MP4	Dog	<i>Canis lupus familiaris</i>	2	
2020-08-04	8:47:20	08040061.MP4	Long-tailed Macaque	<i>Macaca fascicularis</i>	1	
2020-08-04	11:51:04	08040062.MP4	Dog	<i>Canis lupus familiaris</i>	1	
2020-08-04	7:28:22	08050064.MP4	Long-tailed Macaque	<i>Macaca fascicularis</i>	2	
2020-08-06	10:41:10	08060067.MP4	Common Emerald Dove	<i>Chalcophaps indica</i>	1	female
2020-08-06	7:36:28	08070069.MP4	Common Emerald Dove	<i>Chalcophaps indica</i>	1	
2020-08-07	1:17:04	08080070.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-07	7:55:48	08080071.MP4	Red Junglefowl	<i>Gallus gallus</i>	1	female
2020-08-08	18:43:24	08080072.MP4	Wild Pig	<i>Sus scrofa</i>	3	
2020-08-09	8:09:46	08090073.MP4	Long-tailed Macaque	<i>Macaca fascicularis</i>	2	
2020-08-09	8:51:02	08090074.MP4	Long-tailed Macaque	<i>Macaca fascicularis</i>	1	
2020-08-09	19:09:32	08090076.MP4	Common Treeshrew	<i>Tupaia glis</i>	1	
2020-08-09	7:57:56	08100077.MP4	Wild Pig	<i>Sus scrofa</i>	1	1 juvenile
2020-08-10	8:06:42	08100078.MP4	Wild Pig	<i>Sus scrofa</i>	2	1 juvenile
2020-08-10	8:27:16	08100079.MP4	Common Emerald Dove	<i>Chalcophaps indica</i>	1	
2020-08-10	15:38:46	08100081.MP4	Common Emerald Dove	<i>Chalcophaps indica</i>	1	male
2020-08-10	15:40:20	08100082.MP4	Common Emerald Dove	<i>Chalcophaps indica</i>	1	male
2020-08-10	22:28:04	08100083.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-10	23:32:22	08100084.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-10	7:01:06	08110085.MP4	Common Treeshrew	<i>Tupaia glis</i>	1	
2020-08-10	7:35:22	08110086.MP4	Common Emerald Dove	<i>Chalcophaps indica</i>	1	
2020-08-11	9:20:44	08110087.MP4	Common Emerald Dove	<i>Chalcophaps indica</i>	1	female
2020-08-11	10:28:46	08110088.MP4	Common Emerald Dove	<i>Chalcophaps indica</i>	1	juvenile
2020-08-11	10:34:40	08110089.MP4	Wild Pig	<i>Sus scrofa</i>	2	2 juveniles
2020-08-12	9:06:30	08120090.MP4	Common Emerald Dove	<i>Chalcophaps indica</i>	1	male
2020-08-12	9:14:04	08120091.MP4	Dog	<i>Canis lupus familiaris</i>	1	
2020-08-12	12:33:06	08120093.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-12	14:06:14	08120094.MP4	Common Emerald Dove	<i>Chalcophaps indica</i>	1	juvenile
2020-08-12	14:21:36	08120095.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-12	14:22:14	08120096.MP4	Wild Pig	<i>Sus scrofa</i>	1	1 juvenile
2020-08-12	15:34:18	08120097.MP4	Common Emerald Dove	<i>Chalcophaps indica</i>	1	female
2020-08-12	17:24:48	08120098.MP4	Red Junglefowl	<i>Gallus gallus</i>	1	male
2020-08-12	17:24:48	08120098.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-13	12:32:04	08130100.MP4	Common Emerald Dove	<i>Chalcophaps indica</i>	1	male
2020-08-13	15:50:36	08130104.MP4	Common Emerald Dove	<i>Chalcophaps indica</i>	1	female
2020-08-13	16:56:30	08130105.MP4	Wild Pig	<i>Sus scrofa</i>	2	
2020-08-13	17:23:02	08130106.MP4	Common Emerald Dove	<i>Chalcophaps indica</i>	1	female
2020-08-13	7:05:28	08140110.MP4	Red Junglefowl	<i>Gallus gallus</i>	1	male
2020-08-13	7:06:48	08140111.MP4	Red Junglefowl	<i>Gallus gallus</i>	1	female
2020-08-14	17:39:14	08140113.MP4	Common Emerald Dove	<i>Chalcophaps indica</i>	1	
2020-08-15	9:13:30	08150114.MP4	Common Emerald Dove	<i>Chalcophaps indica</i>	1	
2020-08-15	11:53:40	08150117.MP4	Wild Pig	<i>Sus scrofa</i>	3	2 juveniles
2020-08-15	13:10:56	08150118.MP4	Common Emerald Dove	<i>Chalcophaps indica</i>	1	
2020-08-15	17:01:56	08150119.MP4	Common Emerald Dove	<i>Chalcophaps indica</i>	1	

2020-08-15	19:48:04	08150121.MP4	Wild Pig	<i>Sus scrofa</i>	3	2 juveniles
2020-08-16	8:24:06	08160122.MP4	Common Emerald Dove	<i>Chalcophaps indica</i>	1	
2020-08-16	9:39:44	08160123.MP4	Long-tailed Macaque	<i>Macaca fascicularis</i>	4	
2020-08-16	10:50:02	08160126.MP4	Common Emerald Dove	<i>Chalcophaps indica</i>	1	
2020-08-16	15:03:44	08160127.MP4	Common Emerald Dove	<i>Chalcophaps indica</i>	1	female
2020-08-16	15:59:52	08160128.MP4	Common Emerald Dove	<i>Chalcophaps indica</i>	1	female
2020-08-16	16:16:08	08160129.MP4	Red Junglefowl	<i>Gallus gallus</i>	4	3 chicks
2020-08-16	16:27:42	08160130.MP4	Wild Pig	<i>Sus scrofa</i>	4	
2020-08-16	5:53:14	08170132.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-17	8:15:50	08170133.MP4	Dog	<i>Canis lupus familiaris</i>	1	
2020-08-17	9:05:42	08170134.MP4	Dog	<i>Canis lupus familiaris</i>	1	
2020-08-17	15:38:32	08170136.MP4	Common Emerald Dove	<i>Chalcophaps indica</i>	1	male
2020-08-17	19:38:58	08170137.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-17	21:42:46	08170138.MP4	Wild Pig	<i>Sus scrofa</i>	2	
2020-08-17	7:22:46	08180141.MP4	Common Emerald Dove	<i>Chalcophaps indica</i>	1	
2020-08-17	7:47:40	08180142.MP4	Long-tailed Macaque	<i>Macaca fascicularis</i>	1	
2020-08-18	10:02:08	08180147.MP4	Long-tailed Macaque	<i>Macaca fascicularis</i>	4	
2020-08-18	10:05:02	08180148.MP4	Wild Pig	<i>Sus scrofa</i>	1	1 juvenile
2020-08-18	10:07:02	08180149.MP4	Long-tailed Macaque	<i>Macaca fascicularis</i>	1	
2020-08-18	17:13:36	08180150.MP4	Common Emerald Dove	<i>Chalcophaps indica</i>	1	
2020-08-18	20:21:16	08180151.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-18	0:52:22	08190152.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-18	7:19:36	08190153.MP4	Common Emerald Dove	<i>Chalcophaps indica</i>	1	
2020-08-18	7:31:40	08190155.MP4	Dog	<i>Canis lupus familiaris</i>	1	
2020-07-20	17:33:34	07200016.MP4	Common Emerald Dove	<i>Chalcophaps indica</i>	1	
2020-07-21	15:26:56	07210017.MP4	Plantain Squirrel	<i>Callosciurus notatus</i>	1	
2020-07-21	20:09:06	07210018.MP4	Rat sp.	<i>Rattus</i> sp.	1	Likely Asian House Rat (<i>Rattus tanezumi</i>); tail about body length, underside pale but does not appear white, back appears to have some guard hairs.
2020-07-21	22:23:08	07210019.MP4	Rat sp.	<i>Rattus</i> sp.	1	Likely Asian House Rat (<i>Rattus tanezumi</i>); tail about body length, underside pale but does not appear white, back appears to have some guard hairs.
2020-07-21	0:21:20	07220020.MP4	Rat sp.	<i>Rattus</i> sp.	1	Likely Asian House Rat (<i>Rattus tanezumi</i>); tail about body length, underside pale but does not appear white, back appears to have some guard hairs.
2020-07-21	3:12:48	07220022.MP4	Rat sp.	<i>Rattus</i> sp.	1	Likely Asian House Rat (<i>Rattus tanezumi</i>); tail about body length, underside pale but does not appear white, back appears to have some guard hairs.
2020-07-21	6:30:06	07220023.MP4	Rat sp.	<i>Rattus</i> sp.	1	Likely Asian House Rat (<i>Rattus tanezumi</i>); tail about body length, underside pale but does not appear white, back appears to have some guard hairs.
2020-07-22	6:12:34	07230025.MP4	Dog	<i>Canis lupus familiaris</i>	1	
2020-07-23	19:38:16	07230026.MP4	Rat sp.	<i>Rattus</i> sp.	1	Likely Asian House Rat (<i>Rattus tanezumi</i>); tail about body length, underside pale but does not appear white, back appears to have some guard hairs.
2020-07-25	0:22:38	07260028.MP4	Rat sp.	<i>Rattus</i> sp.	1	Likely Asian House Rat (<i>Rattus tanezumi</i>); tail about body length, underside pale but does not appear white, back appears to have some guard hairs.
2020-07-26	19:56:22	07260029.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-07-26	0:14:34	07270030.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-07-26	7:28:08	07270031.MP4	Dog	<i>Canis lupus familiaris</i>	1	
2020-07-27	17:39:54	07270032.MP4	Red Junglefowl	<i>Gallus gallus</i>	1	
2020-07-27	20:59:08	07270033.MP4	Rat sp.	<i>Rattus</i> sp.	1	Likely Asian House Rat (<i>Rattus tanezumi</i>); tail about body length, underside pale but does not appear white, back appears to have some guard hairs.
2020-07-27	23:03:20	07270035.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-07-27	23:38:20	07270036.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-07-28	9:32:12	07280040.MP4	Common Emerald Dove	<i>Chalcophaps indica</i>	1	
2020-07-31	8:48:50	07310044.MP4	Dog	<i>Canis lupus familiaris</i>	1	
2020-07-31	20:56:18	07310045.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-07-31	21:07:32	07310046.MP4	Wild Pig	<i>Sus scrofa</i>	2	
2020-07-31	0:00:54	08010049.MP4	Rat sp.	<i>Rattus</i> sp.	1	Likely Asian House Rat (<i>Rattus tanezumi</i>); tail about body length, underside pale but does not appear white, back appears to have some guard hairs.
2020-07-31	1:05:54	08010050.MP4	Rat sp.	<i>Rattus</i> sp.	1	Likely Asian House Rat (<i>Rattus tanezumi</i>); tail about body length, underside pale but does not appear white, back appears to have some guard hairs.
2020-08-01	2:57:12	08020053.MP4	Wild Pig	<i>Sus scrofa</i>	3	2 juveniles
2020-08-02	0:11:58	08030054.MP4	Rat sp.	<i>Rattus</i> sp.	1	Likely Asian House Rat (<i>Rattus tanezumi</i>); tail about body length, underside pale but does not appear white, back appears to have some guard hairs.
2020-08-03	11:12:06	08030056.MP4	Plantain Squirrel	<i>Callosciurus notatus</i>	1	
2020-08-03	19:51:44	08030057.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-03	21:00:42	08030059.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-03	1:31:36	08040060.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-03	1:45:02	08040061.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-04	16:12:40	08040062.MP4	Dog	<i>Canis lupus familiaris</i>	1	
2020-08-05	3:22:14	08060066.MP4	Rat sp.	<i>Rattus</i> sp.	1	Likely Asian House Rat (<i>Rattus tanezumi</i>); tail about body length, underside pale but does not appear white, back appears to have some guard hairs.

2020-08-05	3:43:54	08060067.MP4	Rat sp.	<i>Rattus</i> sp.	1	Likely Asian House Rat (<i>Rattus tanezumi</i>); tail about body length, underside pale but does not appear white, back appears to have some guard hairs.
2020-08-06	17:13:18	08060068.MP4	Common Emerald Dove	<i>Chalcophaps indica</i>	1	
2020-08-07	23:44:18	08070070.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-08	13:38:58	08080071.MP4	Spotted Dove	<i>Spilopelia chinensis</i>	1	
2020-08-08	20:12:58	08080072.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-10	12:24:12	08100077.MP4	Red Junglefowl	<i>Gallus gallus</i>	1	female
2020-08-10	12:26:22	08100078.MP4	Plantain Squirrel	<i>Callosciurus notatus</i>	1	
2020-08-10	12:33:44	08100080.MP4	Red Junglefowl	<i>Gallus gallus</i>	1	female
2020-08-10	19:39:52	08100087.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-10	20:30:20	08100088.MP4	Dog	<i>Canis lupus familiaris</i>	1	
2020-08-11	23:39:04	08110091.MP4	Rat sp.	<i>Rattus</i> sp.	1	Likely Asian House Rat (<i>Rattus tanezumi</i>); tail about body length, underside pale but does not appear white, back appears to have some guard hairs.
2020-08-11	0:56:20	08120092.MP4	Rat sp.	<i>Rattus</i> sp.	1	Likely Asian House Rat (<i>Rattus tanezumi</i>); tail about body length, underside pale but does not appear white, back appears to have some guard hairs.
2020-08-12	18:29:46	08120093.MP4	Wild Pig	<i>Sus scrofa</i>	3	2 juveniles
2020-08-12	21:50:44	08120094.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-12	0:49:16	08130096.MP4	Rat sp.	<i>Rattus</i> sp.	1	Likely Asian House Rat (<i>Rattus tanezumi</i>); tail about body length, underside pale but does not appear white, back appears to have some guard hairs.
2020-08-12	1:20:40	08130097.MP4	Rat sp.	<i>Rattus</i> sp.	1	Likely Asian House Rat (<i>Rattus tanezumi</i>); tail about body length, underside pale but does not appear white, back appears to have some guard hairs.
2020-08-12	5:58:14	08130098.MP4	Dog	<i>Canis lupus familiaris</i>	2	
2020-08-14	12:23:58	08140100.MP4	Dog	<i>Canis lupus familiaris</i>	1	
2020-08-14	15:27:36	08140102.MP4	Red Junglefowl	<i>Gallus gallus</i>	1	female
2020-08-15	21:15:26	08150103.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-16	8:00:26	08160104.MP4	Dog	<i>Canis lupus familiaris</i>	1	
2020-08-16	12:43:12	08160105.MP4	Dog	<i>Canis lupus familiaris</i>	1	
2020-08-16	16:14:08	08160106.MP4	Dog	<i>Canis lupus familiaris</i>	1	
2020-08-16	2:46:38	08170108.MP4	Rat sp.	<i>Rattus</i> sp.	1	Likely Asian House Rat (<i>Rattus tanezumi</i>); tail about body length, underside pale but does not appear white, back appears to have some guard hairs.
2020-08-17	1:45:16	08180112.MP4	Dog	<i>Canis lupus familiaris</i>	1	
2020-08-17	7:52:04	08180113.MP4	Dog	<i>Canis lupus familiaris</i>	1	
2020-08-18	8:31:44	08180115.MP4	Dog	<i>Canis lupus familiaris</i>	1	
2020-08-18	11:09:10	08180117.MP4	Dog	<i>Canis lupus familiaris</i>	1	
2020-08-18	16:49:54	08180119.MP4	Dog	<i>Canis lupus familiaris</i>	1	
2020-08-18	17:39:18	08180120.MP4	Red Junglefowl	<i>Gallus gallus</i>	4	3 chicks
2020-08-18	20:57:36	08180121.MP4	Rat sp.	<i>Rattus</i> sp.	1	Likely Asian House Rat (<i>Rattus tanezumi</i>); tail about body length, underside pale but does not appear white, back appears to have some guard hairs.
2020-08-18	21:56:08	08180122.MP4	Wild Pig	<i>Sus scrofa</i>	1	
2020-08-18	22:27:08	08180123.MP4	Dog	<i>Canis lupus familiaris</i>	1	
2020-08-18	7:50:54	08190125.MP4	Dog	<i>Canis lupus familiaris</i>	1	

Appendix D: Noise Baseline Report

CALIBRATION CERTIFICATE

Date : 12-Aug-20

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Report No. : EM/20/08181
Customer : Emetrology Pte Ltd
Address : 59 Ubi Avenue 1 #06-17
Bizlink Centre
Singapore 408938

Attention : Mr Teo

Description : Real Time Signal Analyzer with 1/1 & 1/3 Octave Band Analysis (Class 1)
Model : ACE6291
Vendor : Emetrology Pte Ltd
Serial No. : 034555
Sub-Assembly : AWA14423 2661

Date Calibrated : 12-Aug-20

Temperature : 23°C ± 3°C

Next Calibration : 12-Aug-21
(Recommended)

Humidity : 45 % RH – 65% RH

No adjustment was done Before Adjustment.

The result of the After Adjustment was shown and / or the difference of the reading was provided in the comment area.

Note:

- The intended use of the instrument should be ascertained based on user's requirement.
- This Certificate and the attached measurement report shall not be reproduced wholly or in parts without the prior consent of the Emetrology Facility.
- Emetrology Facility agrees to use reasonable diligence in the manner of the tests.
- In no event shall Emetrology Facility be liable for collateral, special or consequential damage cause by mishandling, corrosion, and drop.
- For the avoidance of doubt and without limiting the effect that Emetrology shall not be liable to its customers in contract, tort, negligence, breach of statutory duty.



Calibrated By
Peter Yap
(Calibration Officer)



Approved By
Christopher Teo
(Technical Manager)

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Results of Calibration

Applied Ref. Level	Ref. Level [dB]	SLM Display [dB]	Error [dB]
Pre-Calibration (Before Adjustment)			
114.0 dB at 1000 Hz	114.0	113.9	-0.1
94.0 dB at 1000 Hz	94.0	93.9	-0.1
Calibration with Microphone Test (After Adjustment)			
114.0 dB at 1000 Hz	114.0	114.0	0.0
94.0 dB at 1000 Hz	94.0	94.0	0.0

The following tests were performed with the Sound Level Meter / Noise Analyzers' microphone replaced by an electrical input signal device.

Frequency [Hz]	Ref. Level [dB]	SLM Display [dB]	Error [dB]
Frequency Weighting : A Network			
31.5 Hz	54.6	54.3	-0.3
63 Hz	67.8	67.7	-0.1
125 Hz	77.9	77.8	-0.1
250 Hz	85.4	85.3	-0.1
500 Hz	90.8	90.8	0.0
1000 Hz	94.0	94.0	0.0
2000 Hz	95.2	95.3	0.1
4000 Hz	95.0	95.3	0.3
8000 Hz	92.9	93.6	0.7
16000 Hz	87.4	84.3	-3.1



Calibration Officer

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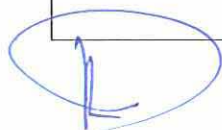
Results of Calibration

Frequency [Hz]	Ref. Level [dB]	SLM Display [dB]	Error [dB]
Frequency Weighting : C Network			
31.5 Hz	91.0	90.9	-0.1
63 Hz	93.2	93.2	0.0
125 Hz	93.8	93.8	0.0
250 Hz	94.0	94.0	0.0
500 Hz	94.0	94.0	0.0
1000 Hz	94.0	94.0	0.0
2000 Hz	93.8	93.9	0.1
4000 Hz	93.2	93.5	0.3
8000 Hz	91.0	91.7	0.7
16000 Hz	85.5	82.4	-3.1
Frequency Weighting : F Network			
31.5 Hz	94.0	94.0	0.0
63 Hz	94.0	94.0	0.0
125 Hz	94.0	94.0	0.0
250 Hz	94.0	94.0	0.0
500 Hz	94.0	94.0	0.0
1000 Hz	94.0	94.0	0.0
2000 Hz	94.0	94.0	0.0
4000 Hz	94.0	94.0	0.0
8000 Hz	94.0	94.0	0.0
16000 Hz	94.0	94.0	0.0

Level Linearity Test

Frequency Weighting : A Network

Attenuate Setting [dB] 1 kHz @ 120.0 dB	Ref. Level [dB]	SLM Display [dB]	Error [dB]
0 dB	120.0	120.0	0.0
- 10 dB	110.0	110.0	0.0
- 20 dB	100.0	100.0	0.0
- 30 dB	90.0	90.0	0.0
- 40 dB	80.0	80.0	0.0
- 50 dB	70.0	70.1	0.1
- 60 dB	60.0	60.0	0.0
- 70 dB	50.0	49.9	-0.1



Calibration Officer

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Results of Calibration

Measuring the Reference Level on the Available Range at 1 kHz @ 94.0 dB

Level Range Control [dB]	Ref. Level [dB]	SLM Display [dB]	Error [dB]
140	94.0	94.0	0.0
130	94.0	94.0	0.0
120	94.0	94.0	0.0
110	94.0	94.0	0.0
100	94.0	94.0	0.0

Measuring 5 dB below Full Scale on All Available Ranges

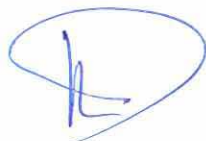
Attenuator Setting [dB]	Ref. Level [dB]	SLM Display [dB]	Error [dB]
140	135.0	135.0	0.0
130	125.0	125.0	0.0
120	115.0	115.0	0.0
110	105.0	105.0	0.0
100	95.0	95.0	0.0
90	85.0	85.1	0.1

Self Generated Noise Test (Leq 5 mins)

With 18 pf Equivalent Capacitance		SLM Display [dB]
A Weighting Network	Measure & Record	22.1
C Weighting Network	Measure & Record	24.2
F Weighting Network	Measure & Record	24.9

Comm Test

Connect to Computer or Printer	LCD Display Serial / Parallel	Not Tested
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Calibration Officer

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Results of Calibration

Overload Test

Applied Attenuation Input Level 128.0 dB @ 4 kHz	OL Indicator	OL Indicator
- 4 dB	Off	OFF
- 3 dB	May be On	OFF
- 2 dB	May be On	OFF
- 1 dB	May be On	OFF
0 dB	On	ON

The Sound Level Meter or Noise Analyzer was tested with its microphone installed. The acoustic signal generated by the sound calibrator in its ½-inch configuration was measured.

Frequency and Time Weights at 94.0 dB @ 1 kHz

Weightings		Reference Level [dB]	SLM Display [dB]	Error [dB]
Time	Network			
Fast	A	94.0	94.0	0.0
Fast	C	94.0	94.0	0.0
Fast	Z	94.0	94.0	0.0
Slow	A	94.0	94.0	0.0
Leq	A	94.0	93.9	-0.1
SEL	A	104.0	103.9	-0.1

Steady State Response Test

Applied Ref Level [dB] at 1 kHz	Ref. Level [dB]	SLM Display [dB]	Error [dB]
94 dB at Slow Respond (S)	94.0	94.0	0.0
94 dB at Fast Respond (F)	94.0	94.0	0.0
94 dB at Impulse Respond (I)	94.0	94.0	0.0

Acoustical Response at Frequency A Network

Applied Ref Level [dB] at 1 kHz	Ref. Level [dB]	SLM Display [dB]	Error [dB]
114.0 dB at 1000 Hz	114.0	114.0	0.0
94.0 dB at 1000 Hz	94.0	94.0	0.0



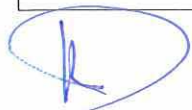
Calibration Officer

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Results of Calibration

Applied Ref. Level	Frequency [Hz]	SLM Display [dB]
SLM Setting : - Frequency Weighting Z - Time Weighting FAST - Range from 20 dB to 110 dB		
Approx. 50 dB down points	31.5	53.3
Approx. 3 dB down points	56.07	97.8
Center Frequency 63.0 Hz, SPL = 100.0 dB	63	100.0
Approx. 3 dB down points	70.56	96.2
Approx. 50 dB down points	126	19.7
Approx. 50 dB down points	40	47.5
Approx. 3 dB down points	71.2	97.8
Center Frequency 80.0 Hz, SPL = 100.0 dB	80	100.0
Approx. 3 dB down points	89.6	94.0
Approx. 50 dB down points	160	19.6
Approx. 50 dB down points	50	48.7
Approx. 3 dB down points	89	98.0
Center Frequency 100 Hz, SPL = 100.0 dB	100	100.0
Approx. 3 dB down points	112	95.3
Approx. 50 dB down points	200	19.5
Approx. 50 dB down points	62.5	52.0
Approx. 3 dB down points	111.25	96.9
Center Frequency 125 Hz, SPL = 100.0 dB	125	100.0
Approx. 3 dB down points	140	97.4
Approx. 50 dB down points	250	18.5



Calibration Officer

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Results of Calibration

Applied Ref. Level	Frequency [Hz]	SLM Display [dB]
Approx. 50 dB down points	80	46.8
Approx. 3 dB down points	142.4	98.1
Center Frequency 160 Hz, SPL = 100.0 dB	160	100.0
Approx. 3 dB down points	179.2	94.1
Approx. 50 dB down points	320	19.7
Approx. 50 dB down points	100	48.4
Approx. 3 dB down points	178	98.1
Center Frequency 200 Hz, SPL = 100.0 dB	200	100.0
Approx. 3 dB down points	224	95.8
Approx. 50 dB down points	400	20.1
Approx. 50 dB down points	125	52.0
Approx. 3 dB down points	222.5	96.9
Center Frequency 250 Hz, SPL = 100.0 dB	250	100.0
Approx. 3 dB down points	280	97.2
Approx. 50 dB down points	500	19.5
Approx. 50 dB down points	157.5	45.7
Approx. 3 dB down points	280.35	96.7
Center Frequency 315 Hz, SPL = 100.0 dB	315	100.0
Approx. 3 dB down points	352.8	96.9
Approx. 50 dB down points	630	20.5



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Results of Calibration

Applied Ref. Level	Frequency [Hz]	SLM Display [dB]
Approx. 50 dB down points	200	48.7
Approx. 3 dB down points	356	98.0
Center Frequency 400 Hz, SPL = 100.0 dB	400	100.0
Approx. 3 dB down points	448	96.1
Approx. 50 dB down points	800	20.0
Approx. 50 dB down points	250	52.0
Approx. 3 dB down points	445	97.0
Center Frequency 500 Hz, SPL = 100.0 dB	500	100.0
Approx. 3 dB down points	560	97.5
Approx. 50 dB down points	1000	19.0
Approx. 50 dB down points	315	45.8
Approx. 3 dB down points	560.7	96.8
Center Frequency 630 Hz, SPL = 100.0 dB	630	100.0
Approx. 3 dB down points	705.6	97.3
Approx. 50 dB down points	1260	22.4
Approx. 50 dB down points	400	48.8
Approx. 3 dB down points	712	98.1
Center Frequency 800 Hz, SPL = 100.0 dB	800	100.0
Approx. 3 dB down points	896	95.4
Approx. 50 dB down points	1600	24.9



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Results of Calibration

Applied Ref. Level	Frequency [Hz]	SLM Display [dB]
Approx. 50 dB down points	500	51.5
Approx. 3 dB down points	890	96.9
Center Frequency 1000 Hz, SPL = 100.0 dB	1000	100.0
Approx. 3 dB down points	1120	97.0
Approx. 50 dB down points	2000	25.2
Approx. 50 dB down points	625	45.5
Approx. 3 dB down points	1112.5	96.0
Center Frequency 1250 Hz, SPL = 100.0 dB	1250	100.0
Approx. 3 dB down points	1400	98.2
Approx. 50 dB down points	2500	21.2
Approx. 50 dB down points	800	48.7
Approx. 3 dB down points	1424	98.2
Center Frequency 1600 Hz, SPL = 100.0 dB	1600	100.0
Approx. 3 dB down points	1792	95.0
Approx. 50 dB down points	3200	10.7
Approx. 50 dB down points	1000	52.0
Approx. 3 dB down points	1780	95.6
Center Frequency 2000 Hz, SPL = 100.0 dB	2000	100.0
Approx. 3 dB down points	2240	97.2
Approx. 50 dB down points	4000	18.1



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Results of Calibration

Applied Ref. Level	Frequency [Hz]	SLM Display [dB]
Approx. 50 dB down points	1250	45.7
Approx. 3 dB down points	2225	96.0
Center Frequency 2500 Hz, SPL = 100.0 dB	2500	100.0
Approx. 3 dB down points	2800	98.2
Approx. 50 dB down points	5000	20.1
Approx. 50 dB down points	1575	47.9
Approx. 3 dB down points	2803.5	95.7
Center Frequency 3150 Hz, SPL = 100.0 dB	3150	100.0
Approx. 3 dB down points	3528	98.6
Approx. 50 dB down points	6300	6.1
Approx. 50 dB down points	2000	51.0
Approx. 3 dB down points	3560	97.0
Center Frequency 4000 Hz, SPL = 100.0 dB	4000	100.0
Approx. 3 dB down points	4480	97.2
Approx. 50 dB down points	8000	18.3
Approx. 50 dB down points	2500	45.4
Approx. 3 dB down points	4450	95.4
Center Frequency 5000 Hz, SPL = 100.0 dB	5000	100.0
Approx. 3 dB down points	5600	98.5
Approx. 50 dB down points	10000	20.9


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Results of Calibration

Applied Ref. Level	Frequency [Hz]	SLM Display [dB]
Approx. 50 dB down points	3150	48.1
Approx. 3 dB down points	5607	95.7
Center Frequency 6300 Hz, SPL = 100.0 dB	6300	100.0
Approx. 3 dB down points	7056	98.8
Approx. 50 dB down points	12600	7.0
Approx. 50 dB down points	4000	52.1
Approx. 3 dB down points	7120	97.0
Center Frequency 8000 Hz, SPL = 100.0 dB	8000	100.0
Approx. 3 dB down points	8960	97.2
Approx. 50 dB down points	16000	17.2
Approx. 50 dB down points	5000	45.5
Approx. 3 dB down points	8900	95.5
Center Frequency 10000 Hz, SPL = 100.0 dB	10000	100.0
Approx. 3 dB down points	11200	98.5
Approx. 50 dB down points	20000	23.9
Approx. 50 dB down points	6250	47.6
Approx. 3 dB down points	11125	94.2
Center Frequency 12500 Hz, SPL = 100.0 dB	12500	100.0
Approx. 3 dB down points	14000	99.4
Approx. 50 dB down points	25000	8.7



Calibration Officer

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Results of Calibration

Applied Ref. Level	Frequency [Hz]	SLM Display [dB]
Approx. 50 dB down points	8000	52.1
Approx. 3 dB down points	14240	96.8
Center Frequency 16000 Hz, SPL = 100.0 dB	16000	100.0
Approx. 3 dB down points	17920	97.3
Approx. 50 dB down points	32000	10.9
Approx. 50 dB down points	10000	45.3
Approx. 3 dB down points	17800	96.7
Center Frequency 20000 Hz, SPL = 100.0 dB	20000	100.0
Approx. 3 dB down points	22400	98.4
Approx. 50 dB down points	40000	18.8

Calibration Officer

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Method of Calibration

The method of calibration are generally as recommended in the calibration procedure :
EM-WI-CAL-SLM-001 & EM-WI-CAL-SOB-001.


Reference : IEC 61672-3 Sound Level Meters Parts 3 : Periodic Tests

Measuring instruments used in this calibration are traceable to National Metrology Centre.

No.	Description	Serial No.	Cal. Date
1	Sound Calibrator	16787	24.06.2020
2	Audio Analyzer	3413A13844	11.07.2019
3	Attenuator	527378	09.07.2019

The expanded uncertainties of measurement is 0.2 dB, estimated at a confidence level of approximately 95% with a coverage factor $k = 2$.

The user should determine the suitability of this instrument for its intended use.



Calibration Officer

Company Name : EnviroSolutions & Consulting Pte Ltd

Project Name : 1 Mandai Road

Project Duration : 25-August-2020 To 01-September-2020

Device Model : ACE Wireless

Device Serial Number : 034555

Total RunTime : 168:35:00

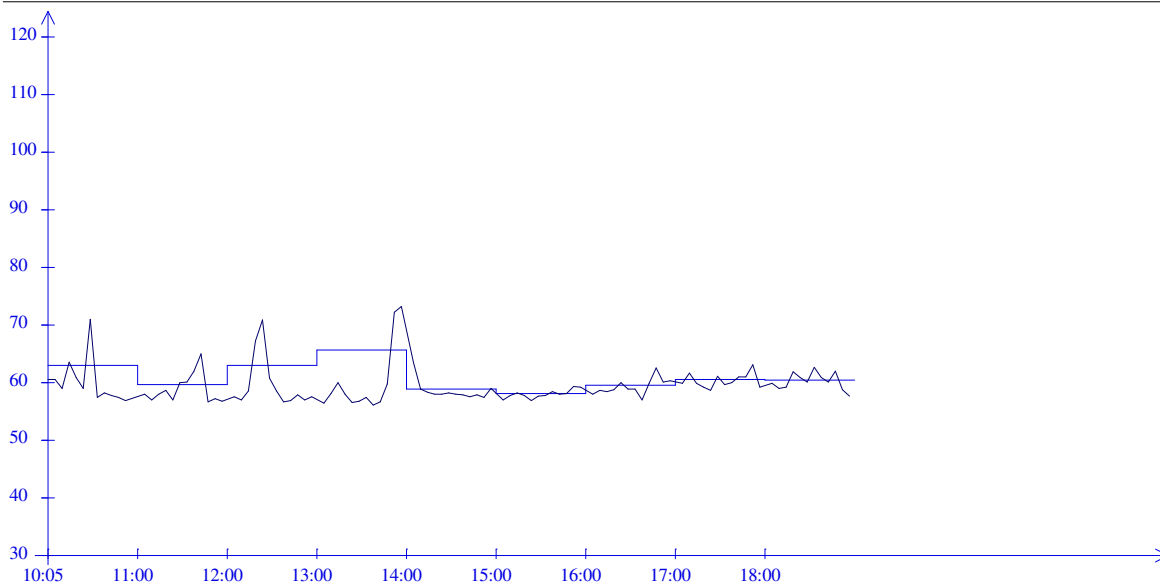
Stop Time: 19:00:00

Data Summary

Max Level 73.2 dB 2020-08-25 @13:55:00

Min Level 56.1 dB 2020-08-25 @13:35:00

Starting Date : 25-August-2020											
Time	Leq	Time	Leq	Time	Leq	Time	Leq	Time	Leq	Time	Leq
10:05:00	60.5	10:10:00	58.9	10:15:00	63.5	10:20:00	60.8	10:25:00	58.9	10:30:00	71.0
10:35:00	57.4	10:40:00	58.2	10:45:00	57.7	10:50:00	57.4	10:55:00	56.8		
1 hour average Leq: 62.9											
11:00:00	57.9	11:05:00	57.0	11:10:00	58.0	11:15:00	58.6	11:20:00	57.0	11:25:00	60.0
11:30:00	60.1	11:35:00	61.9	11:40:00	64.9	11:45:00	56.6	11:50:00	57.2	11:55:00	56.7
1 hour average Leq: 59.7											
12:00:00	57.5	12:05:00	57.0	12:10:00	58.5	12:15:00	67.2	12:20:00	70.8	12:25:00	60.7
12:30:00	58.5	12:35:00	56.6	12:40:00	56.8	12:45:00	57.8	12:50:00	56.9	12:55:00	57.5
1 hour average Leq: 62.9											
13:00:00	56.4	13:05:00	58.1	13:10:00	60.0	13:15:00	58.0	13:20:00	56.5	13:25:00	56.7
13:30:00	57.4	13:35:00	56.1	13:40:00	56.6	13:45:00	59.7	13:50:00	72.2	13:55:00	73.2
1 hour average Leq: 65.6											
14:00:00	63.4	14:05:00	58.8	14:10:00	58.3	14:15:00	58.0	14:20:00	58.0	14:25:00	58.2
14:30:00	58.0	14:35:00	57.8	14:40:00	57.5	14:45:00	57.8	14:50:00	57.4	14:55:00	58.9
1 hour average Leq: 58.9											
15:00:00	56.9	15:05:00	57.7	15:10:00	58.2	15:15:00	57.7	15:20:00	56.8	15:25:00	57.6
15:30:00	57.7	15:35:00	58.4	15:40:00	57.9	15:45:00	58.1	15:50:00	59.3	15:55:00	59.2
1 hour average Leq: 58.0											
16:00:00	57.9	16:05:00	58.6	16:10:00	58.4	16:15:00	58.7	16:20:00	59.9	16:25:00	58.8
16:30:00	58.8	16:35:00	57.0	16:40:00	59.8	16:45:00	62.5	16:50:00	60.1	16:55:00	60.3
1 hour average Leq: 59.5											
17:00:00	59.8	17:05:00	61.6	17:10:00	59.8	17:15:00	59.2	17:20:00	58.6	17:25:00	61.1
17:30:00	59.6	17:35:00	60.0	17:40:00	61.0	17:45:00	61.0	17:50:00	63.1	17:55:00	59.2
1 hour average Leq: 60.5											
18:00:00	59.8	18:05:00	59.0	18:10:00	59.2	18:15:00	61.8	18:20:00	60.8	18:25:00	60.1
18:30:00	62.6	18:35:00	60.8	18:40:00	60.1	18:45:00	62.0	18:50:00	58.7	18:55:00	57.6
1 hour average Leq: 60.4											
12 hour average Leq: 61.6											
Ending date: 25-August-2020											



ACE Wireless

Company Name : EnviroSolutions & Consulting Pte Ltd

Project Name : 1 Mandai Road

Project Duration : 25-August-2020 To 01-September-2020

Device Model : ACE Wireless

Device Serial Number : 034555

Total RunTime : 168:35:00

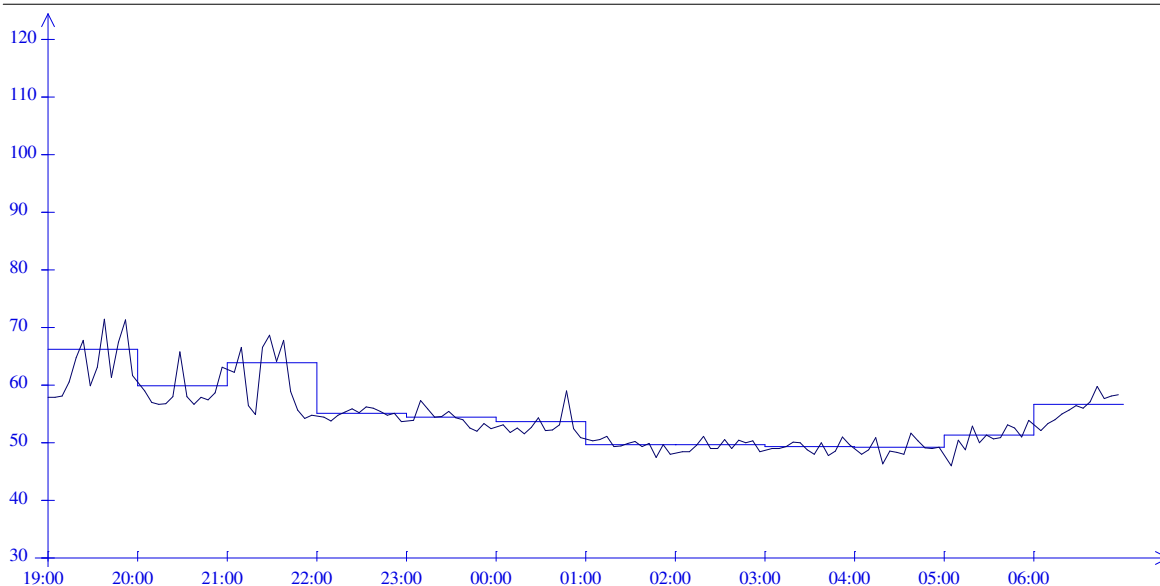
Stop Time: 19:00:00

Data Summary

Max Level 71.4 dB 2020-08-25 @19:35:00

Min Level 45.9 dB 2020-08-26 @05:00:00

Starting Date : 25-August-2020											
Time	Leq	Time	Leq	Time	Leq	Time	Leq	Time	Leq	Time	Leq
19:00:00	57.8	19:05:00	58.1	19:10:00	60.5	19:15:00	64.7	19:20:00	67.7	19:25:00	59.8
19:30:00	63.1	19:35:00	71.4	19:40:00	61.3	19:45:00	67.4	19:50:00	71.3	19:55:00	61.6
1 hour average Leq: 66.2											
20:00:00	58.9	20:05:00	57.0	20:10:00	56.6	20:15:00	56.7	20:20:00	58.0	20:25:00	65.7
20:30:00	58.0	20:35:00	56.6	20:40:00	57.8	20:45:00	57.4	20:50:00	58.6	20:55:00	63.1
1 hour average Leq: 59.8											
21:00:00	62.2	21:05:00	66.5	21:10:00	56.4	21:15:00	54.8	21:20:00	66.5	21:25:00	68.6
21:30:00	64.1	21:35:00	67.7	21:40:00	58.8	21:45:00	55.6	21:50:00	54.2	21:55:00	54.7
1 hour average Leq: 63.8											
22:00:00	54.4	22:05:00	53.7	22:10:00	54.7	22:15:00	55.3	22:20:00	55.8	22:25:00	55.2
22:30:00	56.2	22:35:00	56.0	22:40:00	55.4	22:45:00	54.7	22:50:00	55.1	22:55:00	53.6
1 hour average Leq: 55.1											
23:00:00	53.8	23:05:00	57.3	23:10:00	55.8	23:15:00	54.4	23:20:00	54.5	23:25:00	55.4
23:30:00	54.3	23:35:00	54.0	23:40:00	52.5	23:45:00	51.9	23:50:00	53.3	23:55:00	52.4
1 hour average Leq: 54.4											
00:00:00	53.1	00:05:00	51.7	00:10:00	52.5	00:15:00	51.5	00:20:00	52.6	00:25:00	54.3
00:30:00	52.1	00:35:00	52.2	00:40:00	53.1	00:45:00	58.9	00:50:00	52.4	00:55:00	50.8
1 hour average Leq: 53.6											
01:00:00	50.3	01:05:00	50.5	01:10:00	51.1	01:15:00	49.3	01:20:00	49.4	01:25:00	49.8
01:30:00	50.2	01:35:00	49.3	01:40:00	49.8	01:45:00	47.4	01:50:00	49.6	01:55:00	47.9
1 hour average Leq: 49.7											
02:00:00	48.4	02:05:00	48.4	02:10:00	49.5	02:15:00	51.1	02:20:00	49.0	02:25:00	49.0
02:30:00	50.5	02:35:00	49.0	02:40:00	50.4	02:45:00	50.0	02:50:00	50.3	02:55:00	48.4
1 hour average Leq: 49.6											
03:00:00	49.0	03:05:00	48.9	03:10:00	49.3	03:15:00	50.1	03:20:00	49.9	03:25:00	48.7
03:30:00	47.9	03:35:00	49.9	03:40:00	47.7	03:45:00	48.5	03:50:00	51.0	03:55:00	49.6
1 hour average Leq: 49.3											
04:00:00	48.0	04:05:00	48.7	04:10:00	50.8	04:15:00	46.3	04:20:00	48.5	04:25:00	48.3
04:30:00	47.9	04:35:00	51.6	04:40:00	50.3	04:45:00	49.1	04:50:00	49.0	04:55:00	49.2
1 hour average Leq: 49.2											
05:00:00	45.9	05:05:00	50.4	05:10:00	48.7	05:15:00	52.8	05:20:00	49.9	05:25:00	51.3
05:30:00	50.6	05:35:00	50.8	05:40:00	53.1	05:45:00	52.5	05:50:00	50.9	05:55:00	53.8
1 hour average Leq: 51.3											
06:00:00	52.1	06:05:00	53.3	06:10:00	53.9	06:15:00	54.9	06:20:00	55.6	06:25:00	56.4
06:30:00	56.0	06:35:00	57.1	06:40:00	59.7	06:45:00	57.6	06:50:00	58.1	06:55:00	58.3
1 hour average Leq: 56.6											
12 hour average Leq: 58.9											
Ending date: 26-August-2020											



ACE Wireless

Company Name : EnviroSolutions & Consulting Pte Ltd

Project Name : 1 Mandai Road

Project Duration : 25-August-2020 To 01-September-2020

Device Model : ACE Wireless

Device Serial Number : 034555

Total RunTime : 168:35:00

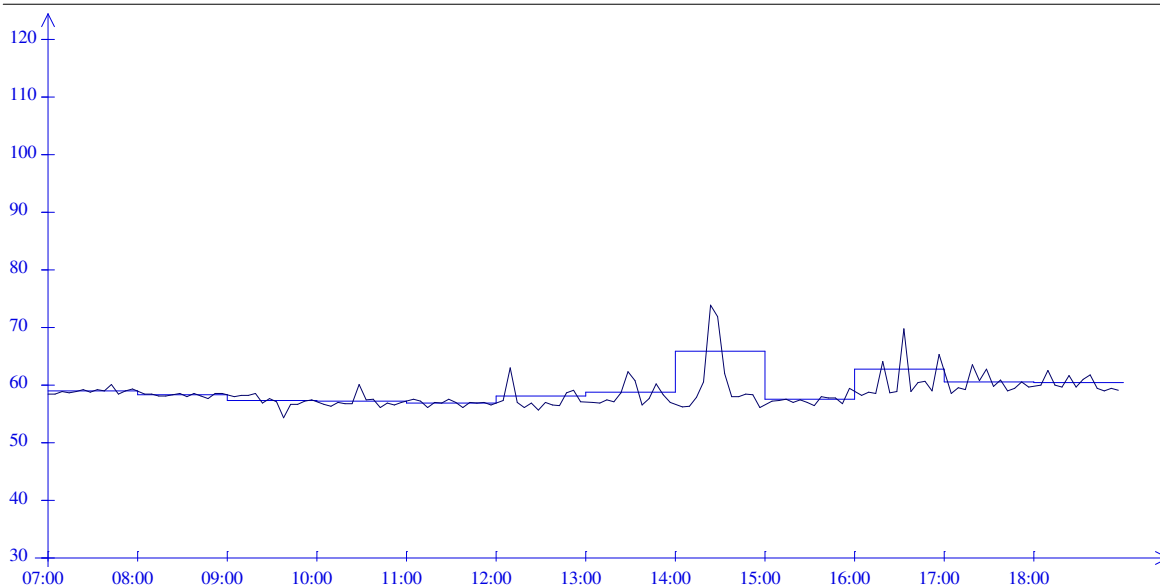
Stop Time: 19:00:00

Data Summary

Max Level 73.8 dB 2020-08-26 @14:20:00

Min Level 54.3 dB 2020-08-26 @09:35:00

Starting Date : 26-August-2020											
Time	Leq	Time	Leq	Time	Leq	Time	Leq	Time	Leq	Time	Leq
07:00:00	58.4	07:05:00	58.8	07:10:00	58.6	07:15:00	58.8	07:20:00	59.2	07:25:00	58.7
07:30:00	59.2	07:35:00	59.0	07:40:00	60.1	07:45:00	58.4	07:50:00	59.0	07:55:00	59.3
1 hour average Leq: 59.0											
08:00:00	58.4	08:05:00	58.4	08:10:00	58.1	08:15:00	58.1	08:20:00	58.3	08:25:00	58.5
08:30:00	57.9	08:35:00	58.5	08:40:00	58.1	08:45:00	57.6	08:50:00	58.5	08:55:00	58.5
1 hour average Leq: 58.3											
09:00:00	57.9	09:05:00	58.2	09:10:00	58.2	09:15:00	58.5	09:20:00	56.8	09:25:00	57.6
09:30:00	57.1	09:35:00	54.3	09:40:00	56.6	09:45:00	56.6	09:50:00	57.2	09:55:00	57.4
1 hour average Leq: 57.3											
10:00:00	56.6	10:05:00	56.3	10:10:00	56.9	10:15:00	56.7	10:20:00	56.7	10:25:00	60.1
10:30:00	57.4	10:35:00	57.5	10:40:00	56.1	10:45:00	56.8	10:50:00	56.5	10:55:00	57.0
1 hour average Leq: 57.2											
11:00:00	57.5	11:05:00	57.2	11:10:00	56.1	11:15:00	57.0	11:20:00	56.8	11:25:00	57.5
11:30:00	57.0	11:35:00	56.1	11:40:00	56.9	11:45:00	56.8	11:50:00	56.9	11:55:00	56.5
1 hour average Leq: 56.9											
12:00:00	57.3	12:05:00	63.0	12:10:00	57.0	12:15:00	56.1	12:20:00	56.8	12:25:00	55.6
12:30:00	56.9	12:35:00	56.5	12:40:00	56.4	12:45:00	58.6	12:50:00	59.1	12:55:00	57.1
1 hour average Leq: 58.1											
13:00:00	57.0	13:05:00	56.8	13:10:00	57.4	13:15:00	57.1	13:20:00	58.6	13:25:00	62.3
13:30:00	60.7	13:35:00	56.5	13:40:00	57.6	13:45:00	60.2	13:50:00	58.3	13:55:00	57.0
1 hour average Leq: 58.7											
14:00:00	56.2	14:05:00	56.3	14:10:00	57.8	14:15:00	60.5	14:20:00	73.8	14:25:00	71.8
14:30:00	61.9	14:35:00	58.0	14:40:00	57.9	14:45:00	58.4	14:50:00	58.3	14:55:00	56.1
1 hour average Leq: 65.9											
15:00:00	57.2	15:05:00	57.3	15:10:00	57.5	15:15:00	57.0	15:20:00	57.4	15:25:00	57.0
15:30:00	56.4	15:35:00	58.0	15:40:00	57.7	15:45:00	57.7	15:50:00	56.7	15:55:00	59.4
1 hour average Leq: 57.5											
16:00:00	58.2	16:05:00	58.7	16:10:00	58.5	16:15:00	64.1	16:20:00	58.6	16:25:00	58.8
16:30:00	69.7	16:35:00	58.8	16:40:00	60.4	16:45:00	60.6	16:50:00	58.9	16:55:00	65.3
1 hour average Leq: 62.8											
17:00:00	58.5	17:05:00	59.5	17:10:00	59.2	17:15:00	63.5	17:20:00	60.7	17:25:00	62.7
17:30:00	59.7	17:35:00	60.8	17:40:00	58.9	17:45:00	59.4	17:50:00	60.5	17:55:00	59.6
1 hour average Leq: 60.5											
18:00:00	60.0	18:05:00	62.5	18:10:00	60.0	18:15:00	59.6	18:20:00	61.6	18:25:00	59.6
18:30:00	61.0	18:35:00	61.7	18:40:00	59.4	18:45:00	59.0	18:50:00	59.4	18:55:00	59.1
1 hour average Leq: 60.4											
12 hour average Leq: 60.3											
Ending date: 26-August-2020											



ACE Wireless

Company Name : EnviroSolutions & Consulting Pte Ltd

Project Name : 1 Mandai Road

Project Duration : 25-August-2020 To 01-September-2020

Device Model : ACE Wireless

Device Serial Number : 034555

Total RunTime : 168:35:00

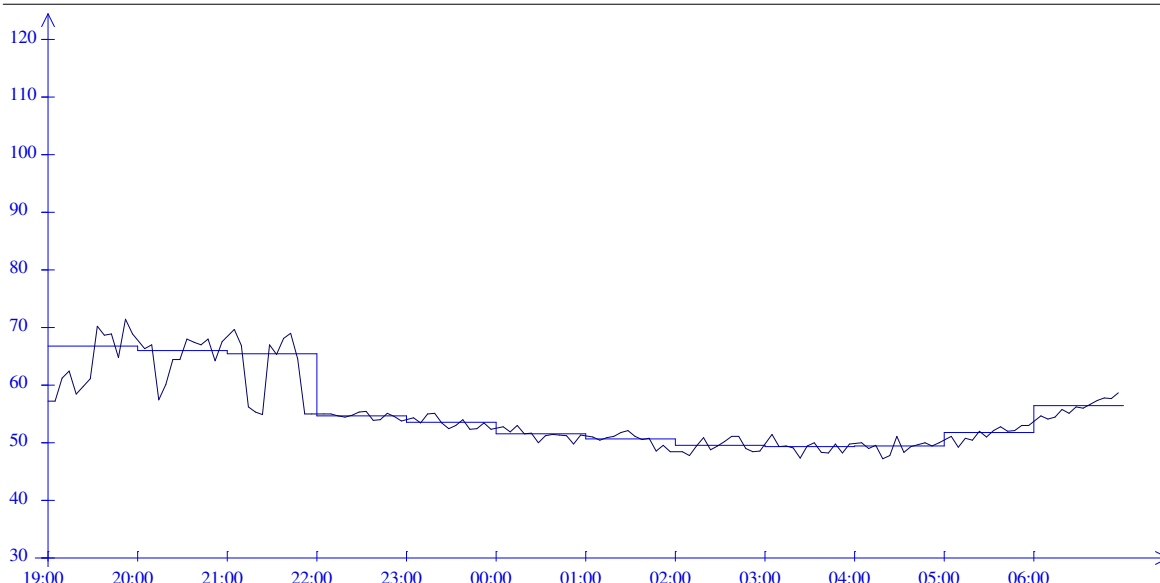
Stop Time: 19:00:00

Data Summary

Max Level 71.4 dB 2020-08-26 @19:50:00

Min Level 47.2 dB 2020-08-27 @04:15:00

Starting Date : 26-August-2020											
Time	Leq	Time	Leq	Time	Leq	Time	Leq	Time	Leq	Time	Leq
19:00:00	57.2	19:05:00	61.2	19:10:00	62.4	19:15:00	58.4	19:20:00	59.7	19:25:00	61.1
19:30:00	70.2	19:35:00	68.6	19:40:00	68.8	19:45:00	64.7	19:50:00	71.4	19:55:00	68.8
1 hour average Leq: 66.7											
20:00:00	66.3	20:05:00	67.0	20:10:00	57.4	20:15:00	60.1	20:20:00	64.4	20:25:00	64.4
20:30:00	68.0	20:35:00	67.4	20:40:00	66.9	20:45:00	68.0	20:50:00	64.2	20:55:00	67.5
1 hour average Leq: 66.0											
21:00:00	69.6	21:05:00	66.8	21:10:00	56.2	21:15:00	55.3	21:20:00	54.8	21:25:00	66.9
21:30:00	65.3	21:35:00	68.1	21:40:00	69.0	21:45:00	64.5	21:50:00	54.9	21:55:00	54.9
1 hour average Leq: 65.3											
22:00:00	54.9	22:05:00	55.0	22:10:00	54.6	22:15:00	54.4	22:20:00	54.7	22:25:00	55.3
22:30:00	55.4	22:35:00	53.8	22:40:00	53.9	22:45:00	55.1	22:50:00	54.5	22:55:00	53.7
1 hour average Leq: 54.6											
23:00:00	54.3	23:05:00	53.4	23:10:00	55.0	23:15:00	55.1	23:20:00	53.4	23:25:00	52.4
23:30:00	53.0	23:35:00	54.0	23:40:00	52.3	23:45:00	52.4	23:50:00	53.4	23:55:00	52.3
1 hour average Leq: 53.5											
00:00:00	52.7	00:05:00	51.8	00:10:00	53.0	00:15:00	51.5	00:20:00	51.6	00:25:00	50.0
00:30:00	51.2	00:35:00	51.4	00:40:00	51.3	00:45:00	51.2	00:50:00	49.7	00:55:00	51.3
1 hour average Leq: 51.5											
01:00:00	50.9	01:05:00	50.4	01:10:00	50.8	01:15:00	51.1	01:20:00	51.7	01:25:00	52.1
01:30:00	51.1	01:35:00	50.5	01:40:00	50.7	01:45:00	48.5	01:50:00	49.5	01:55:00	48.4
1 hour average Leq: 50.6											
02:00:00	48.4	02:05:00	47.7	02:10:00	49.4	02:15:00	50.8	02:20:00	48.7	02:25:00	49.4
02:30:00	50.2	02:35:00	51.1	02:40:00	51.1	02:45:00	48.9	02:50:00	48.4	02:55:00	48.5
1 hour average Leq: 49.5											
03:00:00	51.4	03:05:00	49.3	03:10:00	49.4	03:15:00	49.1	03:20:00	47.3	03:25:00	49.4
03:30:00	50.0	03:35:00	48.3	03:40:00	48.2	03:45:00	49.7	03:50:00	48.2	03:55:00	49.7
1 hour average Leq: 49.3											
04:00:00	49.9	04:05:00	48.9	04:10:00	49.5	04:15:00	47.2	04:20:00	47.7	04:25:00	51.1
04:30:00	48.3	04:35:00	49.3	04:40:00	49.6	04:45:00	50.0	04:50:00	49.4	04:55:00	50.0
1 hour average Leq: 49.4											
05:00:00	51.1	05:05:00	49.2	05:10:00	50.7	05:15:00	50.4	05:20:00	51.9	05:25:00	51.0
05:30:00	52.1	05:35:00	52.7	05:40:00	52.0	05:45:00	52.1	05:50:00	52.9	05:55:00	52.9
1 hour average Leq: 51.7											
06:00:00	54.6	06:05:00	54.1	06:10:00	54.4	06:15:00	55.7	06:20:00	55.1	06:25:00	56.2
06:30:00	56.0	06:35:00	56.6	06:40:00	57.3	06:45:00	57.7	06:50:00	57.6	06:55:00	58.6
1 hour average Leq: 56.4											
12 hour average Leq: 60.6											
Ending date: 27-August-2020											



Company Name : EnviroSolutions & Consulting Pte Ltd

Project Name : 1 Mandai Road

Project Duration : 25-August-2020 To 01-September-2020

Device Model : ACE Wireless

Device Serial Number : 034555

Total RunTime : 168:35:00

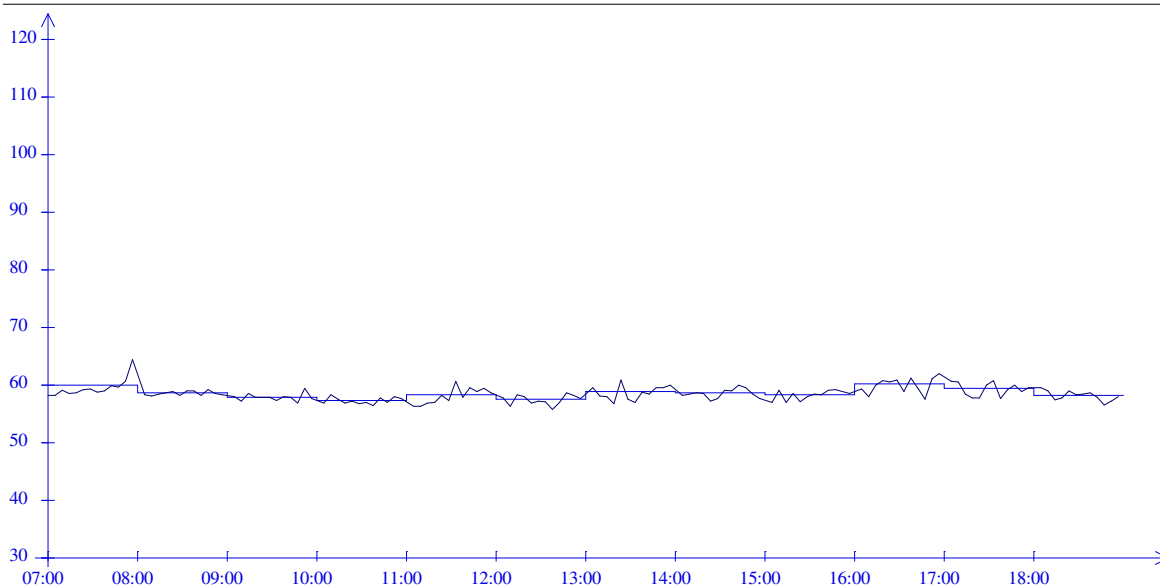
Stop Time: 19:00:00

Data Summary

Max Level 64.4 dB 2020-08-27 @07:55:00

Min Level 55.7 dB 2020-08-27 @12:35:00

Starting Date : 27-August-2020											
Time	Leq	Time	Leq	Time	Leq	Time	Leq	Time	Leq	Time	Leq
07:00:00	58.2	07:05:00	59.1	07:10:00	58.5	07:15:00	58.6	07:20:00	59.2	07:25:00	59.3
07:30:00	58.7	07:35:00	59.0	07:40:00	59.8	07:45:00	59.6	07:50:00	60.6	07:55:00	64.4
1 hour average Leq: 60.0											
08:00:00	58.3	08:05:00	58.1	08:10:00	58.4	08:15:00	58.6	08:20:00	58.8	08:25:00	58.2
08:30:00	59.0	08:35:00	59.0	08:40:00	58.2	08:45:00	59.2	08:50:00	58.5	08:55:00	58.3
1 hour average Leq: 58.6											
09:00:00	58.0	09:05:00	57.2	09:10:00	58.5	09:15:00	57.8	09:20:00	57.8	09:25:00	57.8
09:30:00	57.3	09:35:00	57.9	09:40:00	57.8	09:45:00	56.8	09:50:00	59.4	09:55:00	57.6
1 hour average Leq: 57.9											
10:00:00	56.8	10:05:00	58.3	10:10:00	57.5	10:15:00	56.8	10:20:00	57.2	10:25:00	56.7
10:30:00	56.9	10:35:00	56.4	10:40:00	57.7	10:45:00	56.9	10:50:00	57.9	10:55:00	57.6
1 hour average Leq: 57.3											
11:00:00	56.3	11:05:00	56.3	11:10:00	56.8	11:15:00	56.9	11:20:00	58.2	11:25:00	57.3
11:30:00	60.6	11:35:00	57.8	11:40:00	59.5	11:45:00	58.8	11:50:00	59.4	11:55:00	58.6
1 hour average Leq: 58.2											
12:00:00	57.7	12:05:00	56.3	12:10:00	58.3	12:15:00	58.0	12:20:00	56.8	12:25:00	57.2
12:30:00	57.1	12:35:00	55.7	12:40:00	57.0	12:45:00	58.6	12:50:00	58.2	12:55:00	57.6
1 hour average Leq: 57.5											
13:00:00	59.5	13:05:00	58.1	13:10:00	58.0	13:15:00	56.7	13:20:00	60.8	13:25:00	57.5
13:30:00	57.0	13:35:00	58.7	13:40:00	58.4	13:45:00	59.5	13:50:00	59.5	13:55:00	59.9
1 hour average Leq: 58.8											
14:00:00	58.2	14:05:00	58.4	14:10:00	58.6	14:15:00	58.5	14:20:00	57.2	14:25:00	57.6
14:30:00	59.1	14:35:00	58.9	14:40:00	60.0	14:45:00	59.5	14:50:00	58.4	14:55:00	57.6
1 hour average Leq: 58.6											
15:00:00	56.9	15:05:00	59.1	15:10:00	56.9	15:15:00	58.5	15:20:00	57.1	15:25:00	58.0
15:30:00	58.4	15:35:00	58.3	15:40:00	59.1	15:45:00	59.2	15:50:00	58.8	15:55:00	58.5
1 hour average Leq: 58.3											
16:00:00	59.3	16:05:00	58.0	16:10:00	60.0	16:15:00	60.7	16:20:00	60.5	16:25:00	60.8
16:30:00	58.8	16:35:00	61.2	16:40:00	59.4	16:45:00	57.5	16:50:00	61.1	16:55:00	62.0
1 hour average Leq: 60.1											
17:00:00	60.6	17:05:00	60.5	17:10:00	58.4	17:15:00	57.7	17:20:00	57.7	17:25:00	59.9
17:30:00	60.7	17:35:00	57.6	17:40:00	59.2	17:45:00	59.9	17:50:00	58.8	17:55:00	59.5
1 hour average Leq: 59.3											
18:00:00	59.5	18:05:00	58.9	18:10:00	57.4	18:15:00	57.7	18:20:00	58.9	18:25:00	58.3
18:30:00	58.4	18:35:00	58.6	18:40:00	57.8	18:45:00	56.5	18:50:00	57.2	18:55:00	57.9
1 hour average Leq: 58.2											
12 hour average Leq: 58.6											
Ending date: 27-August-2020											



ACE Wireless

Company Name : EnviroSolutions & Consulting Pte Ltd

Project Name : 1 Mandai Road

Project Duration : 25-August-2020 To 01-September-2020

Device Model : ACE Wireless

Device Serial Number : 034555

Total RunTime : 168:35:00

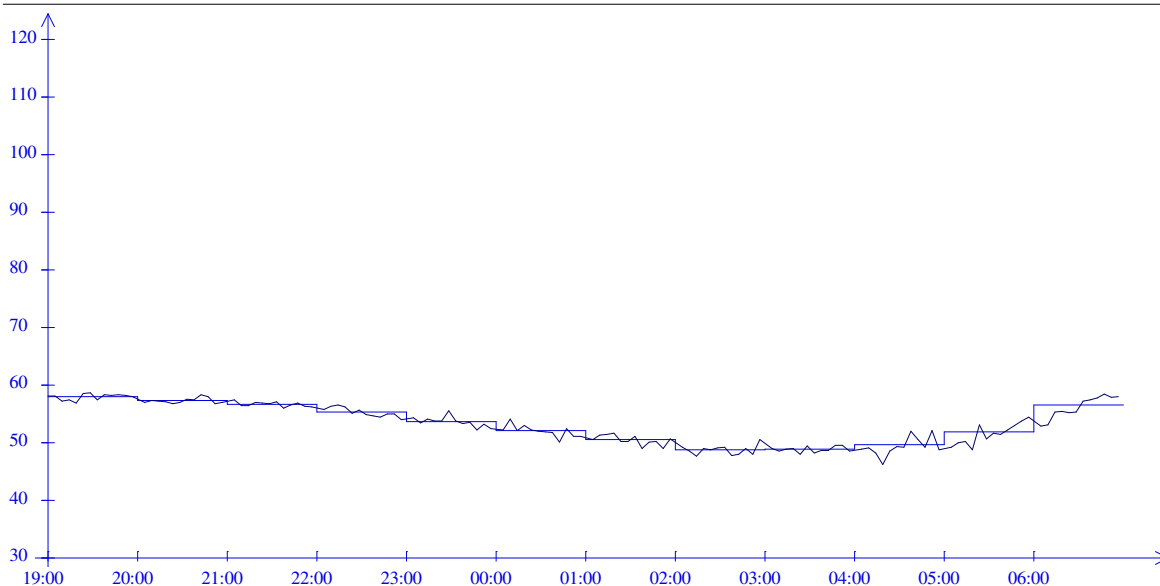
Stop Time: 19:00:00

Data Summary

Max Level 58.6 dB 2020-08-27 @19:25:00

Min Level 46.2 dB 2020-08-28 @04:15:00

Starting Date : 27-August-2020											
Time	Leq	Time	Leq	Time	Leq	Time	Leq	Time	Leq	Time	Leq
19:00:00	58.1	19:05:00	57.2	19:10:00	57.4	19:15:00	56.8	19:20:00	58.5	19:25:00	58.6
19:30:00	57.4	19:35:00	58.3	19:40:00	58.2	19:45:00	58.3	19:50:00	58.2	19:55:00	57.9
1 hour average Leq: 57.9											
20:00:00	57.0	20:05:00	57.3	20:10:00	57.2	20:15:00	57.1	20:20:00	56.7	20:25:00	56.9
20:30:00	57.5	20:35:00	57.4	20:40:00	58.3	20:45:00	57.9	20:50:00	56.7	20:55:00	56.9
1 hour average Leq: 57.3											
21:00:00	57.4	21:05:00	56.4	21:10:00	56.4	21:15:00	57.0	21:20:00	56.8	21:25:00	56.7
21:30:00	57.1	21:35:00	56.0	21:40:00	56.5	21:45:00	56.8	21:50:00	56.3	21:55:00	56.2
1 hour average Leq: 56.7											
22:00:00	55.7	22:05:00	56.3	22:10:00	56.5	22:15:00	56.2	22:20:00	55.1	22:25:00	55.6
22:30:00	54.8	22:35:00	54.6	22:40:00	54.4	22:45:00	55.0	22:50:00	54.9	22:55:00	54.0
1 hour average Leq: 55.3											
23:00:00	54.3	23:05:00	53.4	23:10:00	54.1	23:15:00	53.7	23:20:00	53.7	23:25:00	55.5
23:30:00	53.7	23:35:00	53.3	23:40:00	53.5	23:45:00	52.2	23:50:00	53.2	23:55:00	52.4
1 hour average Leq: 53.7											
00:00:00	52.2	00:05:00	54.1	00:10:00	52.1	00:15:00	52.9	00:20:00	52.2	00:25:00	52.0
00:30:00	51.8	00:35:00	51.7	00:40:00	50.1	00:45:00	52.4	00:50:00	51.1	00:55:00	51.1
1 hour average Leq: 52.1											
01:00:00	50.5	01:05:00	51.3	01:10:00	51.4	01:15:00	51.6	01:20:00	50.2	01:25:00	50.2
01:30:00	51.1	01:35:00	49.0	01:40:00	50.1	01:45:00	50.2	01:50:00	48.9	01:55:00	50.6
1 hour average Leq: 50.5											
02:00:00	49.2	02:05:00	48.5	02:10:00	47.6	02:15:00	49.0	02:20:00	48.7	02:25:00	49.1
02:30:00	49.2	02:35:00	47.7	02:40:00	47.9	02:45:00	48.9	02:50:00	47.9	02:55:00	50.5
1 hour average Leq: 48.8											
03:00:00	49.0	03:05:00	48.5	03:10:00	48.8	03:15:00	48.9	03:20:00	48.0	03:25:00	49.4
03:30:00	48.2	03:35:00	48.6	03:40:00	48.6	03:45:00	49.5	03:50:00	49.5	03:55:00	48.5
1 hour average Leq: 48.8											
04:00:00	48.8	04:05:00	49.1	04:10:00	48.2	04:15:00	46.2	04:20:00	48.5	04:25:00	49.3
04:30:00	49.2	04:35:00	51.9	04:40:00	50.5	04:45:00	49.2	04:50:00	52.1	04:55:00	48.7
1 hour average Leq: 49.6											
05:00:00	49.2	05:05:00	49.9	05:10:00	50.2	05:15:00	48.7	05:20:00	53.1	05:25:00	50.6
05:30:00	51.6	05:35:00	51.4	05:40:00	52.2	05:45:00	52.9	05:50:00	53.7	05:55:00	54.4
1 hour average Leq: 51.8											
06:00:00	52.8	06:05:00	53.1	06:10:00	55.3	06:15:00	55.4	06:20:00	55.2	06:25:00	55.3
06:30:00	57.2	06:35:00	57.4	06:40:00	57.7	06:45:00	58.4	06:50:00	57.8	06:55:00	58.0
1 hour average Leq: 56.5											
12 hour average Leq: 54.4											
Ending date: 28-August-2020											



ACE Wireless

Company Name : EnviroSolutions & Consulting Pte Ltd

Project Name : 1 Mandai Road

Project Duration : 25-August-2020 To 01-September-2020

Device Model : ACE Wireless

Device Serial Number : 034555

Total RunTime : 168:35:00

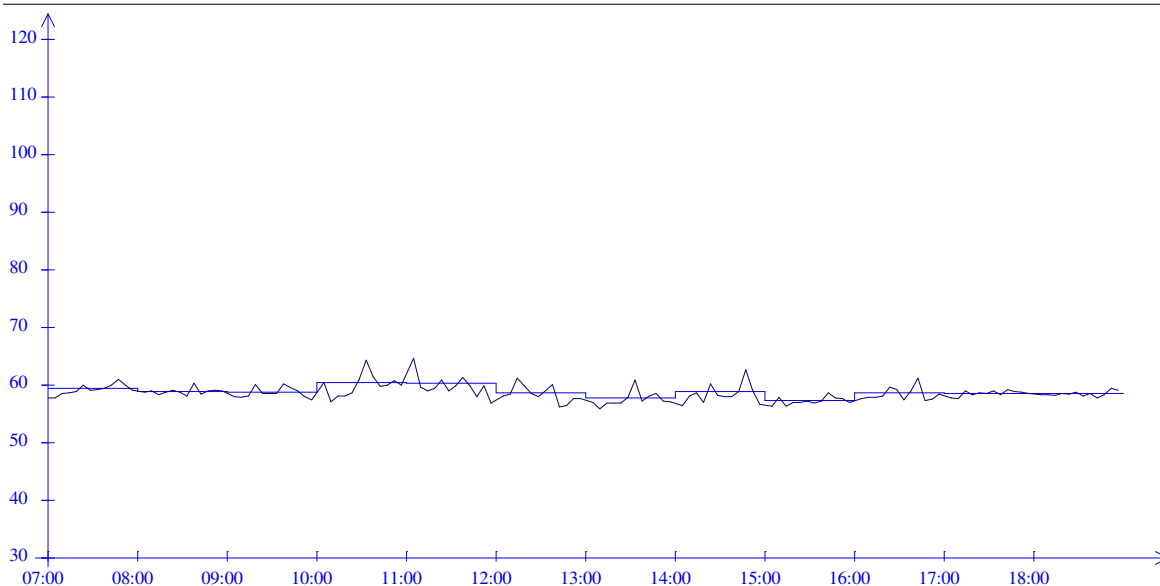
Stop Time: 19:00:00

Data Summary

Max Level 64.6 dB 2020-08-28 @11:00:00

Min Level 55.8 dB 2020-08-28 @13:05:00

Starting Date : 28-August-2020											
Time	Leq	Time	Leq	Time	Leq	Time	Leq	Time	Leq	Time	Leq
07:00:00	57.7	07:05:00	58.5	07:10:00	58.6	07:15:00	58.8	07:20:00	59.9	07:25:00	59.1
07:30:00	59.2	07:35:00	59.4	07:40:00	60.0	07:45:00	60.9	07:50:00	59.9	07:55:00	59.1
1 hour average Leq: 59.3											
08:00:00	58.7	08:05:00	58.9	08:10:00	58.3	08:15:00	58.7	08:20:00	59.1	08:25:00	58.7
08:30:00	58.1	08:35:00	60.3	08:40:00	58.4	08:45:00	58.9	08:50:00	59.1	08:55:00	59.0
1 hour average Leq: 58.9											
09:00:00	58.0	09:05:00	57.8	09:10:00	58.1	09:15:00	60.1	09:20:00	58.5	09:25:00	58.5
09:30:00	58.5	09:35:00	60.2	09:40:00	59.5	09:45:00	58.9	09:50:00	58.0	09:55:00	57.4
1 hour average Leq: 58.7											
10:00:00	60.4	10:05:00	57.1	10:10:00	58.1	10:15:00	58.1	10:20:00	58.6	10:25:00	61.0
10:30:00	64.3	10:35:00	61.4	10:40:00	59.7	10:45:00	60.0	10:50:00	60.7	10:55:00	60.0
1 hour average Leq: 60.4											
11:00:00	64.6	11:05:00	59.6	11:10:00	59.0	11:15:00	59.4	11:20:00	60.8	11:25:00	59.0
11:30:00	59.8	11:35:00	61.3	11:40:00	59.8	11:45:00	57.9	11:50:00	59.8	11:55:00	56.8
1 hour average Leq: 60.3											
12:00:00	58.1	12:05:00	58.4	12:10:00	61.2	12:15:00	59.8	12:20:00	58.5	12:25:00	57.9
12:30:00	58.9	12:35:00	60.1	12:40:00	56.2	12:45:00	56.4	12:50:00	57.6	12:55:00	57.6
1 hour average Leq: 58.6											
13:00:00	56.9	13:05:00	55.8	13:10:00	56.8	13:15:00	56.8	13:20:00	56.8	13:25:00	57.8
13:30:00	60.8	13:35:00	57.2	13:40:00	58.1	13:45:00	58.5	13:50:00	57.2	13:55:00	57.1
1 hour average Leq: 57.7											
14:00:00	56.4	14:05:00	58.1	14:10:00	58.6	14:15:00	56.9	14:20:00	60.2	14:25:00	58.2
14:30:00	57.9	14:35:00	57.9	14:40:00	58.8	14:45:00	62.6	14:50:00	59.0	14:55:00	56.6
1 hour average Leq: 58.8											
15:00:00	56.3	15:05:00	57.8	15:10:00	56.3	15:15:00	57.0	15:20:00	56.9	15:25:00	57.2
15:30:00	56.8	15:35:00	57.2	15:40:00	58.6	15:45:00	57.7	15:50:00	57.6	15:55:00	57.0
1 hour average Leq: 57.2											
16:00:00	57.6	16:05:00	57.8	16:10:00	57.8	16:15:00	58.1	16:20:00	59.6	16:25:00	59.2
16:30:00	57.4	16:35:00	59.0	16:40:00	61.2	16:45:00	57.3	16:50:00	57.5	16:55:00	58.4
1 hour average Leq: 58.6											
17:00:00	57.7	17:05:00	57.6	17:10:00	59.0	17:15:00	58.3	17:20:00	58.6	17:25:00	58.5
17:30:00	58.9	17:35:00	58.3	17:40:00	59.2	17:45:00	58.8	17:50:00	58.7	17:55:00	58.5
1 hour average Leq: 58.5											
18:00:00	58.3	18:05:00	58.3	18:10:00	58.2	18:15:00	58.5	18:20:00	58.4	18:25:00	58.7
18:30:00	58.1	18:35:00	58.5	18:40:00	57.7	18:45:00	58.3	18:50:00	59.4	18:55:00	59.1
1 hour average Leq: 58.5											
12 hour average Leq: 58.9											
Ending date: 28-August-2020											



ACE Wireless

Company Name : EnviroSolutions & Consulting Pte Ltd

Project Name : 1 Mandai Road

Project Duration : 25-August-2020 To 01-September-2020

Device Model : ACE Wireless

Device Serial Number : 034555

Total RunTime : 168:35:00

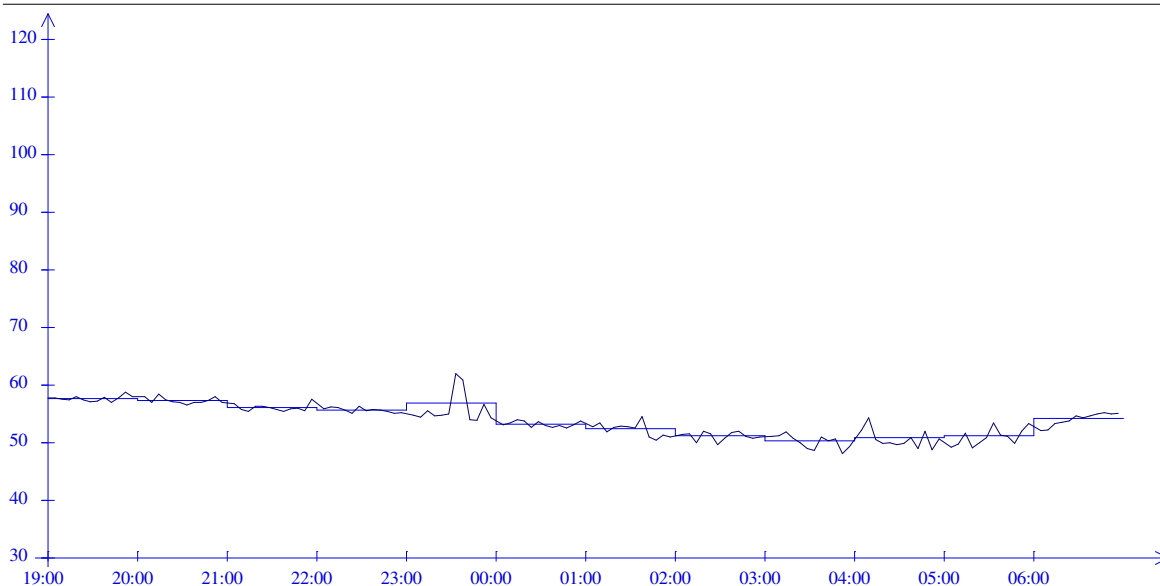
Stop Time: 19:00:00

Data Summary

Max Level 62.0 dB 2020-08-28 @23:30:00

Min Level 48.1 dB 2020-08-29 @03:50:00

Starting Date : 28-August-2020											
Time	Leq	Time	Leq	Time	Leq	Time	Leq	Time	Leq	Time	Leq
19:00:00	57.7	19:05:00	57.5	19:10:00	57.4	19:15:00	58.0	19:20:00	57.4	19:25:00	57.1
19:30:00	57.2	19:35:00	57.8	19:40:00	57.0	19:45:00	57.7	19:50:00	58.7	19:55:00	57.9
1 hour average Leq: 57.6											
20:00:00	57.9	20:05:00	57.0	20:10:00	58.4	20:15:00	57.4	20:20:00	57.1	20:25:00	56.9
20:30:00	56.5	20:35:00	57.0	20:40:00	57.0	20:45:00	57.3	20:50:00	58.0	20:55:00	56.9
1 hour average Leq: 57.3											
21:00:00	56.7	21:05:00	55.7	21:10:00	55.4	21:15:00	56.3	21:20:00	56.3	21:25:00	56.1
21:30:00	55.7	21:35:00	55.4	21:40:00	55.8	21:45:00	55.9	21:50:00	55.5	21:55:00	57.5
1 hour average Leq: 56.1											
22:00:00	55.8	22:05:00	56.2	22:10:00	56.1	22:15:00	55.6	22:20:00	55.1	22:25:00	56.3
22:30:00	55.5	22:35:00	55.7	22:40:00	55.6	22:45:00	55.4	22:50:00	55.1	22:55:00	55.2
1 hour average Leq: 55.7											
23:00:00	54.7	23:05:00	54.4	23:10:00	55.5	23:15:00	54.6	23:20:00	54.7	23:25:00	54.9
23:30:00	62.0	23:35:00	60.8	23:40:00	54.0	23:45:00	53.8	23:50:00	56.6	23:55:00	54.3
1 hour average Leq: 56.9											
00:00:00	53.1	00:05:00	53.4	00:10:00	54.0	00:15:00	53.7	00:20:00	52.6	00:25:00	53.6
00:30:00	52.9	00:35:00	52.6	00:40:00	52.9	00:45:00	52.5	00:50:00	53.1	00:55:00	53.7
1 hour average Leq: 53.2											
01:00:00	52.7	01:05:00	53.4	01:10:00	51.8	01:15:00	52.6	01:20:00	52.8	01:25:00	52.7
01:30:00	52.5	01:35:00	54.5	01:40:00	51.0	01:45:00	50.4	01:50:00	51.3	01:55:00	51.0
1 hour average Leq: 52.4											
02:00:00	51.4	02:05:00	51.5	02:10:00	49.9	02:15:00	51.9	02:20:00	51.5	02:25:00	49.6
02:30:00	50.7	02:35:00	51.7	02:40:00	51.9	02:45:00	51.1	02:50:00	50.7	02:55:00	51.0
1 hour average Leq: 51.1											
03:00:00	51.1	03:05:00	51.2	03:10:00	51.8	03:15:00	50.7	03:20:00	49.9	03:25:00	49.0
03:30:00	48.6	03:35:00	51.0	03:40:00	50.3	03:45:00	50.6	03:50:00	48.1	03:55:00	49.3
1 hour average Leq: 50.3											
04:00:00	52.2	04:05:00	54.3	04:10:00	50.5	04:15:00	49.8	04:20:00	49.9	04:25:00	49.6
04:30:00	49.8	04:35:00	50.8	04:40:00	49.0	04:45:00	51.9	04:50:00	48.7	04:55:00	50.6
1 hour average Leq: 50.9											
05:00:00	49.2	05:05:00	49.7	05:10:00	51.6	05:15:00	49.1	05:20:00	49.9	05:25:00	50.8
05:30:00	53.4	05:35:00	51.3	05:40:00	51.1	05:45:00	49.8	05:50:00	51.9	05:55:00	53.3
1 hour average Leq: 51.2											
06:00:00	52.1	06:05:00	52.2	06:10:00	53.3	06:15:00	53.5	06:20:00	53.7	06:25:00	54.6
06:30:00	54.3	06:35:00	54.6	06:40:00	54.9	06:45:00	55.2	06:50:00	55.0	06:55:00	55.1
1 hour average Leq: 54.2											
12 hour average Leq: 54.7											
Ending date: 29-August-2020											



ACE Wireless

Company Name : EnviroSolutions & Consulting Pte Ltd

Project Name : 1 Mandai Road

Project Duration : 25-August-2020 To 01-September-2020

Device Model : ACE Wireless

Device Serial Number : 034555

Total RunTime : 168:35:00

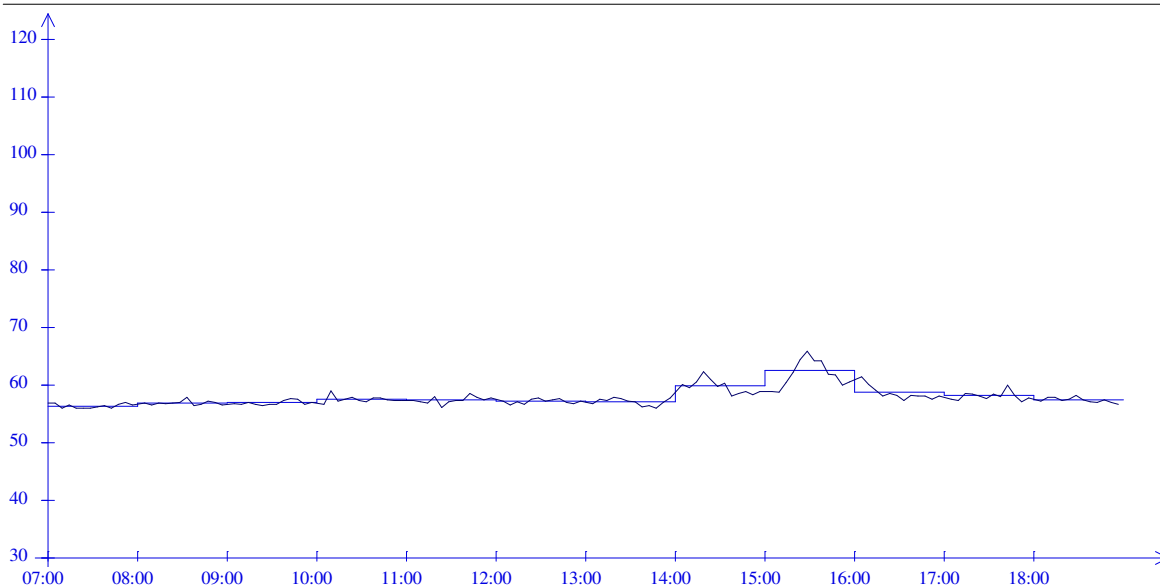
Stop Time: 19:00:00

Data Summary

Max Level 65.8 dB 2020-08-29 @15:25:00

Min Level 55.9 dB 2020-08-29 @07:20:00

Starting Date : 29-August-2020											
Time	Leq	Time	Leq	Time	Leq	Time	Leq	Time	Leq	Time	Leq
07:00:00	56.8	07:05:00	56.0	07:10:00	56.5	07:15:00	56.0	07:20:00	55.9	07:25:00	55.9
07:30:00	56.2	07:35:00	56.4	07:40:00	56.0	07:45:00	56.6	07:50:00	57.0	07:55:00	56.5
1 hour average Leq: 56.3											
08:00:00	56.8	08:05:00	56.5	08:10:00	56.8	08:15:00	56.7	08:20:00	56.8	08:25:00	57.0
08:30:00	57.8	08:35:00	56.4	08:40:00	56.6	08:45:00	57.2	08:50:00	56.9	08:55:00	56.5
1 hour average Leq: 56.8											
09:00:00	56.7	09:05:00	56.6	09:10:00	57.0	09:15:00	56.6	09:20:00	56.4	09:25:00	56.6
09:30:00	56.6	09:35:00	57.3	09:40:00	57.6	09:45:00	57.5	09:50:00	56.6	09:55:00	57.0
1 hour average Leq: 56.9											
10:00:00	56.6	10:05:00	58.9	10:10:00	57.2	10:15:00	57.5	10:20:00	57.8	10:25:00	57.3
10:30:00	57.1	10:35:00	57.7	10:40:00	57.7	10:45:00	57.4	10:50:00	57.3	10:55:00	57.3
1 hour average Leq: 57.5											
11:00:00	57.3	11:05:00	57.1	11:10:00	56.8	11:15:00	58.0	11:20:00	56.1	11:25:00	57.1
11:30:00	57.3	11:35:00	57.3	11:40:00	58.5	11:45:00	57.8	11:50:00	57.4	11:55:00	57.7
1 hour average Leq: 57.4											
12:00:00	57.2	12:05:00	56.5	12:10:00	57.1	12:15:00	56.6	12:20:00	57.5	12:25:00	57.7
12:30:00	57.2	12:35:00	57.4	12:40:00	57.6	12:45:00	56.9	12:50:00	56.7	12:55:00	57.2
1 hour average Leq: 57.1											
13:00:00	56.7	13:05:00	57.5	13:10:00	57.3	13:15:00	57.8	13:20:00	57.6	13:25:00	57.2
13:30:00	57.1	13:35:00	56.2	13:40:00	56.4	13:45:00	56.0	13:50:00	57.0	13:55:00	57.7
1 hour average Leq: 57.1											
14:00:00	60.1	14:05:00	59.5	14:10:00	60.5	14:15:00	62.3	14:20:00	61.0	14:25:00	59.7
14:30:00	60.3	14:35:00	58.1	14:40:00	58.5	14:45:00	58.8	14:50:00	58.3	14:55:00	58.8
1 hour average Leq: 59.8											
15:00:00	58.8	15:05:00	58.7	15:10:00	60.4	15:15:00	62.2	15:20:00	64.4	15:25:00	65.8
15:30:00	64.2	15:35:00	64.2	15:40:00	61.8	15:45:00	61.7	15:50:00	60.0	15:55:00	60.5
1 hour average Leq: 62.5											
16:00:00	61.4	16:05:00	60.1	16:10:00	59.1	16:15:00	58.1	16:20:00	58.5	16:25:00	58.2
16:30:00	57.3	16:35:00	58.2	16:40:00	58.1	16:45:00	58.1	16:50:00	57.5	16:55:00	58.1
1 hour average Leq: 58.7											
17:00:00	57.5	17:05:00	57.3	17:10:00	58.5	17:15:00	58.4	17:20:00	58.1	17:25:00	57.6
17:30:00	58.4	17:35:00	58.0	17:40:00	59.9	17:45:00	58.2	17:50:00	57.1	17:55:00	57.7
1 hour average Leq: 58.1											
18:00:00	57.2	18:05:00	57.8	18:10:00	57.8	18:15:00	57.3	18:20:00	57.5	18:25:00	58.2
18:30:00	57.4	18:35:00	57.1	18:40:00	57.0	18:45:00	57.4	18:50:00	56.9	18:55:00	56.6
1 hour average Leq: 57.4											
12 hour average Leq: 58.4											
Ending date: 29-August-2020											



ACE Wireless

Company Name : EnviroSolutions & Consulting Pte Ltd

Project Name : 1 Mandai Road

Project Duration : 25-August-2020 To 01-September-2020

Device Model : ACE Wireless

Device Serial Number : 034555

Total RunTime : 168:35:00

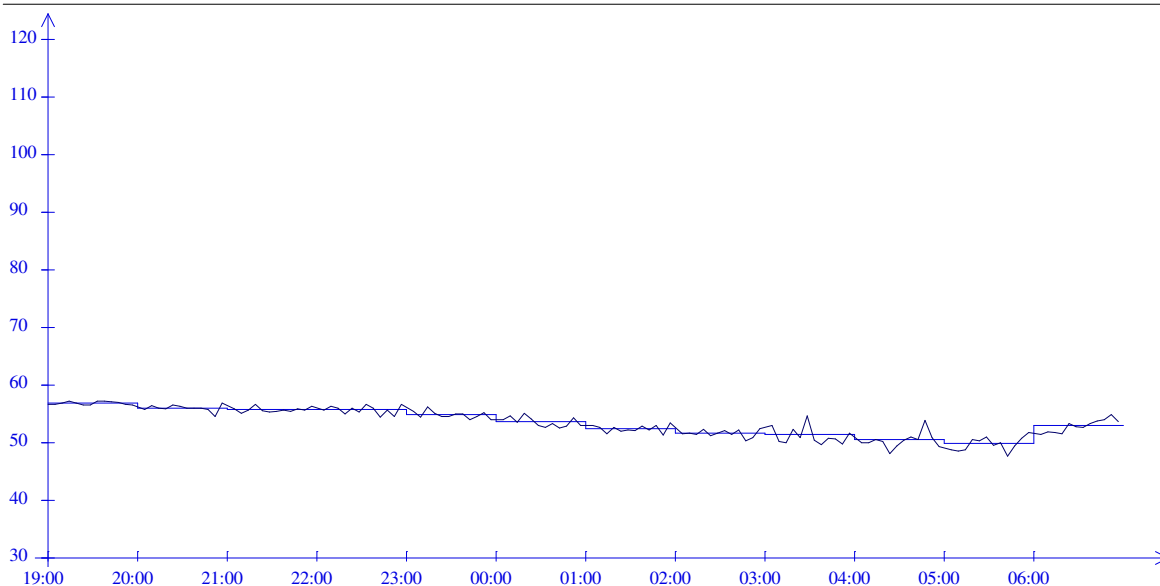
Stop Time: 19:00:00

Data Summary

Max Level 57.2 dB 2020-08-29 @19:10:00

Min Level 47.6 dB 2020-08-30 @05:40:00

Starting Date : 29-August-2020											
Time	Leq	Time	Leq	Time	Leq	Time	Leq	Time	Leq	Time	Leq
19:00:00	56.6	19:05:00	56.8	19:10:00	57.2	19:15:00	56.8	19:20:00	56.5	19:25:00	56.5
19:30:00	57.2	19:35:00	57.2	19:40:00	57.1	19:45:00	56.9	19:50:00	56.6	19:55:00	56.5
1 hour average Leq: 56.8											
20:00:00	55.7	20:05:00	56.4	20:10:00	55.9	20:15:00	55.8	20:20:00	56.5	20:25:00	56.3
20:30:00	56.0	20:35:00	55.9	20:40:00	56.0	20:45:00	55.7	20:50:00	54.5	20:55:00	56.8
1 hour average Leq: 56.0											
21:00:00	55.8	21:05:00	55.1	21:10:00	55.6	21:15:00	56.6	21:20:00	55.5	21:25:00	55.3
21:30:00	55.4	21:35:00	55.6	21:40:00	55.4	21:45:00	55.8	21:50:00	55.6	21:55:00	56.3
1 hour average Leq: 55.7											
22:00:00	55.6	22:05:00	56.3	22:10:00	56.0	22:15:00	55.0	22:20:00	56.0	22:25:00	55.3
22:30:00	56.6	22:35:00	56.0	22:40:00	54.4	22:45:00	55.6	22:50:00	54.5	22:55:00	56.6
1 hour average Leq: 55.7											
23:00:00	55.4	23:05:00	54.4	23:10:00	56.2	23:15:00	55.1	23:20:00	54.5	23:25:00	54.5
23:30:00	54.9	23:35:00	55.0	23:40:00	54.0	23:45:00	54.5	23:50:00	55.2	23:55:00	53.9
1 hour average Leq: 54.8											
00:00:00	53.9	00:05:00	54.6	00:10:00	53.5	00:15:00	55.1	00:20:00	54.1	00:25:00	53.0
00:30:00	52.6	00:35:00	53.3	00:40:00	52.5	00:45:00	52.8	00:50:00	54.3	00:55:00	53.0
1 hour average Leq: 53.6											
01:00:00	53.0	01:05:00	52.6	01:10:00	51.5	01:15:00	52.6	01:20:00	52.0	01:25:00	52.2
01:30:00	52.1	01:35:00	52.8	01:40:00	52.2	01:45:00	53.0	01:50:00	51.3	01:55:00	53.4
1 hour average Leq: 52.4											
02:00:00	51.5	02:05:00	51.6	02:10:00	51.4	02:15:00	52.3	02:20:00	51.2	02:25:00	51.6
02:30:00	52.1	02:35:00	51.4	02:40:00	52.2	02:45:00	50.3	02:50:00	50.8	02:55:00	52.4
1 hour average Leq: 51.6											
03:00:00	53.0	03:05:00	50.2	03:10:00	50.0	03:15:00	52.3	03:20:00	50.8	03:25:00	54.6
03:30:00	50.4	03:35:00	49.6	03:40:00	50.7	03:45:00	50.6	03:50:00	49.7	03:55:00	51.6
1 hour average Leq: 51.4											
04:00:00	49.9	04:05:00	49.9	04:10:00	50.5	04:15:00	50.2	04:20:00	48.1	04:25:00	49.4
04:30:00	50.4	04:35:00	51.0	04:40:00	50.5	04:45:00	53.8	04:50:00	50.8	04:55:00	49.3
1 hour average Leq: 50.5											
05:00:00	48.7	05:05:00	48.5	05:10:00	48.7	05:15:00	50.5	05:20:00	50.3	05:25:00	50.9
05:30:00	49.5	05:35:00	49.9	05:40:00	47.6	05:45:00	49.4	05:50:00	50.7	05:55:00	51.7
1 hour average Leq: 49.8											
06:00:00	51.4	06:05:00	51.8	06:10:00	51.7	06:15:00	51.5	06:20:00	53.3	06:25:00	52.7
06:30:00	52.6	06:35:00	53.3	06:40:00	53.7	06:45:00	53.9	06:50:00	54.8	06:55:00	53.6
1 hour average Leq: 53.0											
12 hour average Leq: 54.0											
Ending date: 30-August-2020											



ACE Wireless

Company Name : EnviroSolutions & Consulting Pte Ltd

Project Name : 1 Mandai Road

Project Duration : 25-August-2020 To 01-September-2020

Device Model : ACE Wireless

Device Serial Number : 034555

Total RunTime : 168:35:00

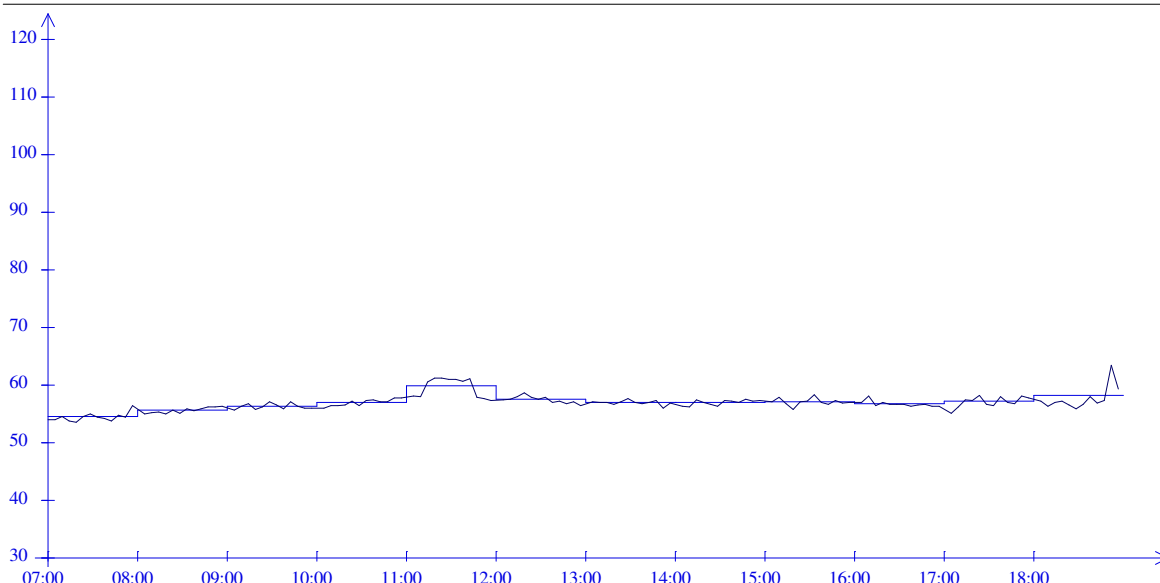
Stop Time: 19:00:00

Data Summary

Max Level 63.4 dB 2020-08-30 @18:50:00

Min Level 53.5 dB 2020-08-30 @07:15:00

Starting Date : 30-August-2020											
Time	Leq	Time	Leq	Time	Leq	Time	Leq	Time	Leq	Time	Leq
07:00:00	53.9	07:05:00	54.5	07:10:00	53.7	07:15:00	53.5	07:20:00	54.5	07:25:00	55.0
07:30:00	54.4	07:35:00	54.2	07:40:00	53.7	07:45:00	54.7	07:50:00	54.4	07:55:00	56.4
1 hour average Leq: 54.5											
08:00:00	54.9	08:05:00	55.2	08:10:00	55.3	08:15:00	55.0	08:20:00	55.6	08:25:00	55.1
08:30:00	55.8	08:35:00	55.5	08:40:00	55.8	08:45:00	56.2	08:50:00	56.2	08:55:00	56.3
1 hour average Leq: 55.6											
09:00:00	55.6	09:05:00	56.3	09:10:00	56.7	09:15:00	55.7	09:20:00	56.2	09:25:00	57.1
09:30:00	56.5	09:35:00	55.8	09:40:00	57.1	09:45:00	56.3	09:50:00	55.9	09:55:00	56.0
1 hour average Leq: 56.3											
10:00:00	55.9	10:05:00	56.4	10:10:00	56.4	10:15:00	56.5	10:20:00	57.2	10:25:00	56.4
10:30:00	57.3	10:35:00	57.4	10:40:00	57.1	10:45:00	57.1	10:50:00	57.7	10:55:00	57.7
1 hour average Leq: 57.0											
11:00:00	58.1	11:05:00	58.0	11:10:00	60.5	11:15:00	61.2	11:20:00	61.2	11:25:00	61.0
11:30:00	60.9	11:35:00	60.6	11:40:00	61.1	11:45:00	57.8	11:50:00	57.6	11:55:00	57.3
1 hour average Leq: 59.9											
12:00:00	57.4	12:05:00	57.5	12:10:00	58.0	12:15:00	58.6	12:20:00	57.8	12:25:00	57.5
12:30:00	57.8	12:35:00	57.0	12:40:00	57.2	12:45:00	56.7	12:50:00	57.1	12:55:00	56.4
1 hour average Leq: 57.5											
13:00:00	57.1	13:05:00	56.9	13:10:00	56.9	13:15:00	56.6	13:20:00	57.1	13:25:00	57.6
13:30:00	57.0	13:35:00	56.7	13:40:00	57.0	13:45:00	57.3	13:50:00	55.9	13:55:00	56.8
1 hour average Leq: 56.9											
14:00:00	56.3	14:05:00	56.2	14:10:00	57.4	14:15:00	56.9	14:20:00	56.6	14:25:00	56.3
14:30:00	57.3	14:35:00	57.2	14:40:00	56.9	14:45:00	57.5	14:50:00	57.2	14:55:00	57.3
1 hour average Leq: 56.9											
15:00:00	57.1	15:05:00	57.8	15:10:00	56.7	15:15:00	55.7	15:20:00	57.1	15:25:00	57.2
15:30:00	58.3	15:35:00	56.9	15:40:00	56.6	15:45:00	57.3	15:50:00	56.8	15:55:00	57.0
1 hour average Leq: 57.1											
16:00:00	56.9	16:05:00	58.1	16:10:00	56.4	16:15:00	56.9	16:20:00	56.6	16:25:00	56.6
16:30:00	56.6	16:35:00	56.3	16:40:00	56.5	16:45:00	56.6	16:50:00	56.3	16:55:00	56.3
1 hour average Leq: 56.7											
17:00:00	55.1	17:05:00	56.2	17:10:00	57.4	17:15:00	57.3	17:20:00	58.2	17:25:00	56.6
17:30:00	56.4	17:35:00	58.0	17:40:00	57.0	17:45:00	56.7	17:50:00	58.1	17:55:00	57.7
1 hour average Leq: 57.1											
18:00:00	57.2	18:05:00	56.3	18:10:00	57.0	18:15:00	57.2	18:20:00	56.5	18:25:00	55.8
18:30:00	56.6	18:35:00	58.0	18:40:00	56.8	18:45:00	57.3	18:50:00	63.4	18:55:00	59.3
1 hour average Leq: 58.2											
12 hour average Leq: 57.2											
Ending date: 30-August-2020											



ACE Wireless

Company Name : EnviroSolutions & Consulting Pte Ltd

Project Name : 1 Mandai Road

Project Duration : 25-August-2020 To 01-September-2020

Device Model : ACE Wireless

Device Serial Number : 034555

Total RunTime : 168:35:00

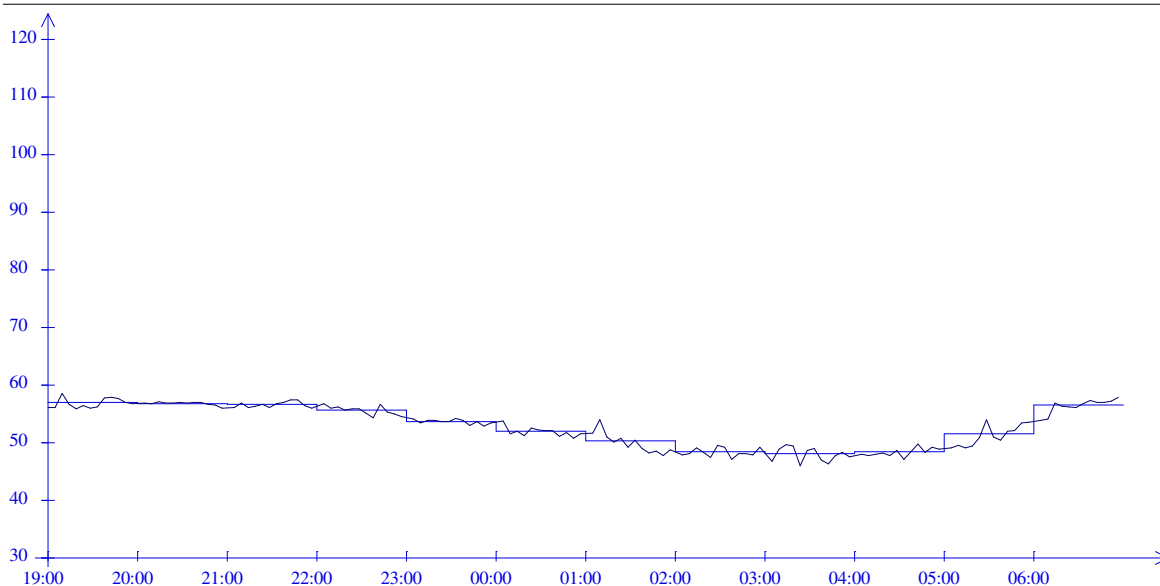
Stop Time: 19:00:00

Data Summary

Max Level 58.5 dB 2020-08-30 @19:05:00

Min Level 46.0 dB 2020-08-31 @03:20:00

Starting Date : 30-August-2020											
Time	Leq	Time	Leq	Time	Leq	Time	Leq	Time	Leq	Time	Leq
19:00:00	56.1	19:05:00	58.5	19:10:00	56.6	19:15:00	55.8	19:20:00	56.4	19:25:00	56.0
19:30:00	56.2	19:35:00	57.7	19:40:00	57.8	19:45:00	57.6	19:50:00	57.0	19:55:00	56.7
1 hour average Leq: 56.9											
20:00:00	56.8	20:05:00	56.7	20:10:00	57.1	20:15:00	56.8	20:20:00	56.8	20:25:00	56.9
20:30:00	56.8	20:35:00	56.9	20:40:00	57.0	20:45:00	56.6	20:50:00	56.5	20:55:00	56.0
1 hour average Leq: 56.7											
21:00:00	56.1	21:05:00	56.8	21:10:00	56.1	21:15:00	56.3	21:20:00	56.6	21:25:00	56.1
21:30:00	56.7	21:35:00	56.9	21:40:00	57.4	21:45:00	57.4	21:50:00	56.4	21:55:00	55.9
1 hour average Leq: 56.6											
22:00:00	56.7	22:05:00	56.0	22:10:00	56.2	22:15:00	55.6	22:20:00	55.8	22:25:00	55.8
22:30:00	55.1	22:35:00	54.3	22:40:00	56.6	22:45:00	55.3	22:50:00	55.0	22:55:00	54.5
1 hour average Leq: 55.6											
23:00:00	54.1	23:05:00	53.4	23:10:00	53.8	23:15:00	53.8	23:20:00	53.6	23:25:00	53.6
23:30:00	54.2	23:35:00	53.8	23:40:00	52.9	23:45:00	53.6	23:50:00	52.8	23:55:00	53.4
1 hour average Leq: 53.6											
00:00:00	53.7	00:05:00	51.5	00:10:00	51.9	00:15:00	51.2	00:20:00	52.5	00:25:00	52.2
00:30:00	52.1	00:35:00	52.1	00:40:00	51.1	00:45:00	51.7	00:50:00	50.7	00:55:00	51.5
1 hour average Leq: 51.9											
01:00:00	51.6	01:05:00	54.0	01:10:00	50.9	01:15:00	50.1	01:20:00	50.7	01:25:00	49.2
01:30:00	50.4	01:35:00	49.0	01:40:00	48.2	01:45:00	48.5	01:50:00	47.7	01:55:00	48.7
1 hour average Leq: 50.3											
02:00:00	47.8	02:05:00	48.1	02:10:00	49.1	02:15:00	48.3	02:20:00	47.4	02:25:00	49.5
02:30:00	49.2	02:35:00	47.1	02:40:00	48.1	02:45:00	48.1	02:50:00	47.8	02:55:00	49.2
1 hour average Leq: 48.4											
03:00:00	46.7	03:05:00	48.8	03:10:00	49.6	03:15:00	49.4	03:20:00	46.0	03:25:00	48.6
03:30:00	48.9	03:35:00	46.9	03:40:00	46.3	03:45:00	47.7	03:50:00	48.3	03:55:00	47.5
1 hour average Leq: 48.0											
04:00:00	48.0	04:05:00	47.7	04:10:00	47.9	04:15:00	48.2	04:20:00	47.7	04:25:00	48.6
04:30:00	47.1	04:35:00	48.4	04:40:00	49.7	04:45:00	48.3	04:50:00	49.2	04:55:00	48.8
1 hour average Leq: 48.4											
05:00:00	49.1	05:05:00	49.5	05:10:00	49.1	05:15:00	49.4	05:20:00	50.8	05:25:00	53.9
05:30:00	50.9	05:35:00	50.4	05:40:00	51.9	05:45:00	52.1	05:50:00	53.4	05:55:00	53.5
1 hour average Leq: 51.5											
06:00:00	53.8	06:05:00	54.1	06:10:00	56.8	06:15:00	56.3	06:20:00	56.2	06:25:00	56.1
06:30:00	56.7	06:35:00	57.3	06:40:00	56.9	06:45:00	56.9	06:50:00	57.2	06:55:00	57.8
1 hour average Leq: 56.5											
12 hour average Leq: 54.1											
Ending date: 31-August-2020											



ACE Wireless

Company Name : EnviroSolutions & Consulting Pte Ltd

Project Name : 1 Mandai Road

Project Duration : 25-August-2020 To 01-September-2020

Device Model : ACE Wireless

Device Serial Number : 034555

Total RunTime : 168:35:00

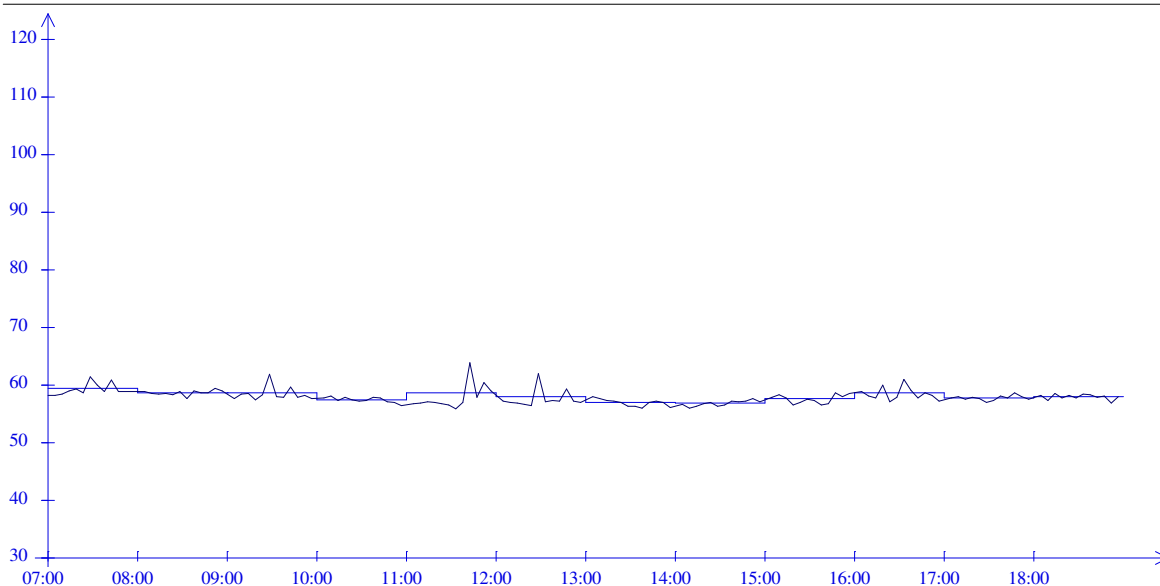
Stop Time: 19:00:00

Data Summary

Max Level 63.8 dB 2020-08-31 @11:40:00

Min Level 55.8 dB 2020-08-31 @11:30:00

Starting Date : 31-August-2020											
Time	Leq	Time	Leq	Time	Leq	Time	Leq	Time	Leq	Time	Leq
07:00:00	58.2	07:05:00	58.4	07:10:00	59.0	07:15:00	59.3	07:20:00	58.6	07:25:00	61.4
07:30:00	59.9	07:35:00	58.8	07:40:00	60.8	07:45:00	58.8	07:50:00	58.8	07:55:00	58.8
1 hour average Leq: 59.3											
08:00:00	58.8	08:05:00	58.5	08:10:00	58.4	08:15:00	58.5	08:20:00	58.3	08:25:00	58.8
08:30:00	57.6	08:35:00	58.9	08:40:00	58.6	08:45:00	58.6	08:50:00	59.4	08:55:00	58.9
1 hour average Leq: 58.6											
09:00:00	57.6	09:05:00	58.4	09:10:00	58.5	09:15:00	57.4	09:20:00	58.3	09:25:00	61.8
09:30:00	58.0	09:35:00	57.8	09:40:00	59.6	09:45:00	57.8	09:50:00	58.2	09:55:00	57.6
1 hour average Leq: 58.6											
10:00:00	57.7	10:05:00	58.1	10:10:00	57.3	10:15:00	57.8	10:20:00	57.4	10:25:00	57.2
10:30:00	57.3	10:35:00	57.8	10:40:00	57.7	10:45:00	57.1	10:50:00	56.9	10:55:00	56.4
1 hour average Leq: 57.4											
11:00:00	56.7	11:05:00	56.8	11:10:00	57.1	11:15:00	57.0	11:20:00	56.7	11:25:00	56.5
11:30:00	55.8	11:35:00	56.9	11:40:00	63.8	11:45:00	57.8	11:50:00	60.4	11:55:00	59.0
1 hour average Leq: 58.6											
12:00:00	57.2	12:05:00	56.9	12:10:00	56.8	12:15:00	56.6	12:20:00	56.4	12:25:00	62.0
12:30:00	57.1	12:35:00	57.3	12:40:00	57.2	12:45:00	59.3	12:50:00	57.2	12:55:00	57.0
1 hour average Leq: 57.9											
13:00:00	58.0	13:05:00	57.6	13:10:00	57.3	13:15:00	57.2	13:20:00	57.0	13:25:00	56.3
13:30:00	56.3	13:35:00	55.9	13:40:00	57.0	13:45:00	57.2	13:50:00	57.0	13:55:00	56.1
1 hour average Leq: 57.0											
14:00:00	56.6	14:05:00	55.9	14:10:00	56.3	14:15:00	56.7	14:20:00	56.9	14:25:00	56.3
14:30:00	56.5	14:35:00	57.2	14:40:00	57.1	14:45:00	57.2	14:50:00	57.6	14:55:00	57.1
1 hour average Leq: 56.8											
15:00:00	57.8	15:05:00	58.3	15:10:00	57.7	15:15:00	56.5	15:20:00	57.0	15:25:00	57.5
15:30:00	57.3	15:35:00	56.5	15:40:00	56.7	15:45:00	58.6	15:50:00	57.9	15:55:00	58.5
1 hour average Leq: 57.6											
16:00:00	58.8	16:05:00	58.1	16:10:00	57.7	16:15:00	60.0	16:20:00	57.1	16:25:00	57.8
16:30:00	61.0	16:35:00	59.1	16:40:00	57.7	16:45:00	58.6	16:50:00	58.2	16:55:00	57.2
1 hour average Leq: 58.6											
17:00:00	57.7	17:05:00	57.9	17:10:00	57.5	17:15:00	57.8	17:20:00	57.6	17:25:00	57.0
17:30:00	57.3	17:35:00	58.1	17:40:00	57.7	17:45:00	58.6	17:50:00	58.0	17:55:00	57.5
1 hour average Leq: 57.7											
18:00:00	58.2	18:05:00	57.3	18:10:00	58.5	18:15:00	57.7	18:20:00	58.2	18:25:00	57.7
18:30:00	58.4	18:35:00	58.3	18:40:00	57.8	18:45:00	58.1	18:50:00	56.8	18:55:00	57.9
1 hour average Leq: 57.9											
12 hour average Leq: 58.1											
Ending date: 31-August-2020											



ACE Wireless

Company Name : EnviroSolutions & Consulting Pte Ltd

Project Name : 1 Mandai Road

Project Duration : 25-August-2020 To 01-September-2020

Device Model : ACE Wireless

Device Serial Number : 034555

Total RunTime : 168:35:00

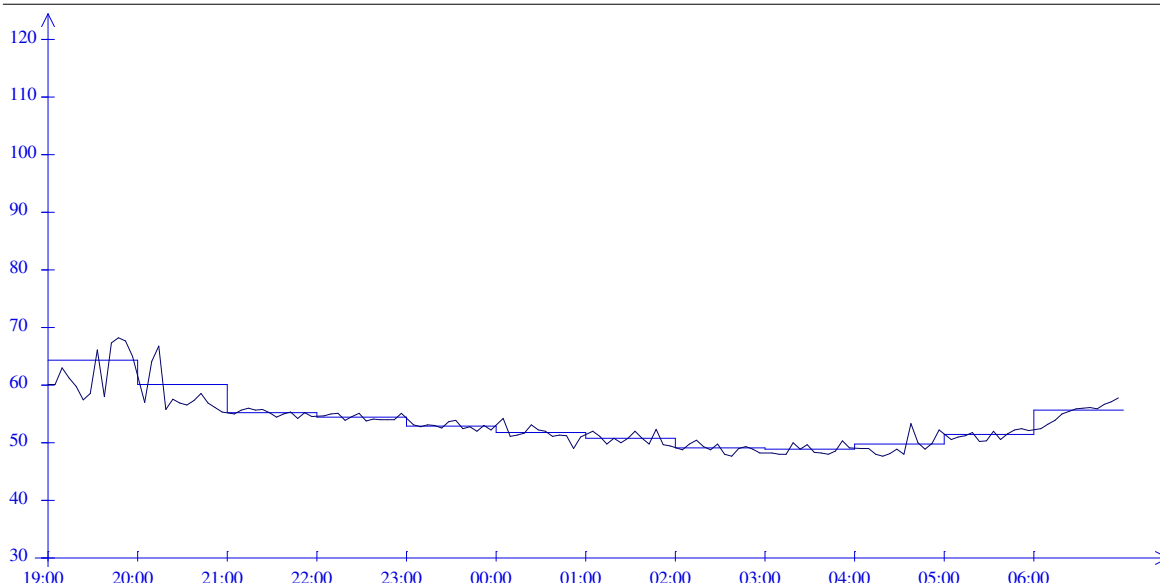
Stop Time: 19:00:00

Data Summary

Max Level 68.2 dB 2020-08-31 @19:45:00

Min Level 47.6 dB 2020-09-01 @02:35:00

Starting Date : 31-August-2020											
Time	Leq	Time	Leq	Time	Leq	Time	Leq	Time	Leq	Time	Leq
19:00:00	60.1	19:05:00	62.9	19:10:00	61.2	19:15:00	59.7	19:20:00	57.4	19:25:00	58.5
19:30:00	66.1	19:35:00	57.9	19:40:00	67.3	19:45:00	68.2	19:50:00	67.6	19:55:00	64.9
1 hour average Leq: 64.3											
20:00:00	56.9	20:05:00	64.1	20:10:00	66.7	20:15:00	55.7	20:20:00	57.5	20:25:00	56.8
20:30:00	56.5	20:35:00	57.3	20:40:00	58.5	20:45:00	56.8	20:50:00	56.1	20:55:00	55.3
1 hour average Leq: 60.0											
21:00:00	55.0	21:05:00	55.6	21:10:00	56.0	21:15:00	55.6	21:20:00	55.7	21:25:00	55.2
21:30:00	54.4	21:35:00	54.9	21:40:00	55.3	21:45:00	54.2	21:50:00	55.2	21:55:00	54.5
1 hour average Leq: 55.2											
22:00:00	54.6	22:05:00	55.0	22:10:00	55.1	22:15:00	53.8	22:20:00	54.5	22:25:00	55.1
22:30:00	53.7	22:35:00	54.1	22:40:00	53.9	22:45:00	54.0	22:50:00	53.9	22:55:00	55.1
1 hour average Leq: 54.4											
23:00:00	53.1	23:05:00	52.7	23:10:00	53.1	23:15:00	52.9	23:20:00	52.5	23:25:00	53.6
23:30:00	53.8	23:35:00	52.4	23:40:00	52.7	23:45:00	52.0	23:50:00	52.9	23:55:00	52.2
1 hour average Leq: 52.9											
00:00:00	54.2	00:05:00	51.1	00:10:00	51.3	00:15:00	51.6	00:20:00	53.1	00:25:00	52.2
00:30:00	51.9	00:35:00	51.1	00:40:00	51.3	00:45:00	51.2	00:50:00	49.0	00:55:00	51.0
1 hour average Leq: 51.8											
01:00:00	51.9	01:05:00	51.1	01:10:00	49.7	01:15:00	50.7	01:20:00	50.0	01:25:00	50.7
01:30:00	51.9	01:35:00	50.7	01:40:00	49.7	01:45:00	52.3	01:50:00	49.6	01:55:00	49.4
1 hour average Leq: 50.7											
02:00:00	48.7	02:05:00	49.7	02:10:00	50.4	02:15:00	49.3	02:20:00	48.7	02:25:00	49.7
02:30:00	48.0	02:35:00	47.6	02:40:00	49.0	02:45:00	49.3	02:50:00	48.8	02:55:00	48.2
1 hour average Leq: 49.0											
03:00:00	48.2	03:05:00	48.0	03:10:00	47.9	03:15:00	50.0	03:20:00	48.8	03:25:00	49.6
03:30:00	48.3	03:35:00	48.2	03:40:00	47.9	03:45:00	48.5	03:50:00	50.3	03:55:00	49.1
1 hour average Leq: 48.8											
04:00:00	49.0	04:05:00	49.0	04:10:00	48.0	04:15:00	47.6	04:20:00	48.1	04:25:00	48.8
04:30:00	48.0	04:35:00	53.3	04:40:00	49.9	04:45:00	48.8	04:50:00	49.8	04:55:00	52.2
1 hour average Leq: 49.7											
05:00:00	50.5	05:05:00	51.0	05:10:00	51.2	05:15:00	51.7	05:20:00	50.2	05:25:00	50.3
05:30:00	52.0	05:35:00	50.5	05:40:00	51.5	05:45:00	52.2	05:50:00	52.4	05:55:00	52.1
1 hour average Leq: 51.4											
06:00:00	52.4	06:05:00	53.2	06:10:00	53.8	06:15:00	54.9	06:20:00	55.4	06:25:00	55.8
06:30:00	55.9	06:35:00	56.1	06:40:00	55.8	06:45:00	56.6	06:50:00	57.1	06:55:00	57.7
1 hour average Leq: 55.6											
12 hour average Leq: 56.6											
Ending date: 01-September-2020											



Company Name : EnviroSolutions & Consulting Pte Ltd

Project Name : 1 Mandai Road

Project Duration : 25-August-2020 To 01-September-2020

Device Model : ACE Wireless

Device Serial Number : 034555

Total RunTime : 168:35:00

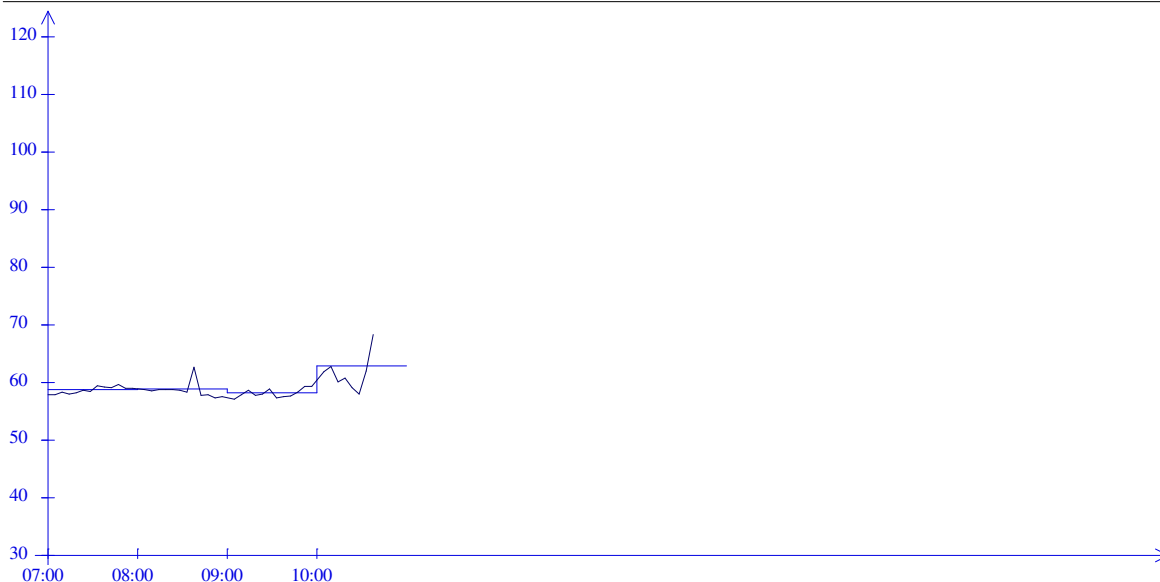
Stop Time: 19:00:00

Data Summary

Max Level 68.3 dB 2020-09-01 @10:35:00

Min Level 57.1 dB 2020-09-01 @09:00:00

Starting Date : 01-September-2020											
Time	Leq	Time	Leq	Time	Leq	Time	Leq	Time	Leq	Time	Leq
07:00:00	57.8	07:05:00	58.3	07:10:00	58.0	07:15:00	58.2	07:20:00	58.6	07:25:00	58.4
07:30:00	59.4	07:35:00	59.2	07:40:00	59.1	07:45:00	59.6	07:50:00	58.9	07:55:00	58.9
1 hour average Leq: 58.7											
08:00:00	58.7	08:05:00	58.5	08:10:00	58.7	08:15:00	58.7	08:20:00	58.7	08:25:00	58.6
08:30:00	58.3	08:35:00	62.6	08:40:00	57.7	08:45:00	57.8	08:50:00	57.3	08:55:00	57.5
1 hour average Leq: 58.8											
09:00:00	57.1	09:05:00	57.8	09:10:00	58.6	09:15:00	57.7	09:20:00	57.9	09:25:00	58.8
09:30:00	57.3	09:35:00	57.5	09:40:00	57.6	09:45:00	58.3	09:50:00	59.3	09:55:00	59.3
1 hour average Leq: 58.2											
10:00:00	61.8	10:05:00	62.7	10:10:00	60.1	10:15:00	60.7	10:20:00	59.1	10:25:00	57.9
10:30:00	61.9	10:35:00	68.3								
1 hour average Leq: 62.8											
12 hour average Leq: 60.1											
Ending date: 01-September-2020											



SUMMARY

PART 1: 12 hours Leq Permissible Level

There are 0 instances exceeding the Permissible values

PART 2: 1 hours Leq Permissible Level

There are 0 instances exceeding the Permissible values

PART 3: 5 minutes Leq Permissible Level

There are 0 instances exceeding the Permissible values



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