EIA at Sunset Way

EIA Report

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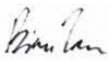
Author signature		Author signature			
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1.	2	Page 83; Section 3.5.3; Figure 3-57	Updated Proposed Retained Area (PRA) and legend in accordance with the revised Land Use Plan following public disclosure. <u>Previous PRA (July 2026)</u>  <u>Updated PRA (Oct 2026)</u> 
2.	2	Page 91; Section 3.6; Table 3-27	Updated impact assessment environmental scoring (importance factor) for both pre-mitigation and post-mitigation scenarios for Deforestation (mammals). Although the Sunda Pangolin was not observed in the current study, it was recorded in the AECOM 2022 EIA. To ensure the assessment remains comprehensive, the importance factor for this criterion was revised upwards accordingly.

Register of Change			
No.	**Version**	**Page and Section**	**Amendment**
3.	2	Page 97 and 98; Section 3.6; Table 3-27	Updated impact assessment environmental scoring (importance factor) for both pre-mitigation and post-mitigation scenarios for Vehicle collision with animals and Loss of Ecological Connectivity (Non-volant mammals and herpetofauna). Although the Sunda Pangolin was not observed in the current study, it was recorded in the AECOM 2022 EIA. To ensure the assessment remains comprehensive, the importance factor for this criterion was revised upwards accordingly

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Abbreviations

Abbreviation	Terminology
ASEAN	Association of Southeast Asian Nations
BEP	Best Environmental Practice
BIA	Biodiversity Impact Assessment
BOD	Biochemical Oxygen Demand
Ca	Calcium
CEMMP	Contract-specific Environmental Management and Monitoring Plan
CFU	Colony Forming Unit
CN	Cyanide
CO	Carbon Monoxide
COD	Chemical Oxygen Demand
CS	Conservation Significance
CVPA	Control of Vectors and Pesticides Act
dB	Decibel
dBA	A-weighted Decibel
DBH	Diameter at Breast Height
DO	Dissolved Oxygen
ECB	Erosion Control Blanket
ECM	Earth Control Measures
ECMO	Earth Control Measures Officer
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EIS	Environmental Impact Study
EMMP	Environmental Management and Monitoring Plan
EPHA	Environmental Public Health Act
EPMA	Environmental Protection and Management Act
EPR	Environmental Performance Report
ES	Environmental Score
Fe	Iron
GIS	Geographic Information System
GPS	Global Positioning System
Ha	Hectare
HDB	Housing and Development Board
Hz	Hertz
IDA	Infectious Diseases Act
IOD	Indian Ocean Dipole
ISA TRAQ	International Society of Arboriculture Tree Risk Assessment Qualification
IUCN	International Union for Conservation of Nature
K	Kelvin
kHz	Kilohertz

Abbreviation	Terminology
LAeq	Equivalent Continuous A-weighted Sound Pressure Level
LMP	Light Management Plan
LTA	Land Transport Authority
Mg	Magnesium
NA	Not Available / Not Applicable
NAS	National Archives Singapore
NEA	National Environment Agency
NEx	Presumed Nationally Extinct
NGs	Nature Groups
NH_4	Ammonia
NLB	National Library Board
NOx	Nitrogen Oxides
NO_2	Nitrogen Dioxide
NO_3	Nitrate
NParks	National Parks Board
NSR	Noise Sensitive Receiver
NTU	Nephelometric Turbidity Unit
NUS	National University of Singapore
O_3	Ozone
OSV	Other Specimens of Value
PCD	Pollution Control Department
PCS	Pollution Control Study
PM	Particulate Matter
PO_4	Phosphate
ppt	Parts Per Thousand
PRA	Proposed Retained Area
PUB	Public Utilities Board
QECP	Qualified Erosion Control Professional
RIAM	Rapid Impact Assessment Matrix
SE	Standard Error
SECR	Site Environmental Control Report
SIDS	Silty Imagery Detection System
SING	Singapore Botanic Gardens (SING) Herbarium
SINGLAS	Singapore Laboratory Accreditation Scheme
SLA	Singapore Land Authority
SO_2	Sulphur Dioxide
SO_4	Sulphate
S.O. Rep	Superintending Officer's Representative
SRDB	Singapore Red Data Book
TA	Technical Agencies
TCA	Tree Conservation Area
TDS	Total Dissolved Solids
TIW	Toxic Industrial Waste

Abbreviation	Terminology
TN	Total Nitrogen
TOC	Total Organic Carbon
TP	Total Phosphorus
TPZ	Tree Protection Zone
TSS	Total Suspended Solids
URA	Urban Redevelopment Authority

1 Introduction

1.1 Study Area

Singapore Environmental Consultancy Solutions Pte Ltd (a part of Aurecon Singapore Pte Ltd; hereafter 'Aurecon') was appointed by the National Parks Board (NParks), on behalf of Housing and Development Board (HDB) on 31 May 2025, to provide Specialist Consultancy Services for an Environmental Impact Assessment (EIA) at Sunset Way. The Sunset Way area is hereafter referred to as the 'Study Area'.

The Study Area, approximately 23 hectares (ha), is bounded by Brookvale Drive to the north, the private housing estate along Sunset Way to the west, and the existing HDB precinct along Clementi Road to the east. Findings from the previous EIA conducted in 2022, highlights that the site features undulating terrain and five habitat types: abandoned land forest, native-dominated secondary forest, scrubland and herbaceous vegetation, waste woodland, and managed vegetation (AECOM, 2022). The Study Area also contains secondary forest with native regeneration, as well as conservation significant flora and fauna species. Additionally, it serves as an ecological connector between Bukit Timah Nature Reserve (BTNR) and the Southern Ridges, and other green spaces such as Clementi Forest.

According to URA's Master Plan 2025, most of the Study Area is designated for residential use, with some land to the south that is zoned as Reserve Site where the former Jurong Railway Line is located, as well as the existing Clementi Neighbourhood Park on land zoned park. Nearby developments include the construction of CR16 MRT Station as part of the Cross Island Line. The tentative proposed works will involve site clearance, earthworks, soil investigation, construction of roads, sewers, drainage, utilities, and residential building construction.

Given the site context, this Environmental Impact Assessment (EIA) aims to validate the current environmental baseline and assess potential impacts during the construction and operational phases of the proposed development (hereafter referred to as the "Project"). Aurecon will incorporate relevant data from a previous environmental study conducted by AECOM in 2022 for the CR2005 study covering the Study Area and Clementi Forest. This report presents findings from the environmental baseline studies and predicted environmental impacts associated with the Project. It also outlines the scope of the EIA, report structure, and study limitations, assumptions, and constraints.

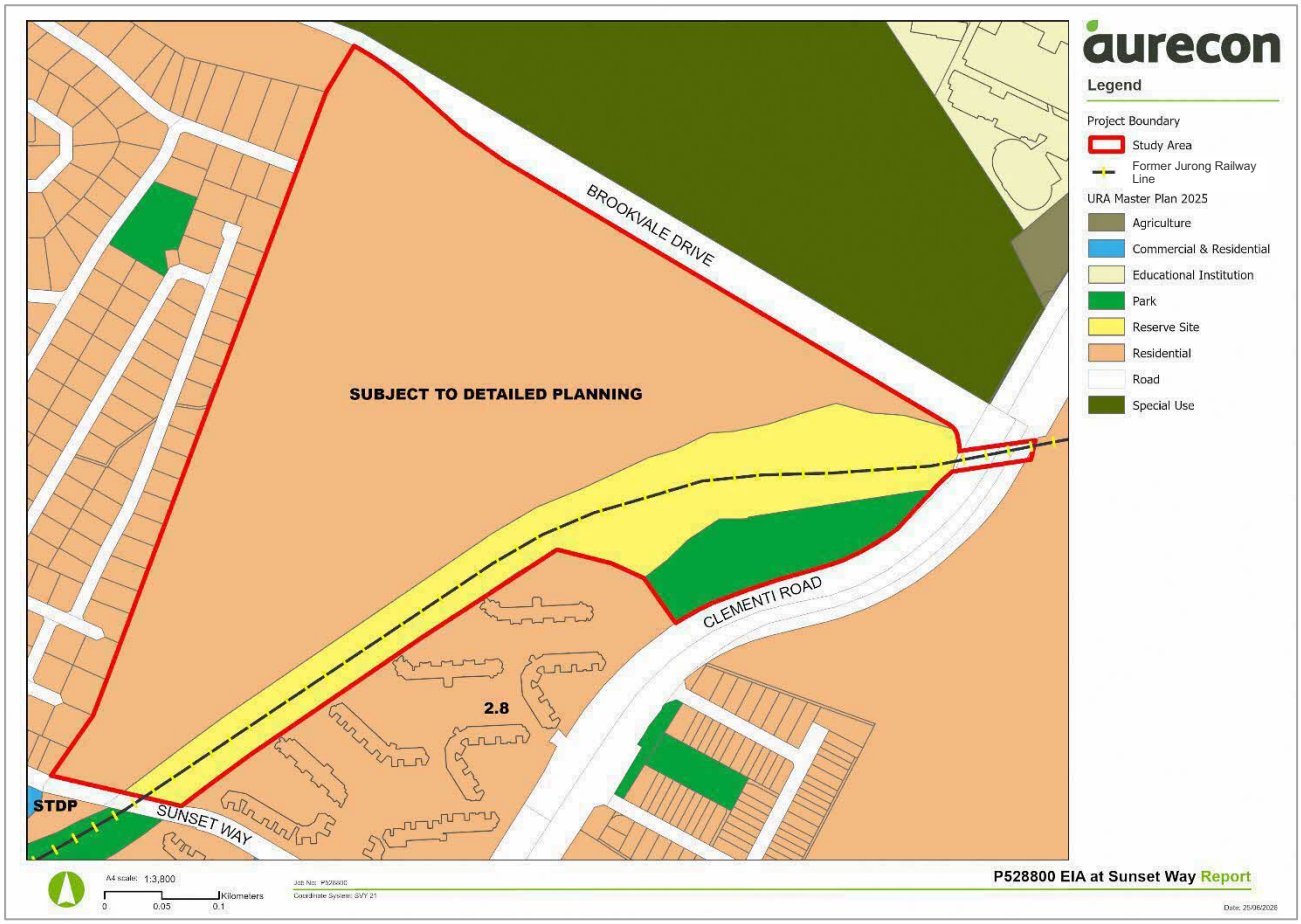


Figure 1-1 Map of Study Area and Proposed Land Use as shown on URA's gazetted Master Plan 2025

1.1.1 Historical Land Use Study

The assessment of historical and temporal land-use changes of the Study Area mainly took reference from aerial photographs and historical maps published on the National University of Singapore Libraries Historical Maps of Singapore (NUSLHMS, 2025) website and existing relevant literature. Historically, majority of Singapore's vegetation was lowland dipterocarp forest (Yee et al., 2011), including the forested Study Area. With the arrival of the British in 1819, 90% of forests had been cleared with approximately 40% turned into plantations – the most important crops being pepper, gambier, nutmeg, pineapple, and rubber (Pwee, 2021).

1914

One of the earliest known maps for the Study Area was published in 1914 (Figure 1-2A). It is not clear as to what vegetation was present, but it is most likely that it was rubber plantations as majority of Singapore consisted of that during this time period (Corlett, 1988). The 1914 map also shows Clementi Road already built and featured prominently. Lorong Gaung was also built before this period, running through the Study Area and connecting to Clementi Road (AECOM, 2022).

1950

An aerial photo captured in 1950 (Figure 1-2B) shows that the Study Area was cleared and covered predominantly by grassland, with no large-scale developments in that area at that point of time. The Tanjong Pagar railway station was opened earlier in 1932 (Yong & Yeo, 2016) and served as the terminus for the West Coastline of the Keretapi Tanah Melayu (KTM) railway which passed through the nearby Clementi Forest linking to Malaysia. In 1963, the Jurong Railway Line was built to connect Bukit Timah to the Jurong industrial estate, planned by the Singapore Government to facilitate the transfer of goods between Malaysia and Jurong (The Straits Times, 1960). The line was opened in 1965, part of which ran along the south-eastern fringe of Study Area, then under Clementi Road through a tunnel (The Straits Times, 1964), before linking to the KTM

railway line in the east of Clementi Forest (Teo, 2021). Construction of both lines likely introduced large-scale disturbances in both forests.

1978

In the 1978 map (Figure 1-2C), the Jurong Railway Line can be seen passing through the southeastern section of the Study Area. Buildings also started appearing to the west in the form of low-density settlements. The Study Area at this point of time matured into abandoned land forest, with the map indicating that majority of the vegetation found there was 'Sundry Tree Cultivation' and 'Grassland' – vegetation characteristic of abandoned land forest (Yee et al., 2016). The Jurong Railway Line eventually ended in early 1990s due to low usage after Singapore's separation with Malaysia (The Straits Times, 1965) and was subsequently abandoned.

2005 – Present

Between 1978 to 2005, more developments took place to the west and south-east of the Study Area, mainly residential in nature (Figure 1-2D). The Jurong Railway Line ran through this area from the 1960s and ceased operations in the 1990s (Tan, 2018a; Tan, 2018b). Currently, the former Jurong Railway Line is overgrown with vegetation, and the abandoned rail infrastructure has attracted nature enthusiasts and explorers (National Heritage Board, 2015). The National Parks Board announced in 2021 that plans were made to convert 4 km of the line into a nature trail and termed as the Former Jurong Railway Line Nature Trail (Lin, 2024). In an update on 31 August 2024 by then-Minister for National Development Desmond Lee, it was shared that the nature trail will be done in stages, with works to begin in early 2025 and progressively open the trail from end-2026 (Ministry of National Development, 2024).

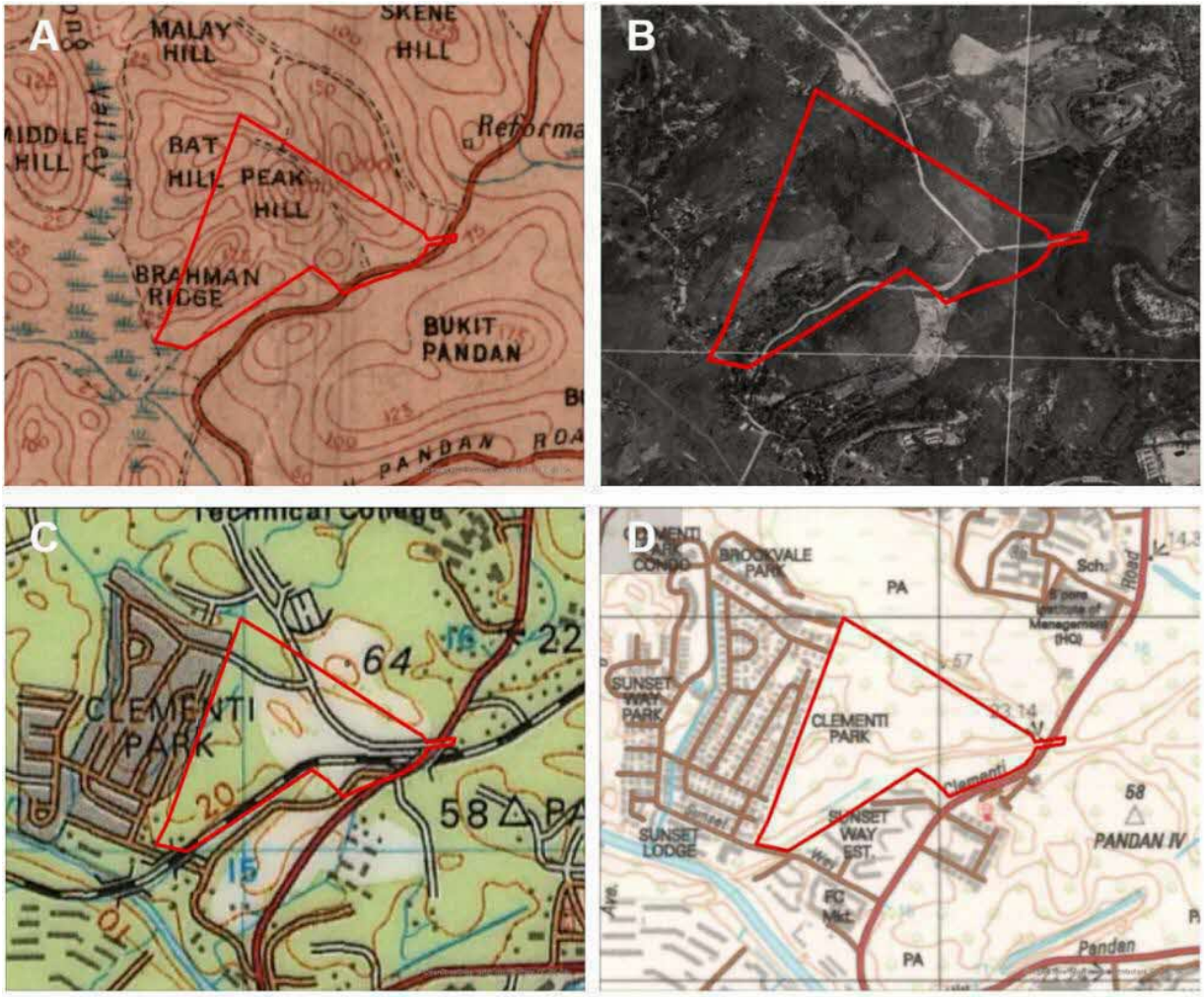


Figure 1-2 Topographical and aerial maps of the Sunset Way Area, with the Study Area boundary overlaid. (A) 1914; (B) 1950; (C) 1978; (D) 2005

1.1.2 Topography

A licensed topographic surveyor was commissioned by HDB to perform the topographical survey within the Study Area depicted in Figure 1-3, between June to November 2025, with the surveyed Study Area totalling approximately 23 ha.

Based on topographical data, the Study Area topography remains similar to the previous study. The elevation across the Study Area is heterogeneous and undulating, ranging from approximately 6 m (metres) Singapore Height Datum (SHD) at the lowest along Sunset Way, to the highest points measuring approximately 44 m SHD situated in the northeastern part of the Study Area as illustrated in Figure 1-3. Water bodies such as natural streams and ephemeral waterbodies were documented. Notably, one stream (D/S25), situated on the northwestern part of the Study Area, was observed to have threatened riparian flora. The full detail topography survey plan is provided in Appendix A.

Tree species identified in the flora survey were cross verified with documentation from the arboriculture surveys. This verification process facilitates accurate species identification and serves as a form of ground-truthing for tree girth and height measurements.

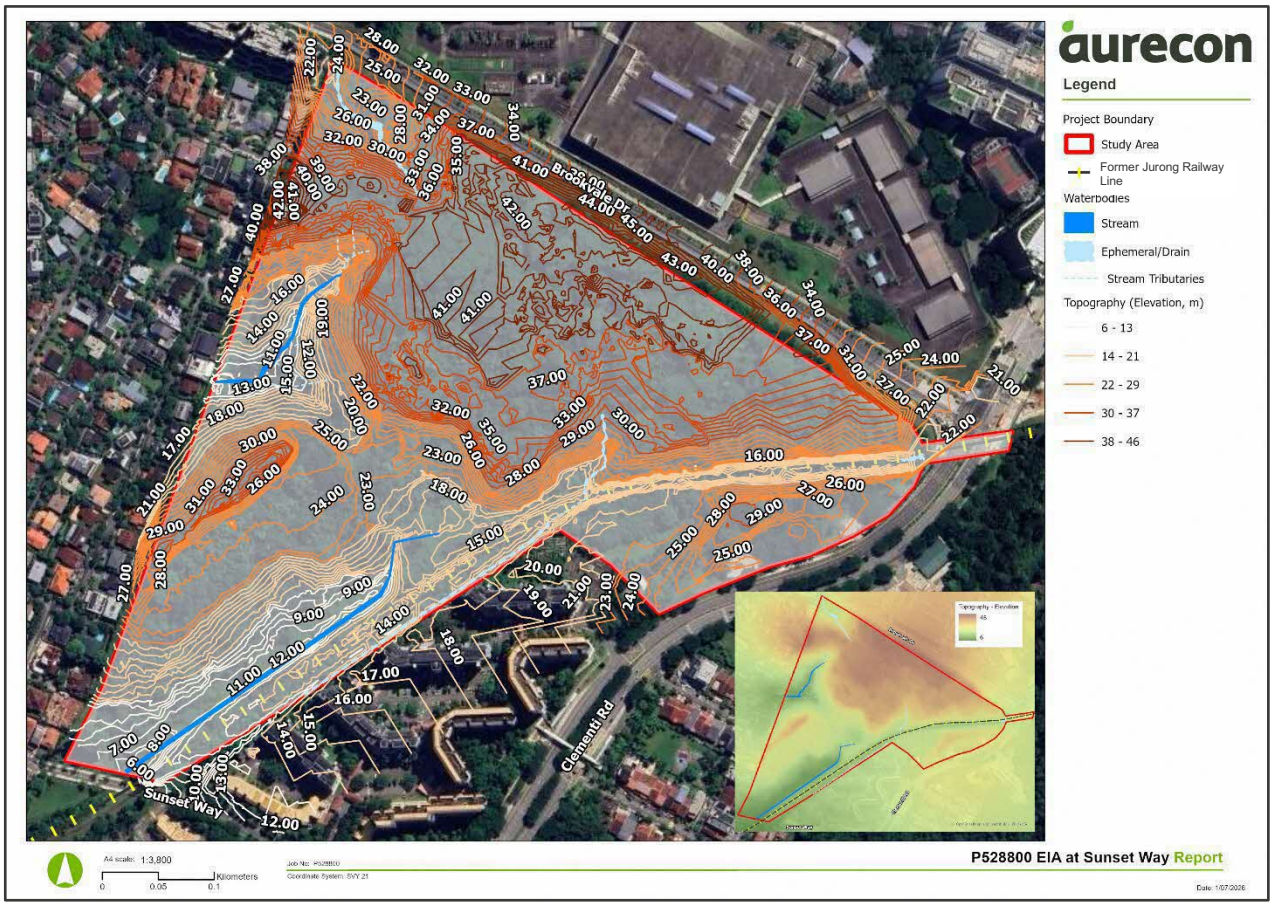


Figure 1-3 Topography of EIA Study Area

1.1.3 Summary of Past EIA

For the purposes of this current EIA, the most recent past EIA was referenced, namely:

- Contract CR2005 – Environmental Impact Study
  - Conducted by AECOM Singapore Pte Ltd in 2022
  - Commissioned by Land Transport Authority (LTA), and hereafter “AECOM, 2022”

The AECOM 2022 EIA study covered the Study Area and the neighbouring Clementi Forest, but for the purposes of this EIA, the focus will be on the findings for the Study Area. It should also be noted that the portion of the Study Area surveyed in the AECOM 2022 EIA also covered additional area to the west (Figure 1-4). There were five vegetation types present:

- Abandoned land forest (10.9 ha, 32.8%)
- Native-dominated secondary forest (7.9 ha, 23.8%)
- Scrubland and herbaceous vegetation (5.5 ha, 16.6%)
- Waste woodland (4.5 ha, 13.6%)
- Managed vegetation (4.5 ha, 13.6%)

A summary of the conservation significant (CS) fauna and flora recorded during the AECOM EIA can be found below in Table 1-1 and Table 1-2 respectively.

Table 1-1 Summary of CS Fauna for AECOM EIA

S/N	Fauna Species	IUCN	SRDB3	AECOM 2022
1	Chocolate Sailor*	-	NT	Present
2	Crested Goshawk*	LC	NT	Present
3	Changeable Hawk-Eagle	LC	VU	Present
4	Red Junglefowl*	LC	NT	Present
5	Blue-Crowned Hanging-parrot*	LC	LC	Present
6	Straw-headed Bulbul	CR	EN	Present
7	Red-legged Crake*	LC	NT	Present
8	Long-tailed Parakeet	VU	NT	Present
9	Sunda Pangolin	CR	CR	Present
10	Long-tailed Macaque	EN	LC	Present
			Total Number	**10**
*Species were considered CS in SRDB2 during 2022 study				

Table 1-2 Summary of CS Flora for AECOM EIA

S/N	Flora Species	National Status*	AECOM 2022
1	*Agelaea macrophylla*	CR	Present
2	*Alsophila latebrosa*	VU	Present
3	*Amphineuron opulentum*	EN	Present
4	*Angiopteris evecta*	VU	Present
5	*Aporosa benthamiana*	VU	Present
6	*Archidendron* cf. *jiringa*	VU	Present
7	*Aspidopterys concava*	EN	Present
8	*Bridelia stipularis*	VU	Present
9	*Caesalpinia sumatrana*	CR	Present
10	*Callicarpa longiflora*	CR	Present
11	*Cansjera rheedei*	VU	Present
12	*Centotheca lappacea*	CR	Present
13	*Connarus semidecandrus*	CR	Present
14	*Cryptocarya ferrea*	CR	Present

S/N	Flora Species	National Status*	AECOM 2022
15	*Dalbergia* cf. *junghuhnii*	CR	Present
16	*Dissochaeta gracilis*	VU	Present
17	*Dysoxylum cauliflorum*	VU	Present
18	*Ficus apiocarpa*	EN	Present
19	*Ficus aurata* var. *aurata*	VU	Present
20	*Galearia fulva*	VU	Present
21	*Garcinia griffithii*	EN	Present
22	*Glochidion zeylanicum* var. *zeylanicum*	VU	Present
23	*Goniophlebium percussum*	VU	Present
24	*Guioa pubescens*	VU	Present
25	*Gymnacranthera farquhariana* var. *farquhariana*	CR	Present
26	*Gymnacranthera forbesii*	CR	Present
27	*Horsfieldia polyspherula*	VU	Present
28	*Limacia scandens*	VU	Present
29	*Litsea castanea*	EN	Present
30	*Litsea* cf. *grandis*	EN	Present
31	*Litsea firma*	VU	Present
32	*Lomariopsis lineata*	CR	Present
33	*Lygodium longifolium*	VU	Present
34	*Macaranga griffithiana*	VU	Present
35	*Melicope glabra*	VU	Present
36	*Oncosperma horridum*	VU	Present
37	*Oxyceros longiflorus*	VU	Present
38	*Pteris semipinnata*	VU	Present
39	*Salacia* cf. *korthalsiana*	CR	Present
40	*Selaginella intermedia*	VU	Present
41	*Sterculia parviflora*	CR	Present
42	*Strophanthus* cf. *caudatus*	CR	Present
43	*Tectaria* cf. *semipinnata*	EN	Present
44	*Uncaria longiflora* var. *pteropoda*	CR	Present
45	*Xanthophyllum eurhynchum*	VU	Present
46	*Xylopia caudata*	VU	Present
		Total Number	**46**
*National status is based on SRDB2 (2008)			

Areas of High Conservation Value

The areas of high conservation value as part of the 2022 AECOM EIA (Figure 1-4) are as follows:

- All waterbodies
  - Uncommon habitats in Singapore
  - Nationally threatened plant species found along western stream

  - Breeding and foraging habitat for aquatic fauna
- Native-dominated secondary forest
  - Uncommon habitat in Singapore
  - Harbours high number of native and CS plant species
  - Habitat for fauna dependent on native flora
- Waterlogged areas along former Jurong Railway Line
  - Habitat for threatened stream-associated plant species and fauna favouring swamps
  - Ecological connectivity to surrounding forests



Figure 1-4 Area of High Conservation Value (Extracted from AECOM EIA, 2022)

1.2 Project Activities

The construction activities are outlined in Table 1-3 below, which are based on standard practices for infrastructure and building works. This includes the clearing of forested land, earthwork, piling operations, building construction, and operational activities that may have an impact on the environment. The environmental impacts resulting from work activities will be assessed in the subsequent chapters, with respective mitigation measures outlined in Section 8 - Environmental Management and Monitoring Plan.

Table 1-3 Anticipated Work Activities

Work Activities	Description
Preliminary works	Cable detection
	Soil investigation
Site Clearance	Machine mobilisation
	Hoarding works

Work Activities	Description
	ECM facilities set up
	Temporary drainage
	Storage and site office set up
	Undergrowth clearance
	Tree felling
	Pre-cast yard
	Noise barrier set up
Earthwork	Excavation
	Land grading / Earth levelling
	Soil stabilisation
General construction works	Bored piling works
	Construction of pile caps
	Hoisting/installation of precast elements/superstructure
	RC works
	Slope stabilisation works
	Sewer works
	Construction of retaining wall / CBP wall
	Drainage and utilities
	Pre-cast yard
	Road works (drain, retaining walls, road base, road kerbs, premix)
Building works	M&E works
	Roofing
	Wrap building - external walls
	External windows
	Internal doors and windows
	Install ceiling
	Masonry wall
	Line wall
	Painting
Landscape	Landscaping works
General operation	Commuting
	Waste generation
	Chemical use

1.3 EIA Objectives

The aim of the EIA is to evaluate the potential environmental impacts arising from the construction and operation of the Project and to identify measures to prevent or minimise these impacts. The objective of this EIA is as follows:

- To establish baseline conditions on the biodiversity and hydrology of the Study Area prior to construction of the Project, considering seasonal variations (such as bird migratory and non-migratory seasons) to better understand the role this area plays in contributing to the integrity of the ecosystem.
- To analyse the nature and extent of all relevant Project induced environmental impacts arising from the construction and operational phases, and related activities that take place concurrently.

- To develop mitigation measures to avoid or minimise predicted environmental impacts associated with construction and operation of the development to reasonably acceptable levels.
- To propose a preliminary Environmental Management and Monitoring Plan (EMMP) to guide the Project based on the finding of the EIA, including full compliance with codes and legislation, and taking reference from relevant guidelines.
- To consult relevant government agencies and conduct stakeholder engagements.

1.3.1 Scope of EIA

The scope of assessment for this EIA has been determined through discussion with HDB and NParks during an engagement with Nature Groups held on 10 September 2025. The EIA has also been carried out according to the scope and methodology as stated in the approved inception report. Based on these consultations, this EIA covers the following aspects during the construction and operational phases in Table 1-4 below.

Table 1-4 Summary of Scope of Works

Scope	Report Reference
Ecology and Biodiversity	Section 3
Surface Water Quality	Section 4
Airborne Noise	Section 5
Illumination	Section 6
Waste Management and Pollution	Section 7

1.3.2 EIA Study Team

Table 1-5 below provides a list of the multidisciplinary team members from Aurecon, along with our associated biodiversity subconsultants from bioSEA, who are actively engaged in the execution of environmental baseline surveys and reporting. This table outlines their specific roles in this Project.

Table 1-5 EIA Team Composition

No.	Name	Position
1.	Donald Folkoff	EIA Director
2.	Shane Chiok Wen Xuan	EIA Lead/Camera Trap Specialist
3.	Benjamin Tan Hong Ern	EIA Consultant
4.	Kang Rui Yuan	EIA Consultant
5.	Deneswari Mariappan	Terrestrial Fauna Specialist
6.	Woo Chee Yoong	Terrestrial Fauna Specialist
7.	Charmaine Lim	Terrestrial Fauna Specialist
8.	Gukaaneswaran Kaliyappan	Terrestrial Fauna Specialist
9.	Brian Cabrera	Aquatic Fauna Specialist
10.	Chua Kiam Poh	Water Quality Field Technician
11.	Ang Huishan	Water Quality Field Technician
12.	Anuj Jain	Lead Biodiversity Specialist, Butterfly Specialist
13.	Bian Tan	Flora Specialist
14.	Karan Jaikishin Lakhyani	Flora Specialist
15.	Sherry Hung Ming Xuan	Flora Specialist and Arborist
16.	Pin Jia Chan	Flora Specialist and Arborist
17.	Eugenia Mok Kai Ern	Flora Specialist
18.	Thinesh Selgum	Arborist
19.	Shivaneswary D/O Saravanan	Flora Field Support
20.	Nat Leong Chun Yung	Flora Field Support
21.	Muhammad Ridhwan bin Rosslan	Flora Field Support

No.	Name	Position
22.	Andin Risdany Yurisno	Flora Field Support
23.	Robin Ngiam Wen Jiang	Odonate Specialist
24.	Movin Nyanasengeran	Bird Specialist
25.	Law Ingg Thong	Herpetofauna and Bat Specialist
26.	Law Ing Sind	Herpetofauna and Bat Specialist
27.	Evan Poh	Flora and Fauna Field Support
28.	Sangam Paudel	Flora and Fauna Data Analyst, Field Support
29.	Ahmad Ruzaini Ja'afar	Flora and Fauna Field Support, Habitat Mapping

1.4 Assumptions and Limitations

The following assumptions and limitations are considered in the preparation of this EIA:

- Aurecon has conducted this EIA study to primarily meet local regulations and standards, with the focus on assessing potential impacts to the terrestrial environment arising from construction and operational activities, as well as impacts on air, noise, and water quality in accordance with the agreement with HDB, NParks and other Technical Agencies.
- The information, assessments, and professional advice contained in this report are provided solely for the purpose of assessing the Project's environmental impacts as part of the development agency's planning approval process. Aurecon accepts no liability for any use of this report other than for the agreed purpose.
- All conclusions and recommendations in this report reflect the professional opinion of the Aurecon personnel and associated subconsultants involved with the Project.
- Unless otherwise specified, the assessments in this report assume that the site and associated infrastructure will continue to be used for their intended purpose without significant change.
- Field investigations were conducted to the necessary level of detail to meet the objectives of this assessment, results from measurements and surveys may vary temporally or spatially, and further investigations may be required if there is a significant delay in utilising this report. Consequently, Aurecon provides the results as an indication of possible impacts rather than definitive.
  - Due to the nature of this study, it is understood that there will be inherent limitations associated with data collection pertaining to the flora and fauna surveys, due to the variability of ecological communities across the site. Variations in the detectability, presence and activity patterns of species with time – including influences due to weather conditions (i.e. thunderstorm, treefall and inaccessible areas due to arduous and unsafe terrain within the site) and seasonal variations are expected – and thus this study provides a snapshot of the ecological communities present during the surveys.
  - There is therefore the possibility that some flora/fauna species occurring within the Study Area were not observed nor recorded during the surveys. However, the biodiversity surveys are deemed as comprehensive as the surveys were strategically and practicably planned to provide representative samples of the Study Area.
  - The surveyors who carried out the surveys have sufficient prior experience in conducting such biodiversity assessments in Singapore and have done so to the best of their abilities and made all practicable effort to identify the species post-survey.
- A full Pollution Control Study (PCS) is not included as part of this EIA. All impact assessments for this study were executed using a qualitative approach. No quantitative modelling was employed in this study.

The Project is currently in the planning stage at the time of writing and detailed planning will be undertaken at a later phase. Thus, this EIA does not include specific assessments related to finalised construction methods, as these details remain subject to future refinement if applicable.

2 EIA Approach and Methodology

2.1 Scoping and Inception Report

Scoping was undertaken with relevant authorities / agencies to identify the potential area of influence for the Project and Study Area, to identify potential interactions between the Project and environmental receptors in the area of influence and the impacts that could result from these interactions.

The aim of the scoping stage is to ensure that the EIA focuses on issues that are most important for planning, design, decision-making and stakeholder interest. The outcome of the scoping was presented in the inception report, which was accepted on 16 December 2024 by NParks. An engagement session consulting local Nature Groups was held on 10 September 2025, with no objections to the scope of works presented.

2.2 Impact Assessment Methodology

The purpose of the impact assessment is to investigate how construction works may affect the surrounding environment, particularly wildlife. The Rapid Impact Assessment Matrix (RIAM) (Pastakia & Jensen, 1998) is one of the proposed methods in the BIA guidelines used to assess impacts related to human disturbance, noise, and light pollution. This method considers the magnitude of each impact, including intensity and duration. The impact analysis follows these key steps:

1. Identification of environmental aspects related to construction activities, with a focus on potential pollution sources or hazards that may arise on site; and

2. Evaluation of potential impacts, considering both likelihood and significance to determine necessary mitigation measures.

For each identified environmental aspect, impacts categorized as slight or minor negative will have control measures recommended to reduce their significance. The assessment covers, but not limited to, the following environmental impacts on biodiversity:

i. Edge effects;
ii. Habitat degradation;
iii. Animal mortality and roadkill;
iv. Loss or reduction in ecological connectivity;
v. Water quality impacts on aquatic habitats;
vi. Human-wildlife conflicts;
vii. Light disturbance on wildlife; and
viii. Noise disturbance on wildlife

The RIAM method provides semi-quantitative evaluation of projected impacts using standardized assessment criteria. Each environmental component is assigned a score, reflecting the expected impact magnitude and significance. This approach ensures a structured, independent, and transparent evaluation of environmental effects. The evaluation criteria used in the RIAM are divided into two main groups:

2.2.1 (A) Key Criteria – Directly Influencing Impact Classification

These criteria are essential in determining the significance of an impact, as they can individually alter the final classification. They include:

- (A1) Importance of Receptor: Evaluates the relevance of the affected condition based on spatial boundaries or the sensitivity of receptors impacted.
- (A2) Magnitude of Impact: Assesses the extent of benefit or damage caused by a given impact.

2.2.2 (B) Supporting Criteria – Indirectly Influencing Impact Classification

These criteria provide additional context but do not individually alter the final classification. They include:

- (B1) Permanence: Determines whether an impact is temporary or permanent.
- (B2) Reversibility: Assesses whether the impact can be mitigated or reversed.
- (B3) Cumulative and Synergistic Effects: Evaluates whether the impact occurs as a single, isolated event, accumulates over time, or interacts synergistically with other environmental conditions.

The scoring for the individual categories is found in Table 2-1 below. The impact assessment will be conducted at two levels, including immediate vicinity of the construction site by assessing localized impacts such as edge effects and habitat degradation; and overall biodiversity area by evaluating broader impacts on ecological connectivity, water quality, and species diversity. The following major construction activities will be assessed in the Environmental Impact Assessment (EIA):

i. Site clearance
ii. Excavation and earth filling;
iii. Ground levelling;
iv. Road works;
v. Drain and culvert works;
vi. Utility diversion and installation; and
vii. Box culvert structural strengthening works which may involve piling works, concrete hacking, and cement grout injection.

Table 2-1 Scoring for Individual Category

Group	Category	Description	Score
A	A1 (Importance of Receptor)	Important to national/ international interests	5
		Important to regional/ national interests	4
		Important to areas immediately outside the local condition	3
		Important to the local condition (within a large direct impact area)	2
		Important only to the local condition (within a small direct impact area)	1
	A2 (Magnitude of Impact)	Major positive benefit or change	+4
		Moderate positive benefit or change	+3
		Minor positive benefit or change	+2
		Slight positive benefit or change	+1
		No change/status quo	0
		Slight negative disadvantage or change	-1
		Minor negative disadvantage or change	-2
		Moderate negative disadvantage or change	-3
		Major negative disadvantage or change	-4
B	B1 (Permanence)	Temporary	2
		Permanent	3
	B2	Recoverable or controllable through EMMP	2

Group	Category	Description	Score
	(Recoverability)	Irrecoverable	3
	B3 (Cumulative Impact)	Non-cumulative/ single	2
		Cumulative/multiple	3

An Environmental Score (ES) is calculated using specific scoring categories to assess the impact of construction activities on the environment. The calculation follows a defined formula, which incorporates various assessment criteria.

$$Environmental\ Score\ (ES) = \sum A1 * A2 * (B1 + B2 + B3)$$

The scoring system involves summation and multiplication of difference weighted scores, which determine the final environmental score. These scores help quantify the significance of environmental impacts, ranging from minor to major effects. Table 2-2 provides the detailed scoring system, including the respective categories and the resulting range of ES based on the assessment framework.

Table 2-2 Environmental Score Range and Respective Class

Environmental Score (ES)	Value of Class	Description of Class
116 to 180	D	Major positive change/impact
81 to 115	C	Moderate positive change/impact
37 to 80	B	Minor positive change/impact
7 to 36	A	Slight positive impact
-6 to 6	N	No impact/status quo/Not applicable
-7 to -36	-A	Slight negative change/impact
-37 to -80	-B	Minor negative change/impact
-81 to -115	-C	Moderate negative change/impact
-116 to -180	-D	Major negative change/impact

The specific criteria for each score under Group A1 (Importance of Receptor) are detailed in Table 2-3 below:

Table 2-3 Specific Criteria for Evaluation of Impacts under Category A1 (Importance of Receptor)

Environmental Aspects	Category A1 (Importance of Receptor)				
	Important only to the local condition (within a small direct impact area)	Important only to the local condition (within a large direct impact area)	Important to areas immediately outside the local condition	Important to regional/ national interests	Important to national/ international interests
	1	2	3	4	5
Biodiversity – Habitat/ Vegetation Types (Construction & Operation Phase)	▪ Non-forested area with urban vegetation ▪ Highly modified or fragmented habitats, including managed turf and streetscapes ▪ Low to non-existent ecological importance; highly substitutable	▪ Smaller, forested area (1 – 5 ha), unmanaged vegetation under open canopy cover, including: Grasslands and Scrublands ▪ Modified-urbanised streams with soft landscaping features ▪ Modest ecological importance with the potential for substitution; important habitat locally; containing common, non-urban species	▪ Medium forested area (5 – 20 ha) with closed canopy cover, outside of designated nature reserves, nature areas, and other legally protected areas ▪ Native-dominated, young secondary forest, Exotic-dominated secondary forest, and restored Mangrove forests ▪ Naturalised streams, marshes or ponds with riparian vegetation ▪ Moderate ecological importance with some potential for substitution, important habitat nationally; containing uncommon species with limited spatial distribution	▪ Nationally or regionally recognised sites of biological and ecological importance ▪ Large, forested area (≥ 20 ha) with closed canopy cover, outside of designated nature reserves, nature areas, and other legally protected areas, including: Native-dominated, old secondary forest, Coastal forests, and Mangrove relic forests ▪ Natural freshwater streams, marshes or ponds within open canopy cover ▪ High ecological importance with limited potential for substitution; core habitat nationally; containing many species with restricted spatial distribution	▪ Nationally or internationally designated habitat/sites of biological and ecological importance (e.g. designated nature reserves, ASEAN Heritage Parks) ▪ Unrecognised habitat/sites of equivalent ecological value to designated and protected nature areas, namely: Primary Forest, freshwater swamp forests, mangrove forests with distinct intertidal zonation ▪ Natural freshwater streams within deep canopy cover ▪ Highest ecological importance, near inexistent potential for substitution, suis generis habitat nationally; containing many species with a highly restricted spatial distribution
Biodiversity – Fauna/Flora (Construction & Operation Phase)	▪ Species of no national importance ▪ Urban adapting or exploiting species	▪ Contains native species that are deemed to be Least Concern based on local assessments and Vulnerable based on global conservation assessments ▪ Proportion of conservation significant (status of Vulnerable and above) taxa/species between 10 – 20% of all recorded species on site	▪ Contains native species that are deemed to be Vulnerable based on local assessments and Endangered based on global conservation assessments ▪ Proportion of conservation significant (status of Vulnerable and above) taxa/species between 20 – 30% of all recorded species on site ▪ Presence of species with defined ecological functions (e.g. pollinators, food source for many species in the area)	▪ Contains native species that are deemed to be Endangered based on local and global conservation assessments ▪ Endangered species found onsite demonstrate high site fidelity and/or Critically Endangered species with lower site specificity ▪ Proportion of conservation significant (status of Vulnerable and above) taxa/species between 30 – 40% of all recorded species on site ▪ Presence of species with important ecological functions (e.g. Fig wasps for specific *Ficus* species)	▪ Contains native species that are deemed to be Critically Endangered based on local and global conservation assessments ▪ Critically Endangered species found onsite demonstrate high site fidelity and/or narrow habitat specificity ▪ Proportion of conservation significant (status of Vulnerable and above) taxa/species between 40 – 50% of all recorded species on site ▪ Presence of species with keystone ecological functions (e.g. bamboo clusters with bamboo bats)
Surface Water Quality (Construction & Operation Phase)	▪ The surface water resource has low value, and little or no role in provisioning of services to the local community or ecosystem (e.g. uncontrolled watercourse, drains discharging to the sea, small concrete-lined ponds)	▪ The surface water receptor is important at a local catchment level for provisioning or regulating services, but there is sufficient capacity or opportunity for alternative sources of comparably quality or function (e.g. small drains that are controlled watercourses)	▪ The surface water receptor is important at a local catchment level for provisioning or regulating services, with limited technically or economically feasible alternatives of comparable quality of unction (e.g. large monsoon drains, PUB rain garden features)	▪ The surface water receptor is wholly relied upon locally, with no suitable technically or economically feasible alternatives, and is important at a local catchment level for provisioning, regulating, or cultural/aesthetic services (e.g. reservoirs outside of a protected catchment, naturalised ponds, stormwater retention ponds, landmark Active, Beautiful, Clean projects, stormwater diversion canals, downstream segments of major rivers and canals leading to reservoirs)	▪ The surface water receptor lies within an unmodified habitat, is nationally rare with high socioeconomic or ecological value or quality, and is generally irreplaceable via engineering means (e.g. forest streams, freshwater swamps and marshes, quarry lakes, hot springs) ▪ The surface water receptor is wholly relied upon locally and is important at a national catchment level for provisioning services and contribution to dependent ecosystems (e.g. reservoirs within a protected catchment area)

Environmental Aspects	Category A1 (Importance of Receptor)				
	Important only to the local condition (within a small direct impact area)	Important only to the local condition (within a large direct impact area)	Important to areas immediately outside the local condition	Important to regional/ national interests	Important to national/ international interests
	1	2	3	4	5
Surface Hydrology (Construction & Operation Phase)	▪ Receptor locations with limited access and where exposure is transient (e.g. Private premises)	▪ Receptor locations accessible by general public, where exposure is transient (e.g. public footpaths, playing fields, parks)	▪ Receptor locations where the surface water resource is an important water supply, and is currently used, but there is capacity and/or adequate opportunity for alternative sources of comparable quality	▪ Receptor locations where human or wildlife populations are readily exposed to surface water and are dependent on the surface water resources for economical or biological support to sustain the population	▪ Receptors specifically protected by national or international policies or legislation and are of significance at a regional or national scale (e.g. designated Nature Reserves, nature Areas, ASEAN Heritage Park)
Air Quality and Airborne Noise (Construction & Operation Phase)	▪ Social-economic receptors with transient exposure (e.g., recreational users of playgrounds, visitors to worship)	▪ Social-economic receptors where the people exposed are workers and they may be exposed for eight hours or more in a day (e.g., office and shop workers)	▪ Social-economic receptors where members of the public are exposed for eight hours to more in a day (e.g., residential properties and schools)	▪ Social-economic receptors where more sensitive members of the public are exposed for eight hours or more in a day (e.g., hospital and care facilities)	▪ Social-economic receptors affected are specifically protected by national or international policies or legislation and are of significance at the regional or national scale
Illumination – Socio-economic (Construction & Operation Phase)	▪ Receptors with transient exposure (e.g. recreational users of parks and playgrounds)	▪ Locations where the people exposed are workers and they may be exposed for eight hours or more in a day (e.g. office, industrial and shop workers) ▪ Locations with existing moderate-to-high ambient light levels	▪ Located near general lived-in uses (e.g. residential developments, dormitories) where presence of illumination could pose moderate disamenities. ▪ Locations with existing moderate ambient light levels ▪ Locations where members of the public are exposed for eight hours or more in a day (e.g. residential properties and schools)	▪ Locations where more sensitive members of the public are exposed for eight hours or more in a day (e.g. residential care home) ▪ Locations with existing low ambient light levels	▪ Locations where light-sensitive activities such as sleep are of high importance by the more sensitive members of the public (e.g. hospitals and polyclinics) ▪ Locations with existing very low ambient light levels
Illumination – Ecological (Construction & Operation Phase)	▪ Locations where the receptors affected are with little to no biodiversity value (e.g. managed turf)	▪ Locations where the receptors affected are within limited biodiversity and ecological value (e.g. grasslands and shrubland) ▪ Fauna populations accustomed to existing night lighting, but slight disturbances are still expected	▪ Locations where the receptors affected are important for the functioning and integrity of adjacent habitats (e.g. green corridors, biodiversity buffer areas) ▪ Fauna accustomed to existing urban night lighting, but minor impacts are expected ▪ Locations where the receptors affected contain species or taxa that are sensitive to ambient light levels	▪ Locations where the receptors affected are of moderate importance at the regional or national scale (e.g. fauna in forested sites outside of designated nature reserves and nature areas) ▪ Populations mainly residing within forests and not urban-adapted	▪ Locations where the receptors affected are specifically protected by national or international policies or legislation and are of high importance at the regional or national scale (e.g. Nocturnal and crepuscular fauna in Nature Reserves, Nature Areas, ASEAN Heritage Park) ▪ Populations mainly residing deep within forests, not urban-adapted and highly susceptible to artificial lighting at night
Construction Waste and Vector Proliferation (Construction & Operation Phase)	▪ Receptor locations with limited access an where exposure is transient (e.g. private premises)	▪ Receptor locations accessible by general public where exposure is transient (e.g. public footpath, playing fields, parks)	▪ Receptor locations where the construction environment is utilized in distant, but not within the immediate proximity. Adequate opportunities are available for the utilization of alternate sources of comparable quality	▪ Receptor locations where human or wildlife populations are readily exposed to the construction environment and are dependent on the soil and groundwater resources for economical or biological support to sustain the population	▪ Receptors specifically protected by national or international policies or legislations and are of significance at the regional or national scale (e.g. designated Nature Reserves, Nature Areas, ASEAN Heritage Park)

The specific criteria for each score under Group A2 (Magnitude of Impact) are detailed in the Table 2-4 below. As there are no expected positive benefits or change to this Project, only the “no change/status quo” to “major negative disadvantage or change” magnitudes of impact are specified.

Table 2-4 Specific Criteria for Evaluation of Impacts under Category A2 (Magnitude of Impact)

Environmental Aspects	Category A2 (Magnitude of Impact)				
	No change/status quo	**Slight negative disadvantage or change**	**Minor negative disadvantage or change**	**Moderate negative disadvantage or change**	**Major negative disadvantage or change**
	0	**-1**	**-2**	**-3**	**-4**
Biodiversity – Loss of Fauna/Flora (Construction and Operation Phases)	▪ No expected loss of flora and fauna ▪ No increments to the expected rate of animal mortality and injury compared to the baseline level	▪ Expected depletion of the population by < 25% of current abundance or diversity ▪ Loss of sufficient population numbers such that expected fecundity or recoverability in the long term, and/or up to 90% of current abundance or diversity ▪ Affects species with the ability to respond and relocate rapidly and further away from the source of potential injurious activities ▪ Injuries/mortality are likely to be limited to no in nature	▪ Expected depletion of the population between 25 – 50% of current abundance or diversity ▪ Loss of sufficient population numbers such that expected fecundity or recoverability of the population is possible in the long term, and/or up to 75% of the current abundance or diversity ▪ Affects species with a delayed response to disturbances, but with the mean to relocate rapidly and further away from the source of potential injurious activities ▪ Injuries/mortality likely to be limited in nature	▪ Expected depletion of population between 50 – 75% of current abundance or diversity ▪ Loss of sufficient population numbers such that expected fecundity or recoverability of the population is possible only in the long term, and/or up to 50% of current abundance or diversity ▪ Affects species likely to respond quickly but lack the means to relocate rapidly and further away from the source of potential injurious activities. Species in this group are likely to be able to live amidst and evade deleterious activities and/or find alternative shelter. ▪ Injuries/mortality likely to be occasional in nature	▪ Expected depletion of population beyond 75% of current abundance or diversity ▪ Loss of sufficient population numbers such that expected fecundity or recoverability of the population is negligible or unlikely ▪ Affects species without the ability to respond and relocate rapidly and further away from the source of potential injurious activities ▪ Likely to experience significant mortality and/or injuries consequential to fitness
Biodiversity – Human-wildlife Conflict (Construction and Operation Phases)	▪ Increase to the rate of encounters with species likely to incite no negative responses in humans ▪ Species that are not perceived as nuisances or threats by construction personnel and others ▪ Species are not tolerant of human presence and urban environments, thus will not enter the construction site and/or go on access routes when proper mitigation and control measures are put in place.	▪ Increase to the rate of encounters with species that may results in annoyance in humans ▪ Species that may be perceived as a nuisance by construction personnel and others ▪ Face restricted to slight persecution when in abundance ▪ Less tolerant of human presence and urban environments ▪ Species are historically not known to enter the construction site and/or go on access routes, when proper mitigation and control measures are put in place.	▪ Increase to the rate of encounters with species that may result in fear, revulsion, or concern in humans ▪ Species that are typically perceived as both nuisances and threats by construction personnel and others ▪ Less tolerant of human presence and urban environments ▪ Species are unlikely to enter the construction site and/or go on access routes, and are mobile enough to avoid oncoming vehicles. ▪ Mortality does not significantly affect the short-term or long-term viability or function of the population.	▪ Increase to the rate of encounters with species that may results in injury to humans ▪ Species that are typically perceived as both nuisances and threats by construction personnel and others ▪ Highly tolerant of human presence and urban environments, and frequently implicated in human-wildlife conflict ▪ Species are highly likely to enter the construction site and/or go on access routes, and are mobile enough to avoid oncoming vehicles. ▪ Mortality significantly affects the short-term viability of function of the population over a few generations, but recovery of the population is possible in the long-term via natural recruitment.	▪ Increase to the rate of encounters with species that may results in severe injury or mortality in humans ▪ Species that are typically perceived as both nuisances and threats by construction personnel and others ▪ Highly tolerant of human presence and urban environments, and are frequently implicated in human-wildlife conflict ▪ Species are highly likely to enter the construction site and/or go on access routes, and are not mobile enough to avoid oncoming vehicles. ▪ Mortality affects entire or significant part of the population, and recovery of the population is not possible via natural recruitment within several generations.
Biodiversity – Loss of Habitat (Construction and Operation Phases)	▪ No loss of habitat	▪ Removal of < 25% of habitat type ▪ Loss of habitat to point of moderate potential recoverability ▪ Habitat may recover in the short term	▪ Removal of between 25 – 50% of habitat type ▪ Loss of habitat to point of moderate potential recoverability ▪ Habitat may only recover in the medium-term	▪ Removal of between 50 – 75% of habitat type ▪ Loss of habitat to point of low recoverability ▪ Habitat may only recover in the long-term	▪ Removal beyond 75% of habitat type ▪ Loss of habitat beyond point of recoverability ▪ Habitat is likely to degrade into other habitats of lesser ecological value

Environmental Aspects	Category A2 (Magnitude of Impact)				
	No change/status quo	Slight negative disadvantage or change	Minor negative disadvantage or change	Moderate negative disadvantage or change	Major negative disadvantage or change
	0	-1	-2	-3	-4
Biodiversity – Loss of Ecological Connectivity (Construction and Operation Phases)	▪ Developed site is in an existing geological connectivity network and developmental works has had no effects on ecological connectivity with adjacent natural sites. ▪ Animals face no anthropogenic barriers when entering the developed site, and are able to forage and nest within the developed site as per pre-development conditions.	▪ Developed site is in an existing ecological connectivity network and has lower connectivity, but it is connected to: – At least two natural sites that are translocatable through short-distance flight, terrestrial, or aquatic locomotion ▪ Animals face no anthropogenic barriers when entering the developed site, and are able to forage and nest within the developed site albeit within a reduced area.	▪ Developed site is in an existing ecological connectivity network and has lower connectivity, but it is connected to: – At least two natural sites that are translocatable through short-distance flight, terrestrial, or aquatic locomotion ▪ Animals face some anthropogenic barriers when entering the developed site, and are able to forage and nest within the developed site albeit within a reduced area.	▪ Developed site is in an existing ecological connectivity network and has lower connectivity, but it is connected to: – At least one natural site that is translocatable through short-distance flight, terrestrial, or aquatic locomotion ▪ Animals face some anthropogenic barriers when entering the developed site, and natural foraging and nesting behaviours are affected due to the development.	▪ Developed site is in an existing ecological connectivity network, but developmental works has removed all ecological connectivity between the developed site and adjacent natural sites ▪ Animals are not able to enter the developed site due to anthropogenic barriers.
Surface Water Quality (Construction & Operation Phase)	▪ Water quality is likely to be well within baseline criteria levels or allowable criteria ▪ No alterations to existing drainage regimes and characteristics and thus negligible or no impact on upstream or downstream flood flows	▪ Short term localised effects on water quality but likely to be highly transitory (i.e. lasting hours) and well within natural fluctuations ▪ Water quality is likely to be within baseline criteria levels or allowable criteria ▪ Likely to be some alteration to excising drainage regimes and characteristics, although the frequency and magnitude of flooding upstream or downstream is not expected to be materially affected	▪ Short term localised effects on water quality but which are likely to return to equilibrium conditions within a short time frame (i.e. hours or days at most) ▪ Water quality is likely to be within baseline criteria levels or allowable criteria ▪ Likely to be some alteration to existing drainage regimes and characteristics, although the frequency and magnitude or flooding upstream or downstream is not expected to be materially affected	▪ Potential localised effects on water quality which are likely to be long lasting (i.e. weeks or months) and give rise to indirect ecological and/or socio-economic impacts ▪ Water quality is likely to occasionally exceed baseline criteria levels or allowable criteria ▪ Likely to involve moderate alternations to existing drainage regimes and patterns	▪ Severe effects in water quality which are likely to be very long lasting (i.e. months or more) and give rise to indirect ecological and/or socio-economic impacts ▪ Water quality is likely to routinely exceed baseline criteria levels or allowable criteria ▪ Likely to involve significant alternations to existing drainage regimes and patterns
Surface Hydrology (Construction & Operation Phase)	▪ Status quo	▪ Localised effects on hydrology but the incident rarely happens ▪ No alterations to existing drainage regimes and characteristics and thus negligible or no impact on upstream or downstream flood flows ▪ Short term localised effects on surface water hydrology but likely to be highly transitory (i.e. lasting hours) and well within natural fluctuations	▪ Localised effects on hydrology which happens occasionally, but can be remediated in time during construction ▪ Likely to be some alteration to existing drainage regimes and characteristics, although the frequency and magnitude of flooding upstream or downstream is not expected to be materially affected	▪ Localised effects on hydrology which happen regularly and may give rise to indirect ecological and/or socio-economic impacts ▪ Likely to involve significant alternations to existing drainage regimes and patterns ▪ Alterations to hydrology expected to cause potential localised effects on catchment processes which is likely to be long lasting	▪ Severe effects on hydrology affecting an extensive area and may give rise to indirect ecological and/or socio-economic impacts ▪ Likely to involve significant alterations to existing drainage regimes and patterns ▪ Alterations to hydrology expected to cause potentially severe effects on catchment processes which are likely to be long lasting (i.e. years or permanent)
Airborne Noise – Human Receptors (Construction Phase)	▪ Predicted noise level at noise sensitive receptor exceeded the limit by up to 1 dBA ▪ Or predicted noise level at noise sensitive receptor causes an increase of up to 3 dBA as compared to baseline level	▪ Predicted noise level at noise sensitive receptor exceeded the limit by between 1 to 3 dBA ▪ Or predicted noise level at noise sensitive receptor causes an increase of up to 5 dBA as compared to baseline level	▪ Predicted noise level at noise sensitive receptor exceeded the limit by between 3 to 5 dBA ▪ Or predicted noise levels at noise sensitive receptor cause an increase of up to 10 dBA as compared to baseline level	▪ Predicted noise level or noise sensitive receptor exceeded the limit by between 5 to 10 dBA ▪ Or predicted noise level at noise sensitive receptor cause an increase of greater than 10 dBA as compared of baseline level	▪ Predicted noise level at noise sensitive receptor exceeded the limit by more than 10 dBA
Airborne Noise – Fauna Receptors (Construction Phase)	▪ Predicted noise level causes an increase of up to 3 dBA as compared to baseline level ▪ Or predicted noise level below 60 dBA, with no changes in fauna behaviour or populations expected	▪ Predicted noise level causes an increase of up to 5 dBA as compared to baseline level ▪ Or predicted noise level of 60 – 65 dBA resulting in temporary/recoverable shifts in fauna behaviour (e.g. change in vocalisation pattern, avoidance or areas with acoustic pollution). Which are not expected to cause a substantial change in species population	▪ Predicted noise level causes an increase of up to 10 dBA as compared to baseline level ▪ Or predicted noise level of 66 – 75 dBA, resulting in significant behavioural changes in fauna (e.g. changes in feeding patterns, predator-prey interactions, reduced ability to maintain territories, increase aggression between individuals)	▪ Predicted noise level causes an increase of greater than 10 dBA as compared to baseline level ▪ Or predicted noise level of 75 – 85 dBA, resulting in evident physiological and anatomical changes, and low survivability and biological fitness of fauna populations	▪ Predicted noise level exceeded 85 dBA, likely resulting in death or injury or fauna receptors

Environmental Aspects	Category A2 (Magnitude of Impact)				
	No change/status quo	Slight negative disadvantage or change	Minor negative disadvantage or change	Moderate negative disadvantage or change	Major negative disadvantage or change
	0	-1	-2	-3	-4
Air Quality (Construction & Operation Phase)	▪ Status quo	▪ Short-term localised effects on air quality but likely to be highly transitory (i.e. hours) and well within natural fluctuations ▪ Air quality is likely to be well within national/international standards, guidelines or target levels	▪ Short-term localise effects on air quality which are likely to return to equilibrium conditions with a short timeframe (i.e. hours or days at most) ▪ Air quality is likely to be within national/international standards, guidelines or target levels	▪ Potential effects on air quality which are likely to be long lasting, typically widespread in nature and requiring moderate intervention to return to baseline ▪ Air quality is likely to approach or in danger or exceeding national/international standards, guidelines or target levels	▪ Severe effects on air quality which are likely to be long lasting, typically widespread in nature and requiring significant intervention to return to baseline ▪ Air quality is likely to routinely exceed national/international standards, guidelines or target levels
Illumination (Construction & Operation Phase)	**General** ▪ Little to no perceptible change to the night lighting conditions assessed as compared to the existing levels **Biodiversity** ▪ Little to no disturbances on populations ▪ Negligible likelihood of behavioural changes within population, and their extirpation from the current habitat **Socio-economic** ▪ Residents not affected nor disturbed by visibility of lights	**General** ▪ Predicted night lighting levels to be slightly higher than existing levels for a short duration throughout the night **Biodiversity** ▪ Populations experience slight disturbances due to artificial lighting at night ▪ Very low likelihood of behavioural changes within populations, and their extirpation from the current habitat **Socio-economic** ▪ Residents are noticing the visibility of lights within their homes, but is unlikely to cause discomfort	**General** ▪ Predicted night lighting levels to be slightly higher than existing levels for a long duration throughout the night **Biodiversity** ▪ Populations are minor disturbed due to artificial lighting at night, but not to the extent that the overall condition of the populations are impaired in the long term ▪ low likelihood of behavioural changes within populations, and their extirpation from the current habitat **Socio-economic** ▪ Residents are mildly disturbed by visible lights and may experience discomfort	**General** ▪ Predicted night lighting levels to be significantly higher than existing levels for a long duration throughout the night **Biodiversity** ▪ Populations are moderately disturbed due to artificial lighting at night ▪ Moderate likelihood of behavioural changes within populations, and their extirpation from the current habitat ▪ Discernible and fundamental changes to existing light levels, that would disturb populations **Socio-economic** ▪ Residents are notable disturbed by visible lights and are likely to file complaints with the local Authorities ▪ Obtrusive light trespass and glare are present inside any room within the house, thereby affecting their quality of life ▪ Sleep quality may be affected without window coverings	**Biodiversity** ▪ Populations are irretrievably compromised due to artificial lighting at night ▪ High likelihood of behavioural changes within populations, and their extirpation from the current habitat **Socio-economic** ▪ Residents are severely disturbed by visible lights ▪ Excessive lights directly visible inside any room in the house leading to sleep disorder and other related health issues ▪ High likelihood that residents will regularly lodge complaints to Authorities about excessive light trespass
Construction Waste and Vector Proliferation (Construction & Operation Phase)	▪ Status quo	▪ Production and retention of waste material that may produce temporary mild irritation, discomfort, or annoyance in human receptors i.e. accidental spillage of organic waste ▪ Effects of environmental pollution are temporary, and self-resolving	▪ Production and retention of waste material that is of indiscernible toxicity, but may be associated with reduced quality of environmental receptors, and long-lasting irritation or discomfort in human receptors i.e. microplastic release, loose ashes, oils, and sludges ▪ Effects of environmental pollution benefit from intentional removal, to reduce the duration an extent of pollutive effects	▪ Production and retention of waste material that is of mild toxicity, resulting in potentially acute impacts on health and quality of environmental receptors ▪ Effects of environmental pollution necessitate dedicated removal, resulting in the disequilibrium of affected environmental receptors if left without intervention	▪ Production and retention of waste material that is of at least intermediate toxicity, resulting in potentially chronic or substantive impacts on health and quality of environmental receptors i.e. release of asbestos, heavy metals, and radioactive material ▪ Effects of environmental pollution are essentially permanent; pollutive effects may be mitigated but not resolved, resulting in the disequilibrium of affected environmental receptors

3 Ecology and Biodiversity

The biodiversity study aims to establish a baseline biodiversity dataset for the Study Area and assess potential impacts of the proposed Project on existing biodiversity. The baseline data collected will be used in later sections to evaluate and determine the scale of impact associated with the Project. This study focuses on surveying both flora and fauna within the site to identify key habitats and species relevant for biodiversity protection. Understanding the existing biodiversity will help in formulating effective control and mitigation measures to support conservation efforts.

3.1 Applicable Legislation, Standards, and Guidelines

The environmental legislations which are applicable to the Project are presented in the following sub-sections. The main legislations relevant to the protection, preservation and management of biodiversity within Singapore are the Parks and Trees Act and the Wildlife Act. This is reinforced by the National Parks Board (NParks) Biodiversity Impact Assessment (BIA) Guidelines.

3.1.1 Parks and Trees Act

The *Parks and Trees Act* provide for the planting, maintenance, and conservation of trees and plants within National Parks, Nature Reserves, Tree Conservation Area (TCA), Heritage Road Green Buffer, and other specified areas. It allows NParks to manage and protect greenery and biodiversity in these spaces, with an emphasis on regulating tree care and removal within said designated areas to ensure public safety and environmental protection.

3.1.2 Wildlife Act

A summary of the relevant sections of the *Wildlife Act* is summarised in Table 3-1 below. All site personnel are to be briefed on the relevant legal requirements and penalties during the Biodiversity Awareness Briefing, prior to the commencement of works.

Table 3-1 Summary of Wildlife Act 2020

Activity	Applicable Section	Legal Requirement	Penalty
Feeding of wildlife	5A	A person must not intentionally feed any wildlife in any place unless the person has the Director-General's written approval to do so	▪ For a first offence, to a fine not exceeding $5,000 ▪ For a second or subsequent offence, to a fine not exceeding $10,000
Killing, trapping, taking or keeping of wildlife	5C	A person must not intentionally kill, trap, take or keep any wildlife in any place unless the person has the Director-General's written approval to do so.	▪ In the case where the offence is committed in respect of a protected wildlife, to a fine not exceeding $50,000 or to imprisonment for a term not exceeding 2 years or to both.
Wildlife-related measures for development or works	10	The Director-General may direct a person to implement, in respect of any development or works being carried out, or to be carried out, by or on behalf of the person, any wildlife related measure that the Director-General considers necessary to safeguard	▪ A person who, without reasonable excuse, contravenes subsection (3) shall be guilty of an offence and shall be liable on conviction to a fine not exceeding $50,000 or to imprisonment for a term not exceeding 6 months or to both.

3.1.3 BIA Guidelines

The Biodiversity Impact Assessment (BIA) guidelines is a technical document issued by NParks and advises on the scope of the biodiversity component of the EIA study. For the purpose of this Project, reference has been taken from the May 2024 BIA guidelines for the baseline field surveys conducted, covering flora, fauna, surface hydrology, and surface water quality.

3.2 Flora

Site reconnaissance surveys were conducted in April and May 2025, to obtain an initial understanding of the existing habitats and dominant vegetation types; determine site accessibility and terrain. The extent of the Study Area was identified and demarcated (Figure 3-1).

The field surveys for flora consisted of:

- Habitat mapping;
- General walking floristic surveys; and
- Tree mapping and tagging;

Comprehensive floristic field assessments were conducted throughout the whole Study Area, except where access was challenging due to water bodies and/or ponding. Flora surveys were conducted from 9 June – 30 September 2025.

3.2.1 Desktop Assessments

Land Use History

Historical and present-day land use of the Study Area was reviewed to obtain an understanding of current vegetation types (NAS, 2025).

Taxonomy and Nomenclature

Flora species composition was referenced with relevant key literature that include books, scientific publications, unpublished literature, and online databases, to identify species to the lowest taxonomic level possible, along with their national conservation status.

Sources of databases include the third edition of the Singapore Red Data Book List (updated 24 May 2024; SRDB3) (NParks, 2024), Flora and Fauna Web by the National Parks Board (NParks, 2025), Chong et al. (2009); Plants of the World Online (Kew, 2025); Lindsay et al. (2022).

Species of Conservation Significance

Threatened species of flora – i.e., listed in the Singapore Red Data Book List (NParks, 2024); Lindsay et al. (2022) and Chong et al. (2009) as nationally Vulnerable, Endangered, Critically Endangered, or Presumed Extinct (which indicates a rediscovery) – recorded in the Study Area were assessed to determine whether they are of conservation significance. While the national conservation status of threatened species is true of wild populations that originate in an area without direct or indirect human intervention, some populations may be relics that persist from past cultivation or escapees from present-day cultivation that do not belong to native genetic stock. The assessment of whether a threatened species is of conservation significance was based on, but not limited to, information on the following:

- Land use history;
- Presence of large parent tree(s);

- Commercial availability (e.g., in nurseries);
- Past experience with biodiversity data from previous environmental impact assessments conducted in Singapore; and
- Natural range etc.

Where the origin of a threatened species population is disputable or difficult to determine, a more conservative approach was adopted by considering them of conservation significance. The global conservation status references the Red List of Threatened Species by the International Union for Conservation of Nature (IUCN, 2025) where applicable. Non-threatened species of interest, on the other hand, are those that, while not currently at risk of extinction, are still considered important due to their ecological roles, scientific value, or other factors that make their conservation significant. This includes species that may serve as indicators of environmental health or have unique characteristics, highlighted under Other Specimens of Value (OSV), underscoring the importance of their continued protection.

3.2.2 Habitat Mapping

Methodology

A preliminary habitat map was prepared based on Google Earth 7.1.2.2041 imagery, which was then ground-truthed throughout the Study Area using a Global Positioning System (GPS) receiver (Garmin GPSMap® 64s). The updated boundaries of each habitat type were mapped out based on the vegetation composition and density, particularly that of dominant species and canopy cover as outlined in the NParks Biodiversity Impact Assessment (BIA) Guidelines (NParks, 2024). Photographs of the habitat areas were also taken.

Results

Habitat types were categorized according to NParks' BIA Guidelines (NParks, 2024). A total of five (5) main habitat types namely: "Albizia-dominated Secondary Forest", "Abandoned Land Forest", "Native-dominated Secondary Forest", "Scrubland" and "Managed Vegetation" were found, as well as waterbodies (Figure 3-1).

The Abandoned Land Forests and Native-dominated Secondary Forests were the dominant habitat types comprising 44.71% and 21.05% of the Study Area Table 3-2. This was followed by Albizia-dominated Secondary Forests (20.13%) and Managed Vegetation (7.83%). Waterbodies comprised roughly 0.86% of the Study Area.

Based on topographical data from HDB, the site topography remains similar to the previous study. The highest elevation of 44 m was recorded near the northeastern part of the Study Area, with the lowest elevation of 6 m recorded along Sunset Way (Figure 1-3).

Table 3-2 Habitat Types and Their Area within the Study Area

Habitat Type	Area (ha)	Percentage coverage (%)
Abandoned Land Forest	9.98	44.71
Native-dominated Secondary Forest	4.70	21.05
Albizia-Dominated Secondary Forest	4.49	20.13
Managed vegetation	1.75	7.83
Scrubland	1.21	5.42
Waterbodies	0.19	0.86
Total	**22.32**	**100.00**



Figure 3-1 Habitat Mapping within the Study Area

Native-dominated Secondary Forest

Native-dominated secondary forests are forests that have been previously disturbed but have retained or regenerated a dominant canopy of healthy native trees. These can be young or old, depending on the time of prior disturbance (due to clearing or replanting). Their progression can be assessed based on species compositions, heterogeneity, vegetation size and presence of indicator species within these patches. These habitats are most prevalent in the large patch along the Southwestern portion of the Study Area (Figure 3-1). The boundaries of these habitats differ slightly from the maps drawn in the previous EIA conducted by AECOM (2022). Habitat boundaries here were drawn using the presence of native mapped trees and species of conservation significance as a guideline, which could have differed from methods used in the previous study, where canopy and understorey species compositions, and forest dynamics may have been given different component weightages in classifying habitats. Species composition of vegetation could have also shifted over the last few years, possibly due to more widespread dispersion of native groundcover and growth of native trees in the area. AECOM (2022) had defined this southwestern portion as three separate, smaller patches. However, based on the native canopy dominance and understorey/undergrowth species composition from data collected in this study, the entire area was combined into one native-dominated secondary forest patch.

A patch of regenerating young native-dominated secondary forest is also found surrounding the natural stream D/S25 located in the northwest of the Study Area (Figure 3-1). Riparian vegetation was also observed, spanning about 2 m on either side of the stream, consisting of ferns like *Alsophila latebrosa* (LC) and *Angiopteris evecta* (VU). These narrow strips are challenging to visualise on satellite imagery basemaps and were thus excluded from the habitat classification. Nevertheless, they are deemed to hold significant ecological value in this study. Although the canopy in this patch is dominated by rubber (*Hevea brasiliensis*) and Tembusu (*Cyrtophyllum fragrans*) trees, the understorey and undergrowth consist mostly of shrubs and treelets of native species, including *Anisophyllea disticha*, *Elaeocarpus petiolatus*, *Rhodamnia cinerea* and *Mallotus paniculatus* and *Trema* sp. among others, interspersed with rubber seedlings. Hence, providing a blanket classification of ‘abandoned land forest’ with native regeneration’ for this habitat would undermine its regenerative potential.

Aside from native-dominated forests, pockets of native-dominated patches were also found interspersed throughout the Study Area, containing saplings, treelets, and occasionally, mature trees of native non-pioneering species like *Syzygium cerasiforme*, *Arthrophyllum jackianum*, *Rhodamnia cinerea*, *Morella esculenta* or *Elaeocarpus mastersii*.

These young native-dominated forests are mainly between early-to-mid or mid-to-late stages of succession, consisting mainly of a canopy of pioneering species like *Cyrtophyllum fragrans*, *Alstonia angustiloba*, *Syzygium cerasiforme*, *Syzygium grande*, with the occasional occurrence of *Macaranga conifera*, an early pioneer (Figure 3-1).The understorey shows indicators of transition via the presence of smaller *Arthrophyllum jackianum* and *Melicope lunu-ankenda* trees, *Anisophyllea disticha* shrubs (Yee et al., 2016) and many native climbers, some of which are nationally threatened (e.g. *Gynochthodes rigida*, *Limacia scandens*). Based on the dynamics of the habitats, it was posited that the age of these patches could range from around 40 years old to over 70 years old (especially the western patch).

A cluster of tall, healthy specimens of the native Ten Men Tree (*Ixonanthes reticulata*) also stands within this habitat, growing amongst a ground cover of dead branches and climbers. The undergrowth is dominated mainly by of a mix of saplings and small shrubs of the native species mentioned above, and others like *Litsea umbellata* (*sensu lato*), *Morella esculenta* and *Melicope lunu-ankenda* (EN), while climbers like *Ficus apiocarpa* (Endangered) and *Gynochthodes coriacea* can be found in abundance (Figure 3-2).

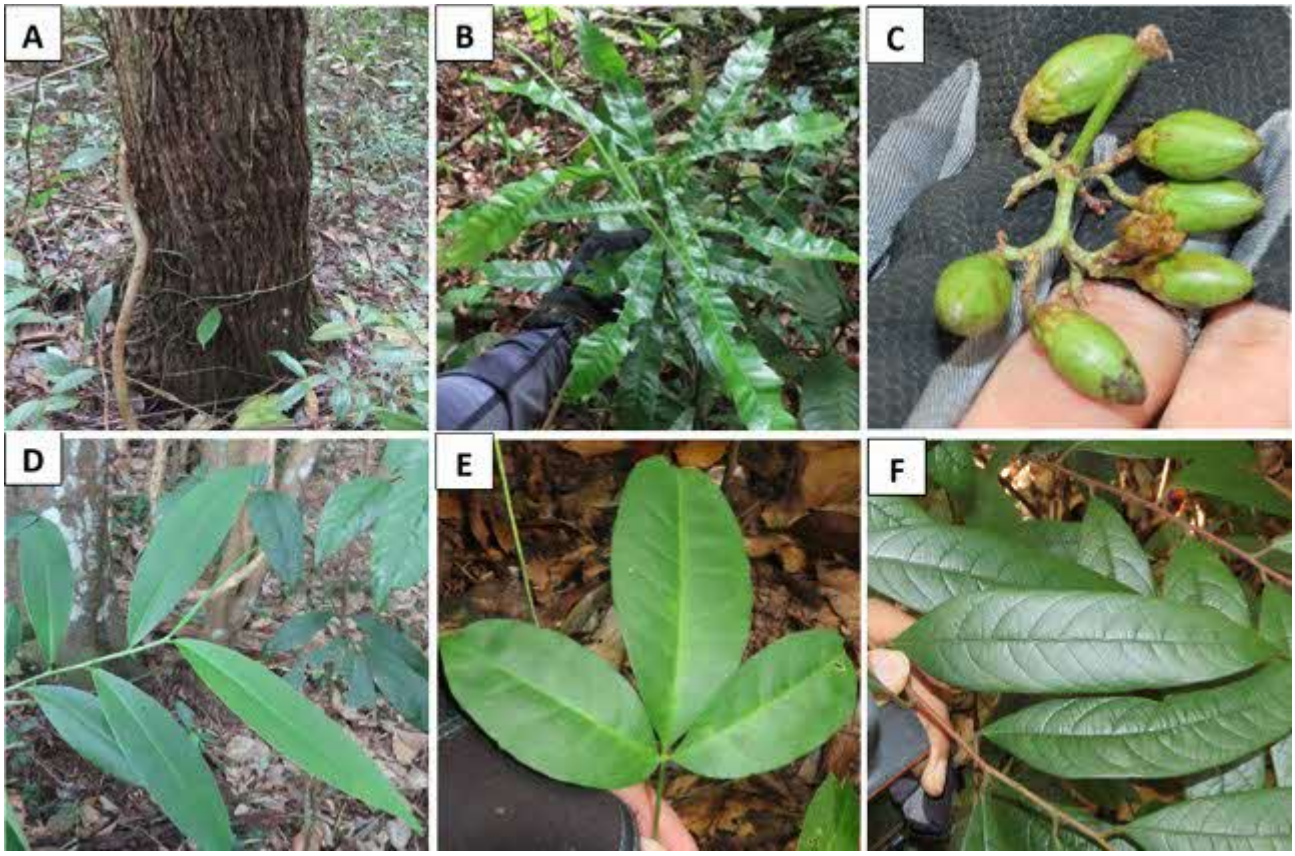


Figure 3-2 Commonly found species in Native-dominated Secondary Forest. (A) Fissured bark of *Cyrtophyllum fragrans*, (B) Serrated young leaves of *Morella esculenta*, (C) Fruits of *Ixonanthes reticulata*, (D) Leaves of *Adinandra dumosa* with crescent terminal bud, (E) Saplings of *Melicope lunu-ankenda* (EN) prevalent in undergrowth, (F) Leaves of *Cryptocarya rugulosa* (CR)

Abandoned Land Forest

Abandoned land forests are forests that have regenerated from land previously utilized for plantations, mainly rubber *(Hevea brasiliensis)* or kampungs (which have ornamental fruit trees) which were since abandoned but retained their mature trees. These habitats make up the majority of the Study Area, consisting of a dominant canopy species of crop plants like para rubber (*Hevea brasiliensis*) and oil palms (*Elaeis guineensis*), consistent with the history of the site as an abandoned plantation. In smaller abundance, species like rambutan

(*Nephelium lappaceum*), *Vitex pinnata*, *Ficus variegata* and occasionally, *Senna siamea,* can be found here. The understorey mostly reflects that of the dominant canopy species, with additional recruitment of Rambai (*Baccaurea motleyana*) and *Syzygium myrtifolium* from cultivated stocks, as well as the nationally vulnerable *Macaranga griffithiana* to a lesser extent (Figure 3-3).

A large cluster of *Senegalia* sp. lianas was also found in the southeast of the Study Area, beside the former Jurong Railway Line. These were initially thought to be *Senegalia kekapur*, a critically endangered species, but was later found to be *Senegalia rugata* based on slight variations in botanical features.

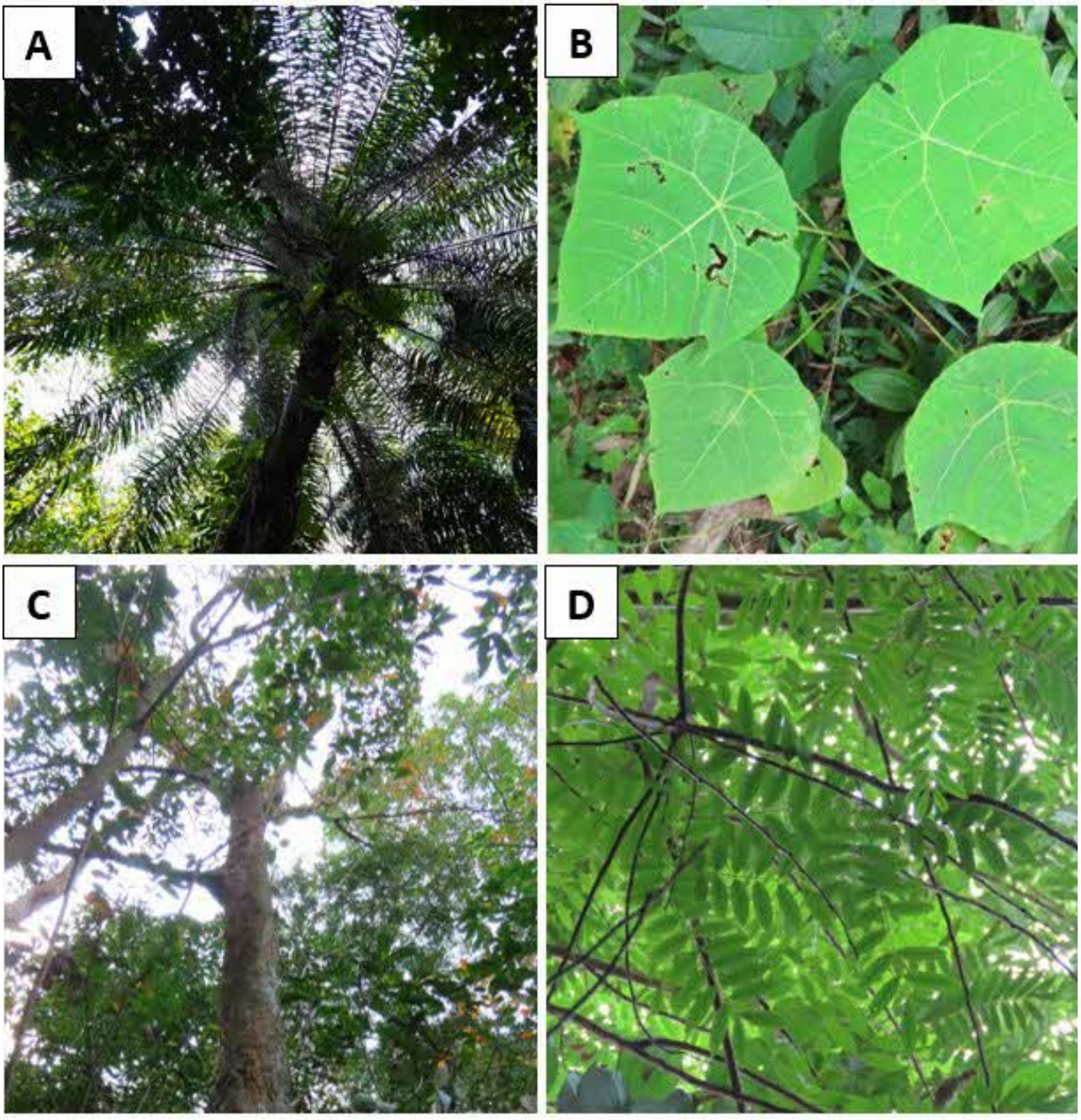


Figure 3-3 (A) Crown of Oil palm (*Elaeis guineensis*), (B) *Macaranga griffithiana* sapling, (C) Para rubber (*Hevea brasiliensis*) canopy, (D) Crown foliage of *Senna siamea*

Albizia-dominated Secondary Forest

Albizia-dominated secondary forests, likely grown from land cleared after the 1960s, is usually situated on level terrain. They consist mainly of the non-native pioneering Albizia (*Falcataria falcata*) which were once cultivated as streetscape trees, and sometimes *Leucaena leucocephala*, likely because their seeds had dispersed from surrounding areas. This is consistent with the findings that Albizia forms a dominant portion of

the canopy, while other species like *Elaeis guineensis* and *Spathodea campanulata* are much less abundant. The understory, albeit much sparser, has a more varied composition, usually of *Cinnamomum iners*, but also some *Macaranga gigantea* nearing the northern boundary.

The undergrowth composition within these habitats is relatively diverse, with some having patches of *Litsea elliptica* saplings or *Heliconia psittacorum* cultivars scattered among the forests, especially in the northeastern part of the Study Area. Areas with Albizia treefalls were also relatively common, resulting in clearances with dense climbers or tall grasses (Figure 3-4). Waterlogging was sometimes noted in these habitats.

In the southern part of the Study Area, strips of medium-sized *Sterculia parviflora* and *Leucaena leucocephala* trees dominate the canopy alongside the Study Area's southern trail entrance, extending approximately 400 m down the trail. *Sterculia* saplings were also found in the undergrowth, likely progeny from the dispersed seeds of these planted trees.



Figure 3-4 Commonly found species in Albizia-dominated secondary forest. (A) Canopy of *Falcataria falcata* (B) Leaflets of *Leucaena leucocephala*, (C) Leaf underside of *Sterculia parviflora*

Scrubland

Scrublands constitute a much smaller proportion of the Study Area, which is slightly more than 1 ha of land if classified strictly by exposed areas with little tree cover (NParks BIA, 2024). These constitute a mixture of scrublands dominated by Resam ferns (*Dicranopteris linearis*) (see Figure 3-5A), found mostly in the northeastern portion of the Study Area, and those dominated by shrubs and herbs, found across the entire area (Figure 3-5B). There was also an instance of scrubland dominated fully by the aroid *Alocasia macrorrhizos* (Figure 3-5C).



Figure 3-5 Types of Scrubland habitat observed (A) Scrubland dominated by Resam ferns, (B) Scrubland dominated by shrubs and climbers, (C) Scrubland dominated by *Alocasia macrorrhizos*

Managed Vegetation

The managed vegetation in the south of the Study Area is made up of managed lawns along Sunset Way, and the urban areas along Clementi Road, where a neighbourhood park with a fitness corner is situated. Some managed trees in the urban areas include *Khaya grandifoliola*, *Syzygium grande*, *Podocarpus rumphii*, *Mimusops elengi* and *Xanthostemon chrysanthus*.

Waterbodies

Three natural streams have been observed within the Study Area (Figure 3-1). The (i) first is D/S24, a natural stream which starts at the centre of the Study Area and runs southwards into a large concrete drainage canal. It starts with high earth banks but is sparsely vegetated throughout.

The (ii) second is D/S25, a natural stream which likely collects groundwater from the northwest of the Study Area. It flows southwards and then westwards towards the western boundary behind the private residences, draining out into a larger enclosed drain. It cuts through a young native-dominated secondary forest, while itself having an abundance of vegetation along its bankside, of which some were found to be specific to riparian habitats. Many species of conservation significance were also recorded along these banks (Figure 3-6).

Lastly, (iii) D/S23, a shallow static stream slightly to the east of the Study Area that runs towards the southeast. It likely starts from runoff or groundwater sources and has high earth banks. Flow is ephemeral towards the north, and more consistent downstream. D/S23 was previously reported to sometimes fuse with D/S24 during wetter seasons of the year (AECOM, 2022)

An ephemeral stream was also noted and has been mapped out as well. A shallow concrete drainage was also noted running along the southeast to east of the Study Area.

Across all the waterbodies mapped, D/S25 is noted to be of high importance due to the presence of riparian habitats and species of conservation significance. The stream is also situated within a young native-dominated secondary forest, giving it greater ecological value (Figure 3-7).



Figure 3-6 Species of Conservation Significance found along stream D/S25. Left: Fronds of *Angiopteris evecta* (VU), Right: Hooked spines of *Uncaria longiflora* var. *pteropoda* (EN)

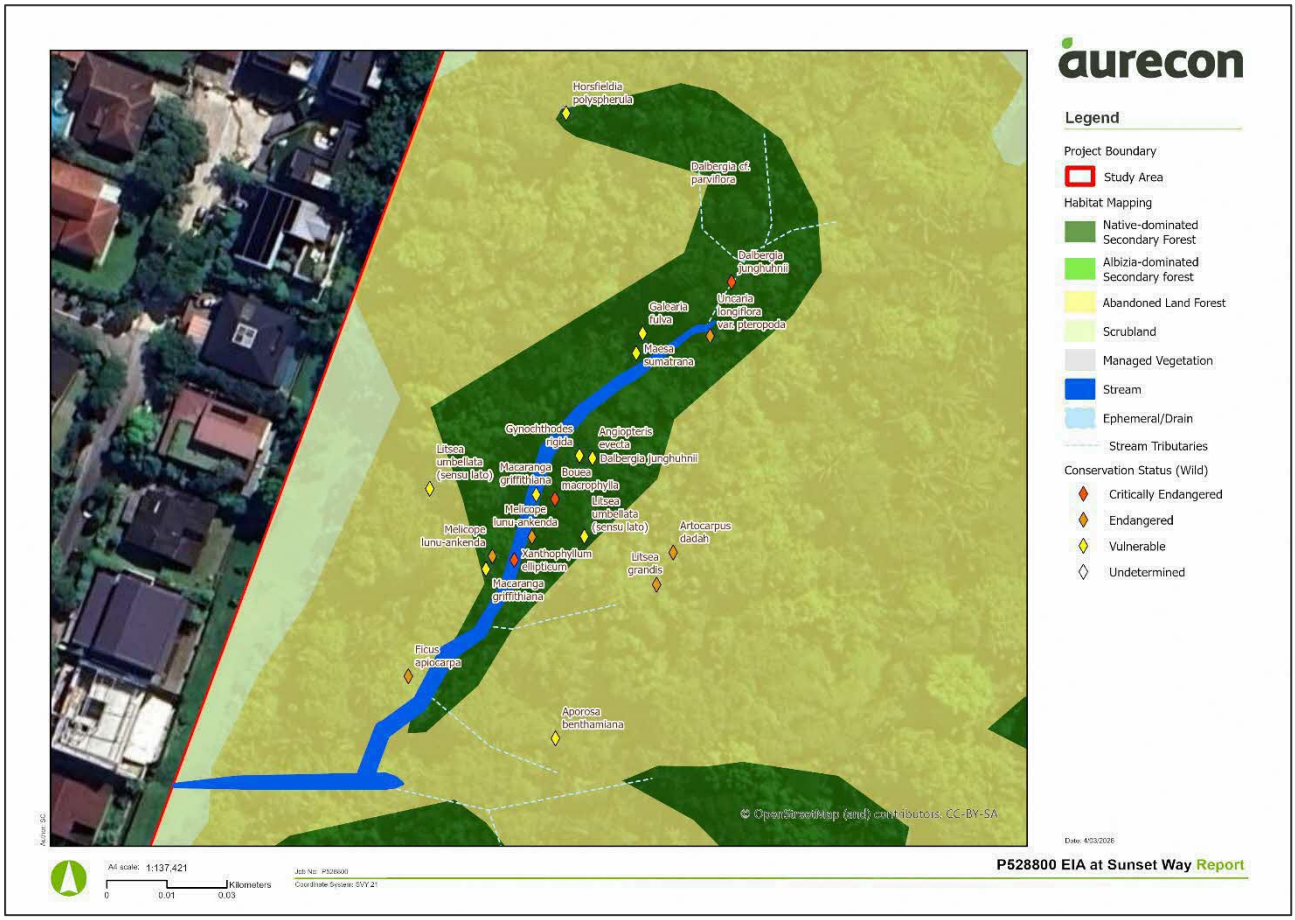


Figure 3-7 CS Flora found within D/S25

3.2.3 Tree Mapping and Tagging

Methodology

Tree mapping was conducted (Figure 3-8) where all trees of ≥ 1.0 m girth (circumference measured at breast height), single-stemmed palms (i.e., defined as having one obvious and erect stem) and strangling *Ficus* species of ≥ 1.0 m girth or spread were assessed and tagged with a unique serial number. Plant health and structural stability was also assessed by a certified Arborist. The aforementioned taxa of ≥ 0.3 m girth recorded as nationally threatened were also assessed and tagged. All geographic locations, girth/spread, and height of the tagged specimens were recorded.

A Total Station (Nikon XS Total Station) was used to record the geographic locations of the specimens using the SVY21 plane coordinate system. Specimens that could not be assessed owing to physical obstructions, such as fallen branches, were not physically tagged, but their locations were recorded using the Total Station.

Species of Conservation Significance

Tree species of conservation significance ≥ 0.3 m girth were assessed and tagged. The geographic locations of other plants (including trees < 0.3 m) of conservation significance were marked using a GPS receiver (Garmin GPSMap® 64s) and not physically tagged. Garmin GPSMap® 64s records locations with accuracy of ± 5 m, during floristic surveys. Where there are clusters of plants of conservation significance – i.e., more than one individual occurring within 5 m or less of another individual – the approximated centre of the area was marked using the GPS receiver.



Figure 3-8 (Left) Field assistant tagging a tree and (Right) scrapping the bark to identify species of tree

Large Plant Specimens

The GPS receiver was used to record locations of all trees of ≥ 3 m girth, as well as bamboo clusters, palm clusters, and strangling *Ficus* species of ≥ 3 m spread. Individuals were identified to species whenever possible. The girth (for trees) and spread (for bamboo clusters, palm clusters, and strangling *Ficus* species) were measured and estimated, respectively. The heights of all specimens were also estimated.

Other Specimens of Value

Locations of other plants that are of significant value but did not meet the minimum size requirement, as detailed above, were also recorded using the GPS receiver. Examples of such include bamboo clusters of ≥ 1 m spread that may be important refugia for rare bamboo bats, exotic Albizia trees (*Falcataria falcata*) with raptor nests and butterfly host plants, amongst others.

Results

Tree Mapping

Of 1661 trees mapped from 59 species in total from the Study Area, 573 native trees (34.50%), 1028 non-native trees (61.89%), 29 cryptogenic trees (1.75%) and 31 trees of undetermined origin (1.87%) were found across 24 different families (Figure 3-9; Figure 3-10; Table 3-3; Table 3-5). Table 3-4 provides an overview of the girth classes and height of all tagged trees. Dead trees were removed from the records.

Table 3-3 Abundance and Species Counts of All Tagged Trees Observed within the Study Area, sorted by Origin and Status (> 1 m girth)

Origin	Status	Species Counts	Tree Counts	%	Sum	Total Percentages
Native	Least Concern [LC]	23	523	31.49%	**573**	34.50%
	Vulnerable [VU]	5	8	0.48%		
	Endangered [EN]	1	1	0.06%		
	Critically Endangered (Cultivated) [CR-C]]	3	28	1.69%		
	Data Deficient [DD]	1	13	0.78%		
	Sub-total	**33**				
Non-Native	Cultivated	6	57	3.43%	**1028**	61.89%

Origin	Status	Species Counts	Tree Counts	%	Sum	Total Percentages
	Casual	9	260	15.65%		
	Naturalised	6	711	42.81%		
	Sub-total	**21**				
Cryptogenic	-	3	29	1.75%	29	1.75%
Indeterminate [-]	-	2	31	1.87%	31	1.87%
	Total	**59**	**1661**	**100.00%**	**1661**	**100.00%**



Figure 3-9 Map of All Tagged Trees Classified by Origin (Native, Non-native, Cryptogenic, Undetermined)

The average girth was 1.65 m with a standard deviation of (± 0.89 m) suggesting there was a small variation in girths. The average height of the trees was 16.22 m (Standard Deviation = ± 4.61 m) suggesting a typical height of trees found in young secondary forests (Table 3-4).

Table 3-4 Summary of All Tagged Trees by Girth Classes and Height

Tree Tagging Summary	Value
Non-Conservation significant Trees with girth ≥ 1.0 m	1626
Conservation significant Trees with girth ≥ 0.3 m	35
Trees with girth ≥ 3.0 m (Large Trees)	115
Trees with girth ≥ 1.0 m & < 3.0 m (Non-CS, Non-large trees)	1511
Other Specimens of Value ≥ 1.0 m (*Ficus*, Bamboo) *excl. CS or large	91
Trees with Good Health and Good Form	334

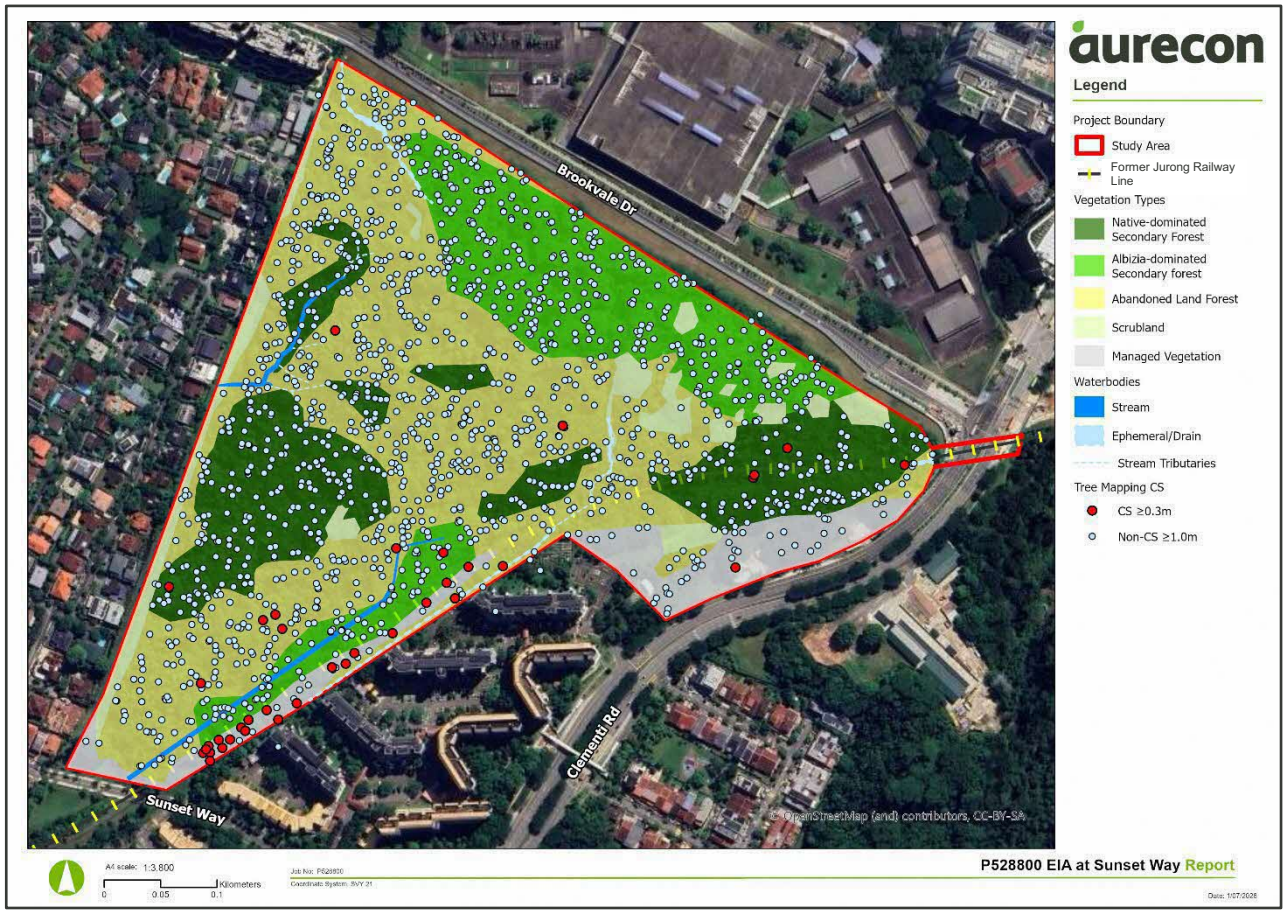


Figure 3-10 Map of All Tagged Trees Classified by Species of Conservation Significance (CS) with girth ≥ 0.3 m, and non-CS Species with girth ≥ 1.0 m

Table 3-5 Number of Individual Tagged Tree per Species

S/N	Species Name	Origin	Status	Counts	%
1	*Hevea brasiliensis*	Non-Native	Naturalised	313	18.84
2	*Falcataria falcata*	Non-Native	Naturalised	286	17.22
3	*Elaeis guineensis*	Non-Native	Casual	226	13.61
4	*Syzygium grande*	Native	LC	107	6.44
5	*Cyrtophyllum fragrans*	Native	LC	92	5.54
6	*Ficus variegata*	Native	LC	76	4.58
7	*Spathodea campanulata*	Non-Native	Naturalised	74	4.46
8	*Vitex pinnata*	Native	LC	73	4.39
9	*Syzygium cerasiforme*	Native	LC	36	2.17
10	*Senna siamea*	Non-Native	Cultivated	31	1.87
11	*Alstonia angustiloba*	Native	LC	27	1.63
12	*Ixonanthes reticulata*	Native	LC	25	1.51
13	*Sterculia parviflora*	Native	CR-C	23	1.38
14	*Nephelium lappaceum*	Cryptogenic	Cryptogenic	20	1.2
15	*Terminalia catappa*	Native	LC	17	1.02
16	*Leucaena leucocephala*	Non-Native	Naturalised	17	1.02
17	*Adenanthera pavonina*	Non-Native	Naturalised	15	0.9
18	*Syzygium polyanthum*	Native	LC	14	0.84
19	*Khaya grandifoliola*	Non-Native	Cultivated	14	0.84
20	*Dimocarpus lichi*	Native	DD	13	0.78

S/N	Species Name	Origin	Status	Counts	%
21	*Cinnamomum iners*	Native	LC	11	0.66
22	*Samanea saman*	Non-Native	Casual	11	0.66
23	*Durio zibethinus*	Non-Native	Casual	9	0.54
24	*Macaranga conifera*	Native	LC	9	0.54
25	*Adinandra dumosa*	Native	LC	8	0.48
26	*Artocarpus integer* var. *integer*	Cryptogenic	Cryptogenic	6	0.36
27	*Delonix regia*	Non-Native	Cultivated	6	0.36
28	*Acacia auriculiformis*	Non-Native	Naturalised	6	0.36
29	*Ficus microcarpa*	Native	LC	5	0.3
30	*Litsea elliptica*	Native	LC	5	0.3
31	*Andira inermis*	Non-Native	Casual	5	0.3
32	*Baccaurea motleyana*	Native	CR-C	4	0.24
33	*Claoxylon indicum*	Native	LC	4	0.24
34	*Macaranga griffithiana*	Native	VU	4	0.24
35	*Rhodamnia cinerea*	Native	LC	3	0.18
36	*Ficus benjamina*	Cryptogenic	Cryptogenic	3	0.18
37	*Podocarpus rumphii*	Non-Native	Cultivated	3	0.18
38	*Mimusops elengi*	Non-Native	Casual	3	0.18
39	*Averrhoa carambola*	Non-Native	Casual	2	0.12
40	*Arthrophyllum jackianum*	Native	LC	2	0.12
41	*Morella esculenta*	Native	LC	2	0.12
42	*Elaeocarpus mastersii*	Native	LC	2	0.12
43	*Aphanamixis polystachya*	Native	LC	2	0.12
44	*Xanthostemon chrysanthus*	Non-Native	Cultivated	2	0.12
45	*Oncosperma horridum*	Native	VU	1	0.06
46	*Lepisanthes rubiginosa*	Native	LC	1	0.06
47	*Cerbera odollam*	Native	VU	1	0.06
48	*Campnosperma auriculatum*	Native	LC	1	0.06
49	*Macaranga hypoleuca*	Native	LC	1	0.06
50	*Artocarpus dadah*	Native	EN	1	0.06
51	*Mangifera indica*	Non-Native	Casual	1	0.06
52	*Glochidion zeylanicum* var. *zeylanicum*	Native	VU	1	0.06
53	*Peltophorum pterocarpum*	Native	CR-C	1	0.06
54	*Pterocarpus indicus*	Non-Native	Casual	1	0.06
55	*Lagerstroemia speciosa*	Non-Native	Cultivated	1	0.06
56	*Elaeocarpus ferrugineus*	Native	VU	1	0.06
57	*Bambusa vulgaris*	Non-Native	Casual	2	0.12
58	cf. *Bambusa vulgaris*	-	-	25	1.51
59	UnID Timber Bamboo	-	-	6	0.36
			Total	**1661**	**100.00**

Large Specimens

A total of 115 large specimens were tagged in the Study Area. Large trees are measured either by the girth of a single stem, the sum of girths of all stems in trees with multiple stem attachments or overall spread for large strangling *Ficus* species (Figure 3-11; Figure 3-12; Table 3-6). Two tall specimens of Albizia (*Falcataria falcata*) with girths ≥ 3.0 m were found to harbour large raptor nests atop their canopies and were also classified as

large specimens instead. These nests likely belong to Changeable Hawk-eagles (*Nisaetus cirrhatus*) that were heard within the area during surveys, though no nest activity was observed during this time.

Table 3-6 Breakdown of All Mapped Large Specimens by Origin and Status

S/N	Species Name	Origin	Status	Counts	%
1	*Alstonia angustiloba*	Native	LC	7	6.1
2	*Ficus microcarpa*	Native	LC	2	1.7
3	*Bambusa vulgaris*	Non-Native	Casual	1	0.9
4	cf. *Bambusa vulgaris*	-	-	17	14.8
5	*Cyrtophyllum fragrans*	Native	LC	3	2.6
6	*Syzygium grande*	Native	LC	9	7.8
7	*Falcataria falcata*	Non-Native	Naturalised	60	52.2
8	*Adenanthera pavonina*	Non-Native	Naturalised	1	0.9
9	*Ficus benjamina*	Cryptogenic	Cryptogenic	1	0.9
10	*Ixonanthes reticulata*	Native	LC	1	0.9
11	*Spathodea campanulata*	Non-Native	Naturalised	1	0.9
12	*Senna siamea*	Non-Native	Cultivated	1	0.9
13	*Durio zibethinus*	Non-Native	Casual	1	0.9
14	*Samanea saman*	Non-Native	Casual	3	2.6
15	*Khaya grandifoliola*	-	-	2	1.7
16	*UnID Timber Bamboo*	-	-	5	4.3
			Total	**115**	**100.0**

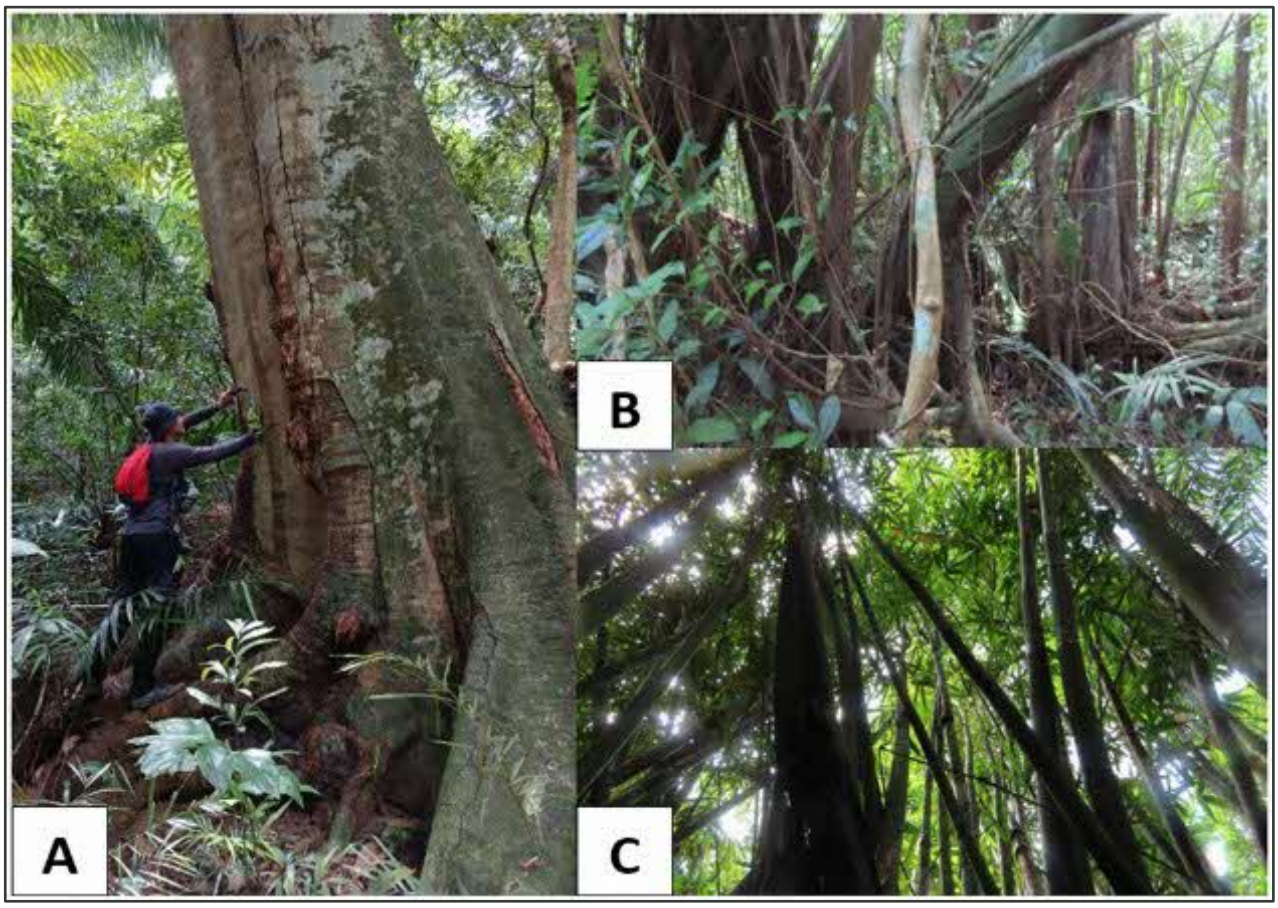


Figure 3-11 (A) Large specimen of *Falcataria falcata* (MSW1222) with 5.4 m girth, (B) *Ficus microcarpa* with 16 m spread (C) Large bamboo cluster (8 m spread)

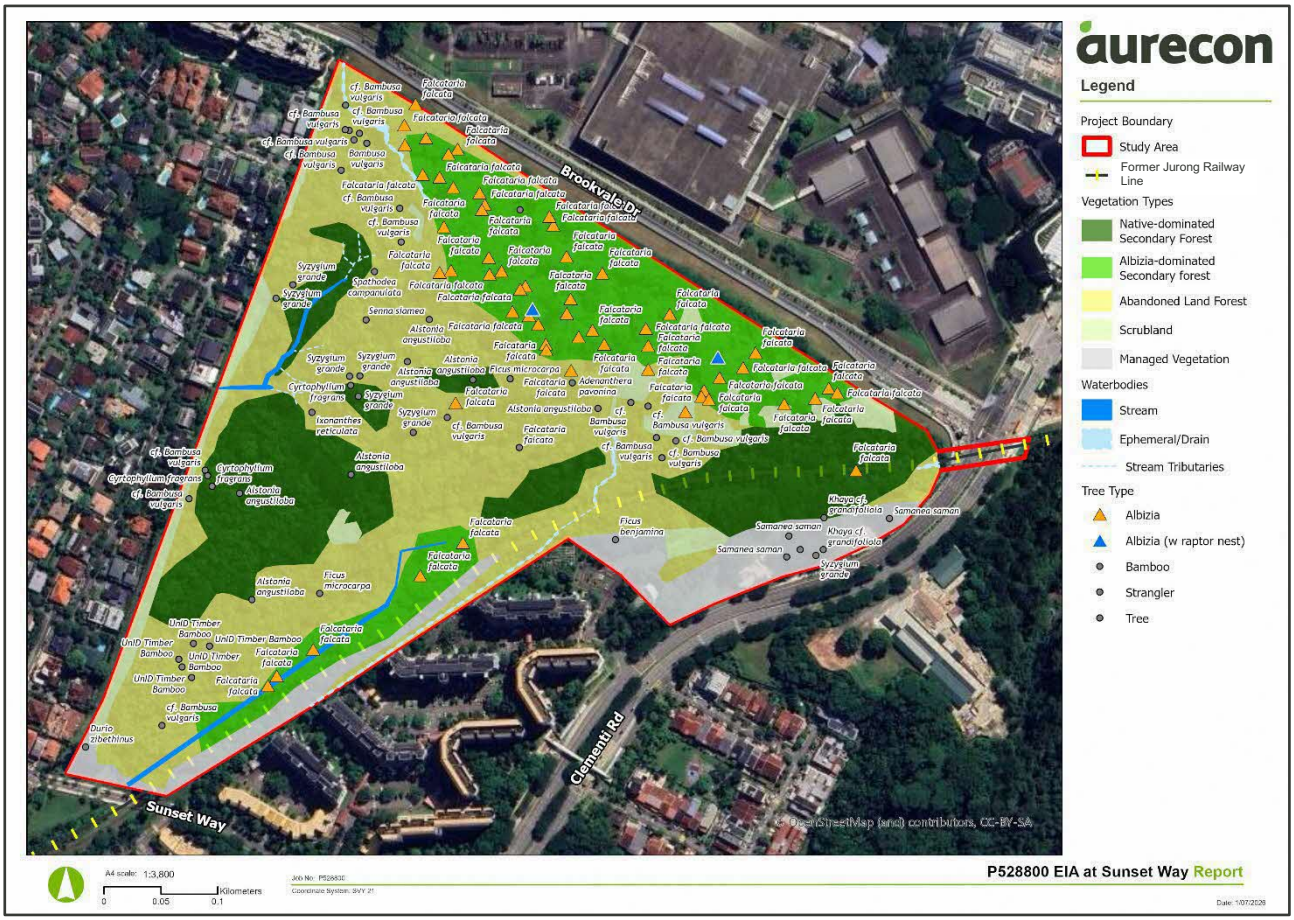


Figure 3-12 Map of all Mapped Large Trees Classified by Growth Habit (Bamboo, Strangler, Tree)

Other Specimens of Significant Value

Other specimens of value (OSV) include non-large *Ficus* specimens of low conservational significance, bamboo clusters which could provide refuge for bamboo bat roosting, as well butterfly host plants (Figure 3-13; Table 3-7).

Table 3-7 Breakdown of All Other Specimens of Value by Ecological Value Provided

OSV Type	Counts
Keystone (Non-large, non-CS)	81
Bamboo Bat Refuge (Non-large, non-CS)	10
Butterfly Host Plant	4

Ficus trees are ecologically valuable as sources of food for birds, mammals and bats all year round, and are thus known as keystone species. Several bamboo clusters (cf. *Bambusa vulgaris* and UnID Timber Bamboo) were recorded within the Study Area. Most of the stems of these clusters were large enough to accommodate bamboo bats (*Tylonycteris* sp.). Acoustic surveys conducted during the survey period had also confirmed the presence of this fauna within the Study Area

However, since larger Bamboo and *Ficus* clusters of ≥ 3.0 m in spread were recorded as large specimens, they are excluded from this category, though both still provide similar respective ecological values.

Several specimens of *Ardisia elliptica*, a host plant to the Critically Endangered Harlequin Butterfly (*Taxila haquinus haquinus*) were found bordering eastern perimeter of the Study Area, likely from dispersed seed of planted specimens along the roadside of Brookvale Drive.

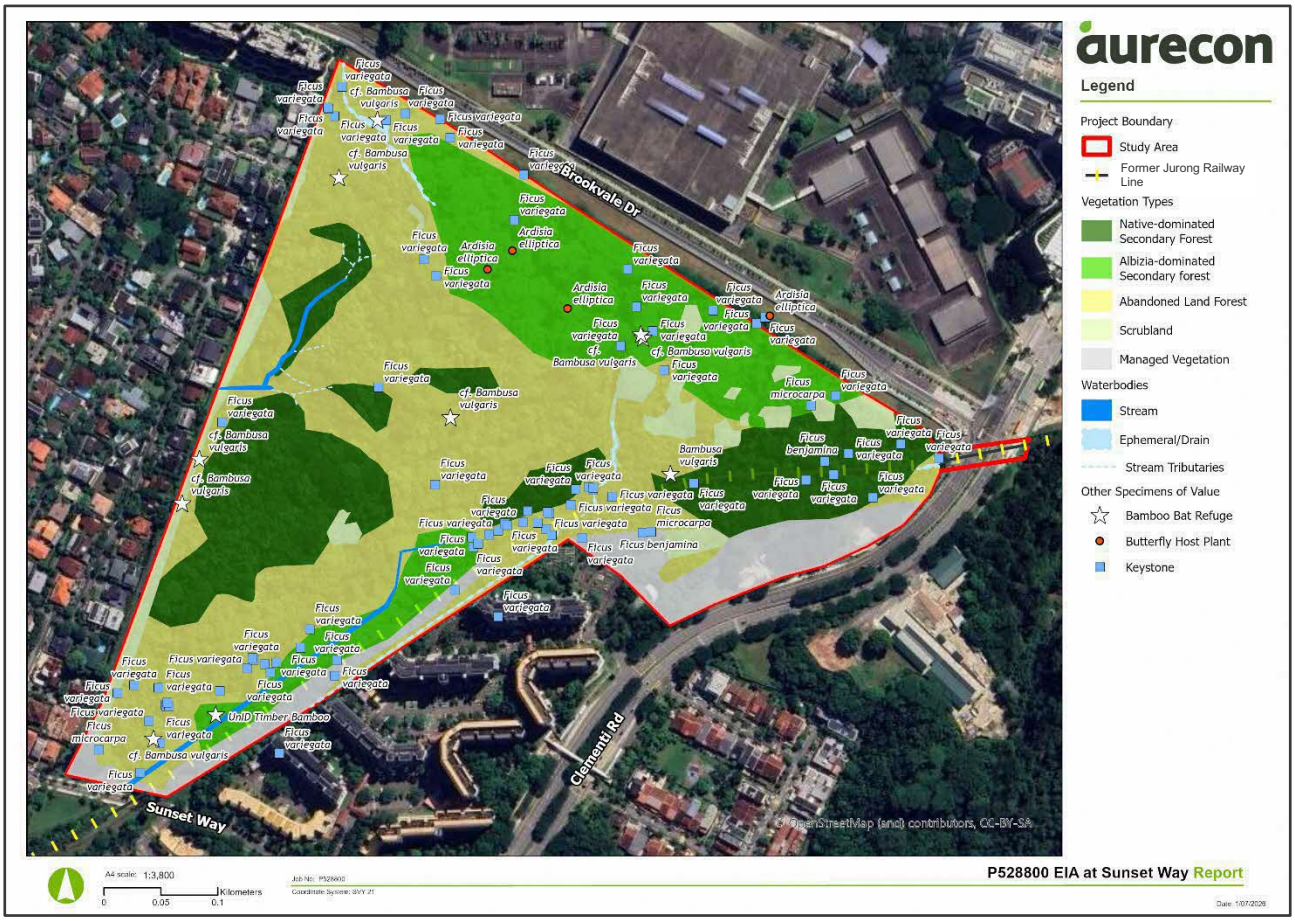


Figure 3-13 Map of all Other Specimens of Value, Classified by Value provided (Bamboo Bat Refuge, Keystone, Tree etc.)

3.2.4 General Walking Floristic Surveys

Methodology

General walking floristic surveys were conducted on foot throughout the entire Study Area. All plants observed within the Study Area during floristic surveys were identified to species whenever possible. A checklist of all the plant species recorded from the present floristic surveys were compiled.

For plants that could not be immediately identified with certainty in the field, photographs and/or voucher specimens were taken. They were then identified using identification keys, taxonomic descriptions, online plant photo databases, with the help of taxonomic experts, and/or by matching the pressed and dried collected specimens with existing specimens in the Singapore Botanic Gardens' Herbarium (SING), where feasible.

For very tall unidentifiable trees with leaves that were too high in the canopy to photograph, dried leaves matching these trees were collected from the forest floor and used to aid in species identification.

Results

The Study Area was found to contain a total of 286 species belonging to 95 families, of which 269 (94.06%) unique species were identified to certainty, while 17 species (5.94%), which includes those of both native and unknown origins, are indeterminate (see Table 3-8). Of this, 16 have been identified either to genus or family level, while one (1) remains unidentified. The single remaining unidentified species may include specimens of species already listed but may currently not be identifiable to certainty due to insufficient information resulting from either i) obstructed access, ii) poor specimen health or iii) inability to obtain fertile specimens. The full list of flora species can be found in Appendix B.

Table 3-8 Summary Breakdown (number and percentage) of Flora Species Seen Within the Study Area

Origin	Total Counts	Status	Counts	% of Total	Total Percentages (%)
Native	152	Least Concern [LC]	102	35.66	53.15
		Vulnerable [VU]	21	7.34	
		Endangered [EN]	10	3.50	
		Critically Endangered [CR]	5	1.75	
		Critically Endangered (Cultivated) [CR-C]	8	2.80	
		Presumed Nationally Extinct (Cultivated) [Nex-C]	2	0.70	
		Not Assessed [N/A]	0	0.00	
		Data Deficient [DD]	2	0.70	
		Indeterminate^ [-]	2	0.70	
Non-native	108	Cultivated	25	8.74	37.76
		Casual	33	11.54	
		Naturalised	49	17.13	
		Not assessed	0	0.00	
		Indeterminate^ [-]	1	0.35	
Cryptogenic*	12	Cryptogenic*	12	4.20	4.20
Not Assessed	0	Not Assessed	0	0.00	0.00
Indeterminate^	14	Indeterminate^	14	4.90	4.90
Total	**286**	**Total**	**286**	**100.00**	**100.00**

***** Cryptogenic species are "weeds of uncertain origin" — plants that cannot be definitively classified as native or exotic due to insufficient historical or biographical evidence (Chong et al., 2009).

^ Indeterminate species total to 17 but is further classified by origin here to aid in visual grouping.

Species of Conservation Significance

A cumulative total of 401 individual specimens and/or clusters from 48 species of conservation significance were recorded in the Study Area, of which 38 species are from wild populations, while 10 are deemed to be from cultivated populations (Table 3-9; Figure 3-14). Notably, five (5) Critically Endangered (wild) species were recorded: *Bouea macrophylla*, *Cryptocarya rugulosa*, *Dalbergia junghuhnii*, *Xanthophyllum stipitatum* and *Xanthophyllum ellipticum*. It should be noted, however, that *Ficus apiocarpa* clusters were too numerous to be tagged at all locations. Hence, aside from individual records, a rough estimate of locations was plotted on the map (Figure 3-16) to ensure consistency with the sheer density of clusters found.

In some cases, specimens recorded have yet to be identified to genus level. However, they were found to belong to a genus in which all locally recorded species in the flora databases of reference (Lindsay, 2022; SRDB3, 2024), are of conservation significance, or may possibly resemble a species known to be nationally threatened. For example, *Salacia* cf. *grandiflora*, whose status is undetermined, belongs to the *Salacia* genus, in which all species in these databases are listed as threatened.

Records of *Dalbergia junghuhnii* (Critically Endangered) (Figure 3-15C), a species suspected to be the same as those recorded in prior reports as *Dalbergia* cf. *junghuhnii* (AECOM, 2022), were found along the riparian zone of D/S25. This species was confirmed via examination of a specimen cutting at Singapore Botanic Gardens (SING) Herbarium.

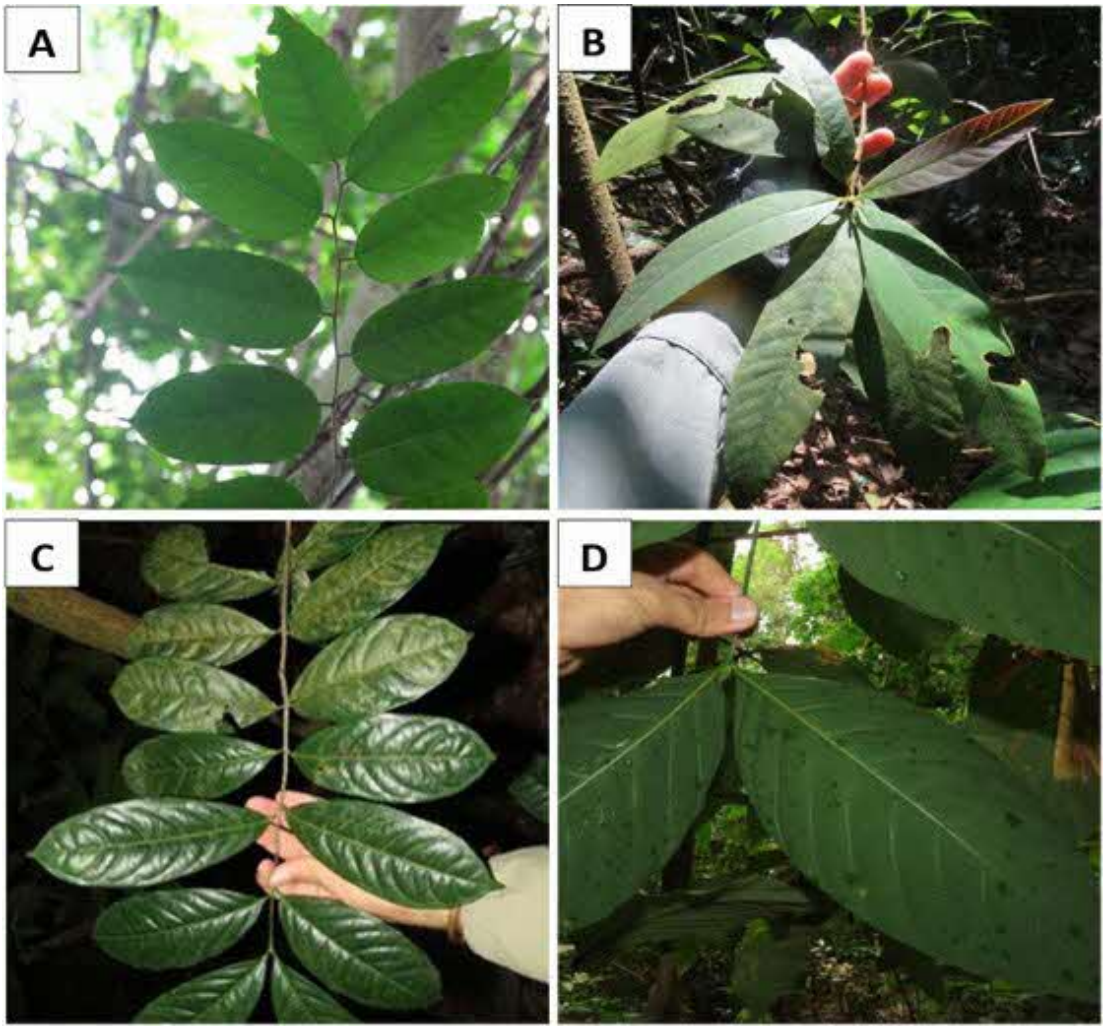


Figure 3-14 Wild Specimens of Conservation Significance recorded in the Study Area (A) Leaves of *Xanthophyllum stipitatum*, (B) Leaves of *Litsea umbellata* (*sensu lato*), (C) Leaves of *Salacia* cf. *korthalsiana*, (D) Leaves of *Uncaria longiflora* var. *pteropoda*

Table 3-9 Flora Specimens of Conservation Significance (SRDB3) Recorded from the Study Area

S/N	Scientific Name	Origin	Status (RDB3)[a]
1	*Bouea macrophylla*	Native	CR
2	*Cryptocarya rugulosa*	Native	CR
3	*Dalbergia junghuhnii*	Native	CR
4	*Xanthophyllum stipitatum*	Native	CR
5	*Xanthophyllum ellipticum*	Native	CR
6	*Archidendron microcarpum*	Native	EN
7	*Artocarpus dadah*	Native	EN
8	*Aspidopterys concava*	Native	EN
9	*Eurycoma longifolia*	Native	EN
10	*Ficus apiocarpa*	Native	EN
11	*Litsea grandis*	Native	EN
12	*Melicope lunu-ankenda*	Native	EN
13	*Strophanthus caudatus*	Native	EN
14	*Uncaria cordata*	Native	EN
15	*Uncaria longiflora* var. *pteropoda*	Native	EN
16	*Adina eurhyncha*	Native	VU
17	*Angelesia splendens*	Native	VU
18	*Angiopteris evecta*	Native	VU
19	*Aporosa benthamiana*	Native	VU

S/N	Scientific Name	Origin	Status (RDB3)[a]
20	*Breynia androgyna*	Native	VU
21	*Callicarpa longifolia*	Native	VU
22	*Calophyllum tetrapterum*	Native	VU
23	*Cerbera odollam*	Native	VU
24	*Cissus repens*	Native	VU
25	*Cyperus brevifolius*	Native	VU
26	*Elaeocarpus ferrugineus*	Native	VU
27	*Galearia fulva*	Native	VU
28	*Glochidion zeylanicum* var. *zeylanicum*	Native	VU
29	*Gynochthodes rigida*	Native	VU
30	*Horsfieldia polyspherula*	Native	VU
31	*Litsea umbellata (sensu lato)*	Native	VU
32	*Macaranga griffithiana*	Native	VU
33	*Maesa sumatrana*	Native	VU
34	*Oncosperma horridum*	Native	VU
35	*Parkia speciosa*	Native	VU
36	*Sandoricum koetjape*	Native	VU
37	*Leea rubra*	Native	Presumed NEx-C
38	*Procris repens*	Native	Presumed NEx-C
39	*Garcinia mangostana*	Native	CR-C
40	*Baccaurea motleyana*	Native	CR-C
41	*Syzygium myrtifolium*	Native	CR-C
42	*Sterculia parviflora*	Native	CR-C
43	*Cyrtostachys renda*	Native	CR-C
44	*Gnetum gnemon* var. *gnemon*	Native	CR-C
45	*Calophyllum soulattri*	Native	CR-C
46	*Peltophorum Pterocarpum*	Native	CR-C
	Uncertain ID*		
47	*Salacia* cf. *korthalsiana*	Native	VU or Higher
48	*Dalbergia* cf. *parviflora*	Native	Threatened (Possibly)

*These species have been identified to be best possible effort by the Flora Specialist and NParks Herbarium at the time of writing (see Appendix B). Their status and species name shall remain as such until such a time whereby additional information surface or otherwise.
[a]Classification is based on the latest SRDB3 (2024), and changes to status may occur after SRDB2 (2008)

Wild Specimens

There were 197 entries (individuals/clusters) of 38 species of wild specimens of conservation significance in total across the Study Area, recording lone individuals, or clusters within a 5 m radius.

Litsea umbellata (*sensu lato*) was prevalent within the Study Area (Figure 3-15B), mainly recorded in the native-dominated secondary forest, and sometimes within abandoned land forests, but also among smaller pockets of native vegetation that did not meet the minimum threshold to be classified as a native-dominated patch. The term *sensu lato* is used here, directly translating to 'In the broad sense', to clarify that this species of *Lauraceae*, which may also be identified as *Litsea firma* by some specialists, have yet to be strictly classified into one species due to unresolved discrepancies in taxonomic description.

Within the southwestern native-dominated secondary forest patch, uncommon species like *Eurycoma longifolia* (EN) and *Calophyllum tetrapterum* (VU) were also noted, alongside more common species like *Melicope lunu-ankenda* and *Macaranga griffithiana*. A young tree of *Elaeocarpus ferrugineus* with girth 0.6 m was also recorded here.

One instance of *Xanthophyllum stipitatum* (CR) was also recorded in the northwest portion of the Study Area, in the abandoned land forest (Figure 3-15A). This sapling was 0.1 m in girth and 2 m tall. A few instances of *Horsfieldia polyspherula* (VU), including shrubs and small trees were recorded across the Study Area.

Besides *Dalbergia junghuhnii*, *Dalbergia* cf. *parviflora* was also recorded at the start of D/S25. Found in a big cluster, with smaller saplings scattered nearby. This had not been recorded in previous surveys, and *Dalbergia parviflora* is categorised as critically endangered. Additionally, one specimen of a small *Bouea macrophylla* (CR) tree was also found within the riparian zone of the natural stream D/S25.

Ficus apiocarpa (Figure 3-15A), an endangered climber from the *Moraceae* family, was most prevalent in the south of the Study Area, where most entries were dense clusters. As mentioned above, in addition to the recorded locations, estimated locations were based on observation and reflected in the map (Figure 3-15).

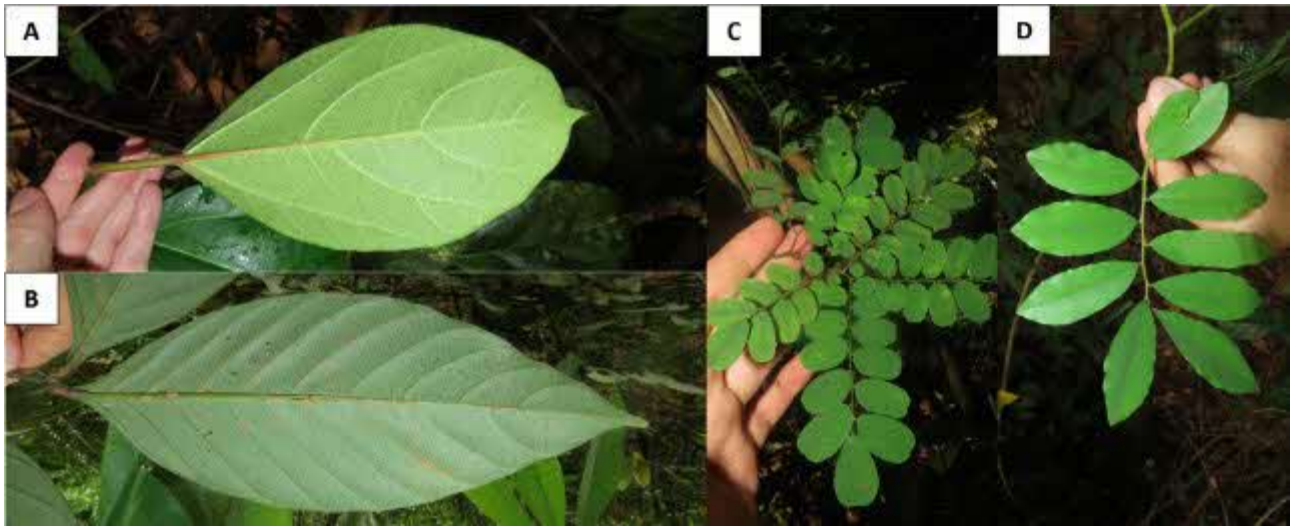


Figure 3-15 (A) *Ficus apiocarpa* leaf underside, showing reddish petiole & punctate tertiary venation patterns, (B) *Uncaria longiflora* var. *pteropoda* leaf underside, broad elliptic shape with scalariform tertiary venation, (C) Oblong leaflets of *Dalbergia junghuhnii*, (D) Elliptic leaflets of *Dalbergia* cf. *parviflora*

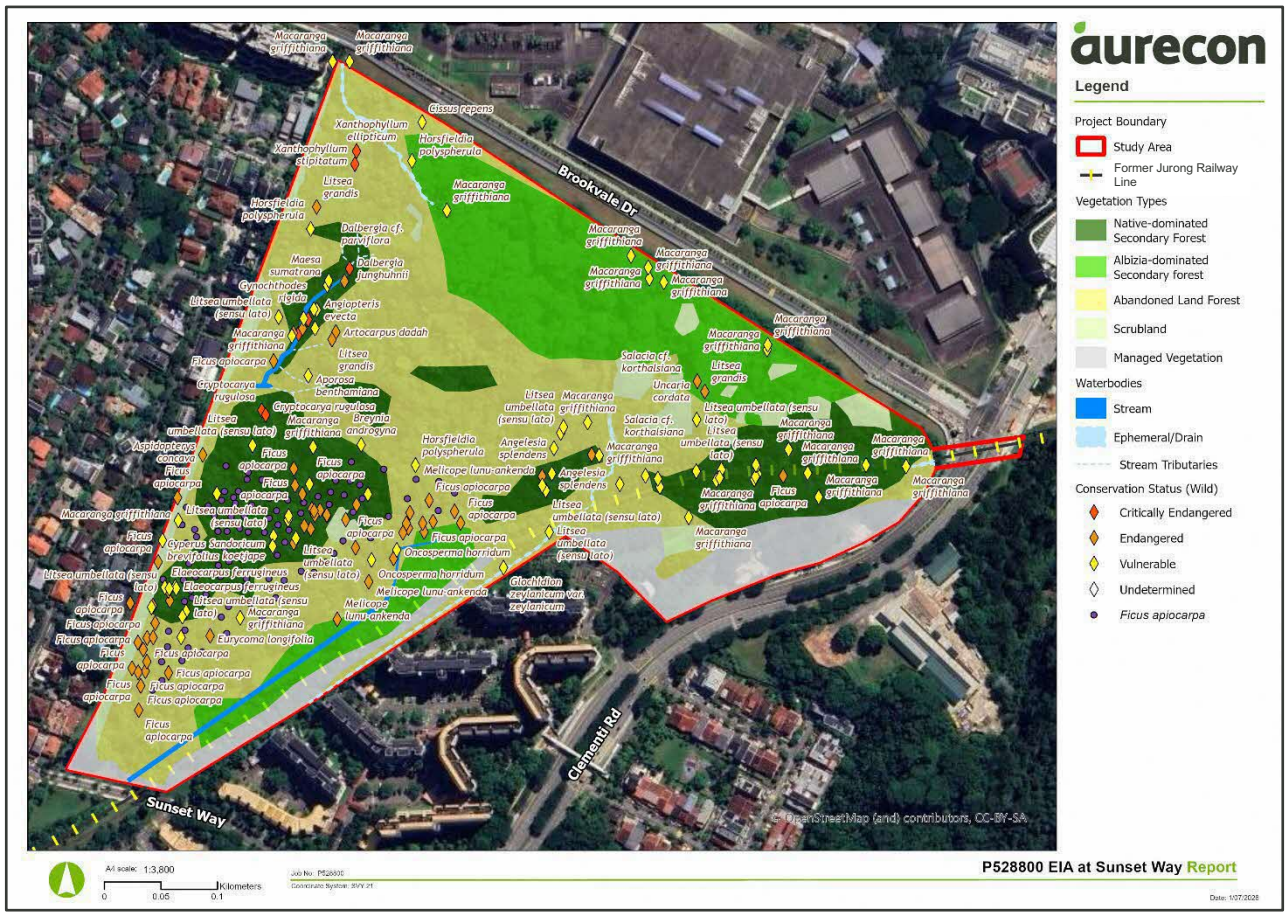


Figure 3-16 Map of all Wild CS Species Classified by Nationally Threatened Status (Critically Endangered, Endangered, Vulnerable, Undetermined)

Cultivated Specimens

There were 204 entries (individuals/clusters) of 10 species of likely cultivated specimens of conservation significance in total across the Study Area, recording lone individuals, or clusters within a 5 m radius.

Self-sustaining populations of cultivated specimens of *Baccaurea motleyana* and *Syzygium myrtifolium* (both CR in the wild), were found within the Study Area (Figure 3-17; Figure 3-18). These were possibly being progeny of parent trees once planted nearby or within the Study Area, before being dispersed into and around the area. The Critically Endangered Lipstick Palm (*Cyrtostachys renda*; Figure 3-17A) was also recorded mainly within native-dominated patches and is likely cultivated. Wild populations, however, have recently been recorded in Nee Soon Swamp Forest.

A cluster of *Procris repens* (Presumed Nationally Extinct in the wild) was also found close to the concrete drainage canal in the southeast, just before the Study Area boundary. This cluster is likely an escapee from cultivation, possibly from the adjacent community gardens or HDB flats. This species favours moist, well-draining soils that can be found in such areas. It is noted that this species is only found in cultivation now, and no records have been listed in the wild as of recent.

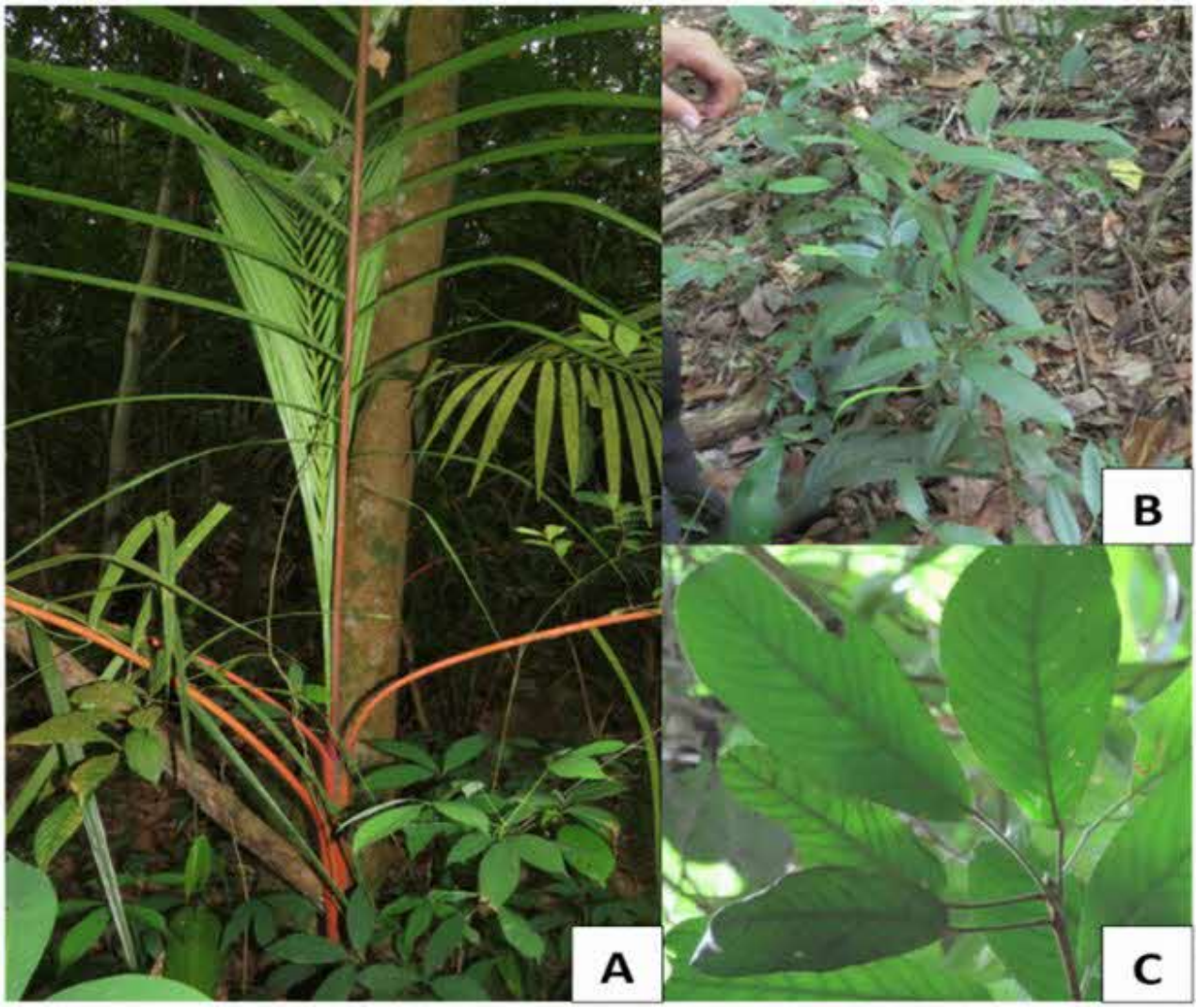


Figure 3-17 (A) Lipstick Palm (*Cyrtostachys renda*), (B) *Syzygium myrtifolium* shrub ~1 m height, (C) Foliage of *Baccaurea motleyana*

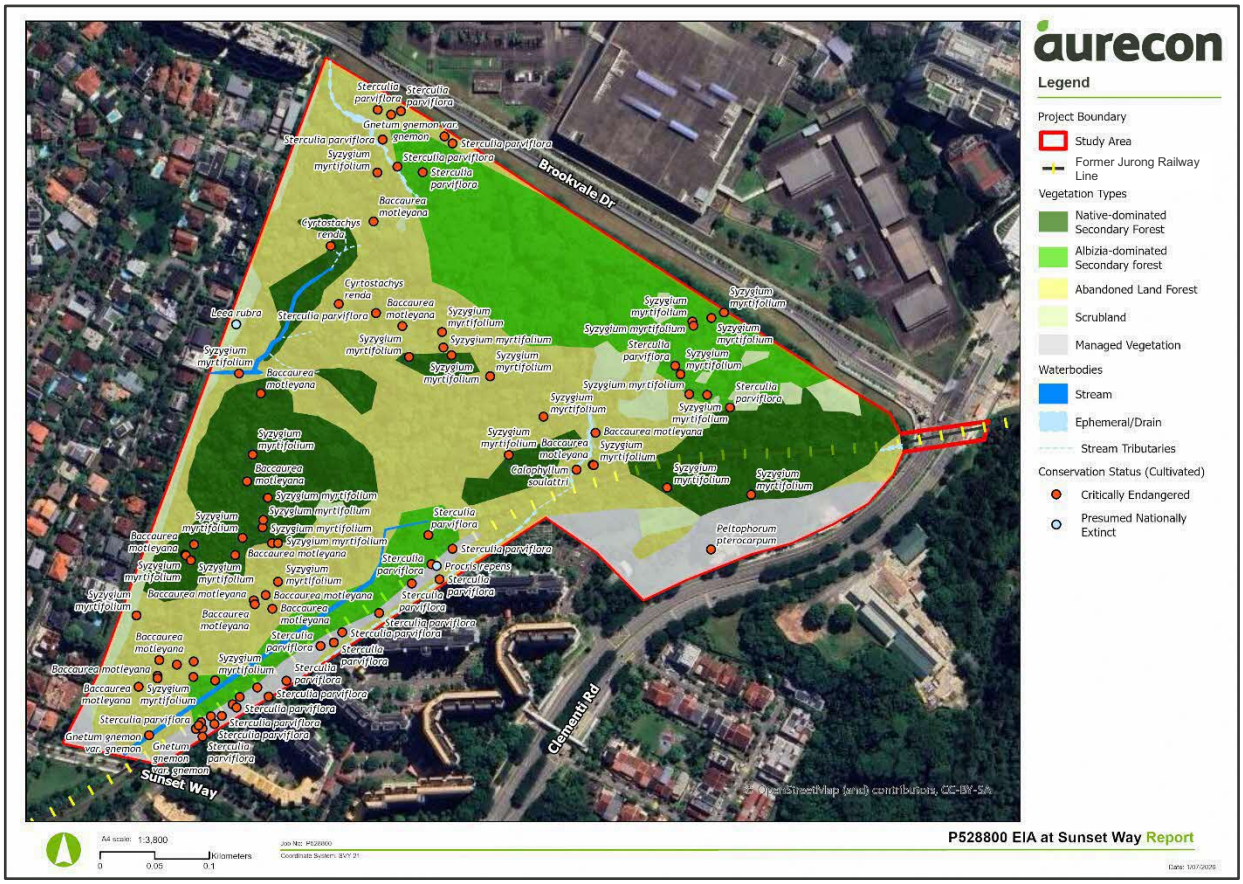


Figure 3-18 Map of all Cultivated CS Species Classified by Nationally Threatened Status (Presumed Nationally Extinct (Cultivated), Critically Endangered (Cultivated))

3.2.5 Mapping of Water Catchment and Ephemeral Tributaries

Riparian habitats, such as those found surrounding D/S25 stream, are considered uncommon landscape elements in Singapore's forests (Kennedy, 2003; Yeo et al., 2010). These habitats are considered critical habitats as they support riparian vegetation that are not typically found in terrestrial habitats (Mello et al., 2017; Luke et al., 2018).

The natural stream D/S25 and its sources were determined to obtain a clearer picture of the catchment or watershed (used interchangeably here) as a whole, to provide a better context for development in this area, so as to preserve stream flow, water quality and ultimately, microclimate function.

To better ascertain the Proposed Retained Areas (PRAs) boundaries, the natural stream D/S25 was assessed further to determine the presence and locations of stream "branches" or tributaries within the surrounding forest, where rainwater or runoff is collected and drains into the headwater of D/S25.

A desktop study was done on GIS using topographical data to estimate the size of the catchment basin (Figure 3-19) as well as to estimate the presence and locations of these tributaries. This was subsequently verified on the ground by visual observation and GPS coordinate captures of these tributaries to accurately match them up to the estimates.

For the desktop study, a digital elevation model (DEM) was generated based on the contours of the Study Area. The DEM was processed by breaching existing depressions. This processing step is deemed suitable to remove artificial depressions in the hydrological analysis of small catchments with good-resolution DEMs. This processed DEM was then used to run a Strahler Order operation, which provided an initial output of the existing drainage network of the site, of which the catchment of D/S25 was calculated to be approximately 2.68 ha (Figure 3-19). Strahler Order is a hydrological classification method that classifies stream network hierarchies, assigning an order of one to unbranched headwater streams (i.e. streams without tributaries).

When streams of the same order merge, the downstream segment increases in order. Lower-order streams were removed from visualisation for clarity.

Field observations have also determined these tributaries to be ephemeral. In the headstream, they appear as narrow channels with depths of about 15 – 20 cm, primarily comprising soil substrate and usually moist to the touch (Figure 3-20A), while in the south (towards the bend), they are relatively flat channels of sandy substrate, with water depths between 5 – 15 cm with the gentle flows of water running downslope, entering D/S25 (Figure 3-21). The water sources of D/S25 were hence concluded to be from rainwater, runoff and likely groundwater sources, hence pointing towards a dependency on the surrounding vegetation. This further reinforces the justification for preserving the surrounding vegetation within the catchment.

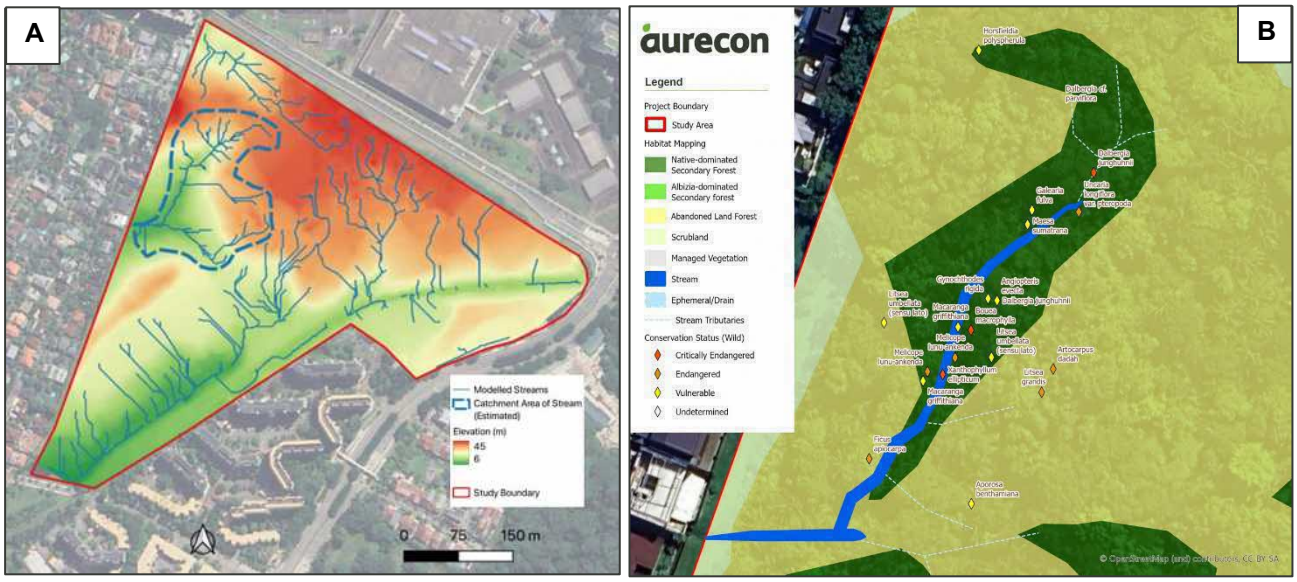


Figure 3-19 (A) Modelled GIS Mapping of estimated water catchment basin with D/S25 catchment area (marked in the map) estimated as 2.68 ha based on the extent of its tributaries. (B) Habitat mapping with field verified D/S25 stream tributaries mapped out

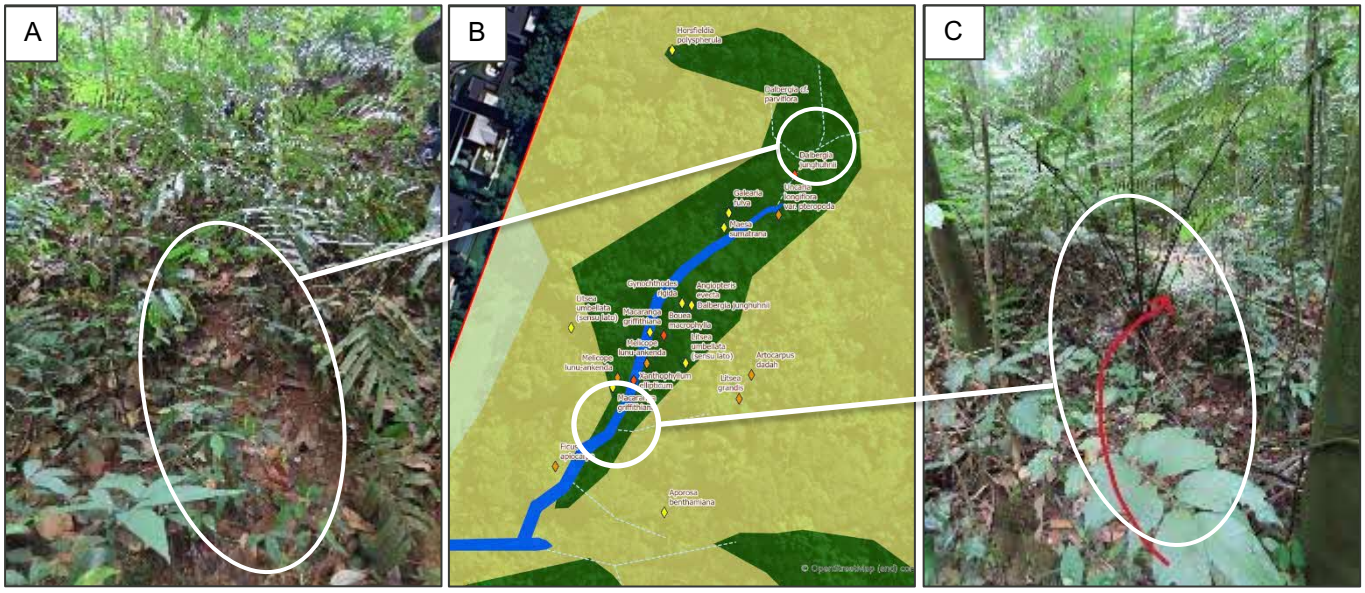


Figure 3-20 Field verified ephemeral tributaries of D/S25. (A) Runoff tributary identified north of headstream, with bare and moist soil running downhill, (B) Map locations of tributaries, (C) Eastern tributary downstream, covered by leaf litter and draining into main waterbody



Figure 3-21 Field verified stream tributaries (A) Stream tributary with gentle flow, along the bend near the South end. (B): Stream tributary draining into main waterbody (C), the ephemeral section of the main stream

Riparian Zones and Buffers

Importance of Riparian Buffers & Stream Catchments

Riparian zones are vegetated areas of land that run parallel to the streams (Figure 3-22). They serve as transition zones between aquatic ecosystems and adjacent upland terrestrial areas (Mello et al., 2017). Riparian forest cover plays an important role in biogeochemical cycles in catchments. The vegetation provides protection against erosion, acts as filters by trapping or removing non-point pollutants (NPSP – i.e. contaminants from pesticides, excessive nutrients runoff and sediment from upland soils), and it has an influence on water temperature, all of which are crucial for the survival of aquatic organisms (Mello et al., 2017; Liu et al., 2022). Despite that, riparian forests remain one of the most degraded ecosystems in the world (Mello et al., 2017).

The preservation of stream catchments in addition to maintaining riparian zones as buffers is important because their degradation can result in negative impacts such as increased run-off, sedimentation, increased risk of flash floods and affect Singapore's native flora and fauna that are associated with these habitats (Liu et al., 2022).



Figure 3-22 Riparian vegetation around stream D/S25, consisting of mainly *Alsophila latebrosa*, *Blechnopsis finlaysoniana* among other shrubs and saplings

Spatial Distribution of Riparian Buffers

The spatial distribution of buffer strips within the water catchment significantly influences water quality. Riparian buffers, specifically along headwater streams (i.e. first-, second-, and third-order streams) have a greater impact on catchment-wide water quality compared to buffers along downstream channels (Fischer & Fischenich, 2000). Hence, it is recommended that the ephemeral tributaries draining into the headwater of D/S25 in the northwest should be retained as much as possible to continue these ecosystem services.

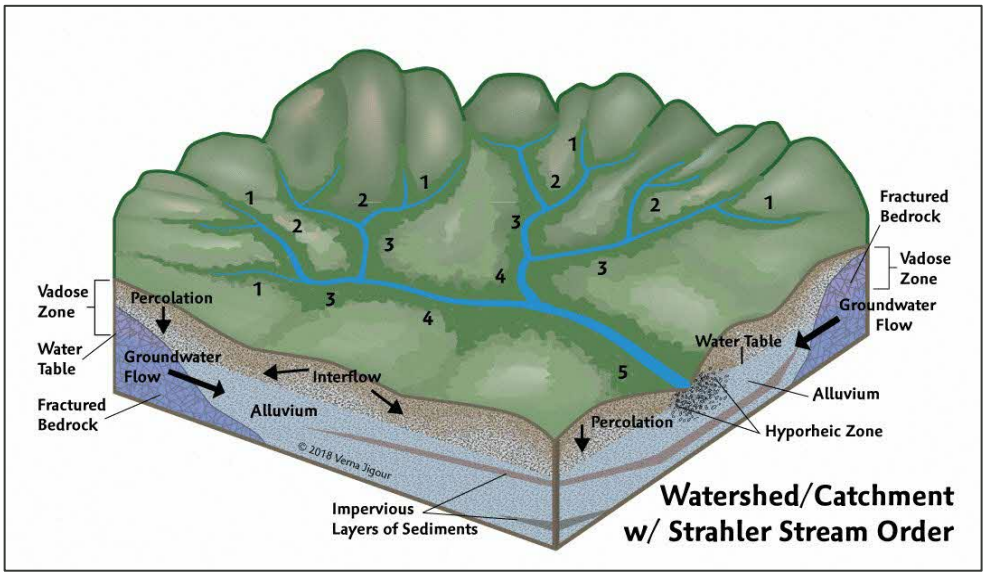


Figure 3-23 Diagram of watershed catchment showing Strahler's Stream Order (Rainfall to Groundwater, n.d.)

3.2.6 Comparison with Past EIA

The most recent baseline study conducted in 2022 by AECOM highlighted 304 species, with nine (9) species unable to be identified to certainty. While floristic findings from this study here reflect closely matching numbers of 286 species, it is important to note that here, 17 species have yet to be identified to certainty (i.e. indeterminate).

Habitat mapping, as mentioned above, also differ slightly from that in the 2022 report by AECOM, as current survey methodology may have been executed differently from previous reports. Species compositions, forest dynamics, and weightages given in canopy and understorey assessments to determine ecological value may have differed. Maps were drawn in this study by observing both canopy and undergrowth species composition; while taking into account the updated nationally threatened statuses of species present in each habitat.

As for species of conservation significance, a comparison between the latest two baseline findings is listed in the table below (Table 3-10). This table uses strikeouts to highlight the demotion of many species from prior nationally threatened status to 'Least Concern (LC)', largely due to review of status in RDB3. Therefore, a comparison between numbers of CS species found among both studies may not be a valid gauge of survey quality. The table also highlights species name changes in a similar manner, to accurately reflect the recent changes.

Table 3-10 Comparison of CS Flora Species across EIA Studies

S/N	Flora Species	National Status	AECOM 2022	Aurecon 2025
1	*Adina eurhyncha*	VU	-	Possible - (ID - *Adina* cf. *eurhyncha)*
2	*Agelaea macrophylla*	~~CR~~ LC	Present	Present
3	~~*Cyathea latebrosa*~~ *Alsophila latebrosa*	~~VU~~ LC	Present	Present
4	~~*Amphineuron opulentum*~~ *Amblovenatum opulentum*	~~EN~~ LC	Present	Possible - Pending ID
5	*Angiopteris evecta*	VU	Present	Present
6	*Aphanamixis polystachya*	~~VU~~ LC	Present	Present
7	*Aporosa benthamiana*	VU	Present	Present
8	*Archidendron* cf. *jiringa*	VU	Present	Possible - (ID – *Archidendron microcarpum*)
9	*Aspidopterys concava*	EN	Present	Present
10	*Artocarpus dadah*	Threatened (Possibly)	-	Present
11	*Baccaurea motleyana*	CR (Cultivated)	Present	Present
12	~~*Bauhinia semibifida*~~ *Phanera semibifida*	VU	Present	-
13	*Bouea macrophylla*	CR	-	Present
14	*Bridelia stipularis*	~~VU~~ LC	Present	Present
15	*Caesalpinia sumatrana* *Mezoneuron sumatranum*	CR	Present	-
16	*Callicarpa longifolia*	CR	Present	Present
17	*Calophyllum tetrapterum*	VU	-	Present
18	*Calophyllum soulattri*	CR (Cultivated)	Present	Present
19	*Cansjera rheedei*	~~VU~~ LC	Present	-
20	*Carallia brachiata*	EN	Present	-
21	*Centotheca lappacea*	~~CR~~ LC	Present	Present
22	*Cerbera odollam*	VU	-	Present
23	*Cissus repens*	VU	-	Present
24	*Connarus semidecandrus*	CR	Present	-
25	*Cryptocarya ferrea*	~~CR~~ EN	Present	-
26	*Cryptocarya rugulosa*	CR	-	Present

S/N	Flora Species	National Status	AECOM 2022	Aurecon 2025
27	*Cyrtostachys renda*	~~NEx~~ CR (Cultivated)	Present	Present
28	*Cyperus brevifolius*	VU	-	Present
29	*Dalbergia junghuhnii*	CR	Possible - (ID - *Dalbergia* cf. *junghuhnii*)	Present
30	*Dissochaeta gracilis*	VU	Present	-
31	~~*Dioscorea orbiculata* var. *tenuifolia*~~ *Dioscorea tenuifolia*	-	Present	Present
32	~~*Dysoxylum cauliflorum*~~ *Epicharis cuneata*	VU	Present	-
33	*Elaeocarpus ferrugineus*	VU	Present	Present
34	*Epipremnum pinnatum*	~~CR~~ Non-Native	Present	Present
35	*Eurycoma longifolia*	Native	-	Present
36	*Ficus apiocarpa*	EN	Present	Present
37	*Ficus aurata* var. *aurata*	~~VU~~ LC	Present	Present
38	*Galearia fulva*	VU	Present	Present
39	*Garcinia griffithii*	EN	Present	Possible - (ID - *Garcinia mangostana* [CR])
40	*Glochidon zeylanicum* var. *zeylanicum*	VU	Present	Present
41	*Gnetum gnemon var. gnemon*	CR (Cultivated)	Present	Present
42	*Goniophlebium percussum*	VU	Present	-
43	*Guioa pubescens*	~~VU~~ LC	Present	Present
44	*Gymnacranthera farquhariana* var. *farquhariana*	CR	Present	-
45	*Gymnacranthera forbesii*	CR	Present	-
46	*Gynochthodes rigida*	VU	-	Present
47	*Horsfieldia polyspherula*	VU	Present	Present
48	*Leea rubra*	NEx (Cultivated)	-	Present
49	*Limacia scandens*	~~VU~~ LC	Present	Present
50	*Litsea castanea*	EN	Present	-
51	*Litsea grandis*	EN	Possible (ID - *Litsea* cf. *grandis*)	Present
52	~~*Litsea firma*~~ *Litsea umbellata (sensu lato)*	VU	Present	Present
53	*Lomariopsis lineata*	~~CR~~ EN	Present	-
54	*Lygodium longifolium*	~~VU~~ LC	Present	-
55	*Macaranga griffithiana*	VU	Present	Present
56	*Macaranga hullettii*	CR		
57	*Maesa sumatrana*	VU	-	Present
58	*Melicope glabra*	VU	Present	Possible - (ID - *Melicope lunu-ankenda*)
59	*Melicope lunu-ankenda*	EN	-	Present
60	*Nephelium lappaceum*	~~CR~~ Cryptogenic	Present	Present
61	*Oncosperma horridum*	VU	Present	Present
62	*Oxyceros longiflorus*	~~VU~~ LC	Present	Present
63	*Parkia speciosa*	VU	-	Present
64	*Peltophorum pterocarpum*	CR (Cultivated)	Present	Present
65	*Podocarpus polystachyus*	CR	-	-
66	*Procris repens*	NEx (Cultivated)	-	Present
67	*Pteris semipinnata*	VU	Present	-
68	*Sandoricum koetjape*	VU	-	Present
69	*Salacia* cf. *korthalsiana*	CR	Present	Present

S/N	Flora Species	National Status	AECOM 2022	Aurecon 2025
70	~~*Sauropus androgynus*~~ *Breynia androgyna*	~~LC~~ VU	Present	Present
71	~~*Selaginella intermedia*~~ *Selaginella intermedia* var. *intermedia*	VU	Present	-
72	*Sterculia parviflora*	CR (Cultivated)	Present	-
73	*Strophanthus caudatus*	~~CR~~ EN	Possible (ID - *Strophanthus cf. caudatus*)	Present
74	*Syzygium myrtifolium*	~~NE~~ CR (Cultivated)	Present	Present
75	*Syzygium polyanthum*	~~VU~~ LC	Present	Present
76	*Tectaria* cf. *semipinnata*	~~EN~~ Non-Native	Present	-
77	*Uncaria longiflora* var. *pteropoda*	~~CR~~ EN	Present	Present
78	*Uncaria cordata*	EN	-	Present
79	*Xanthophyllum ellipticum*	CR	-	Present
80	*Xanthophyllum stipitatum*	CR	Possible (ID – *Xanthophyllum eurhynchum*)	Present
81	*Xylopia caudata*	VU	Present	-
82	*Dalbergia* cf. *parviflora*	Threatened (Possibly)	-	Present

3.3 Fauna

3.3.1 Fauna Results Summary

Overall, a total of 113 fauna species were recorded – 103 from transect surveys, three (3) only from bat song meters, three (3) only from camera traps, and four (4) only from aquatic surveys – were recorded across five (5) different taxa: Birds, Mammals, Herpetofauna, Butterflies, Odonata and others (see Appendix C for taxa under 'others'). Of which, six (6) species are of conservation significance (Table 3-11). The full list of fauna species can be found in Appendix C.

Fauna of Conservation Significance

A total of six (6) fauna species of conservation significance (CS) recorded. Figure 3-24 shows the spatial distribution of fauna species of conservation significance. Four (4) out of the six (6) CS species recorded were birds while the remaining two (2) were mammals (Figure 3-24; Table 3-11). It is also worth noting that the CS species recorded here are not unique to the area and can be found in other locations across Singapore.

Table 3-11 Fauna Species of Conservation Significance

Scientific Name	Common Name	Taxa	IUCN	SRDB3	Transect
Ketupa ketupu	Buffy Fish-owl	Bird	LC	VU	T01
Tylonycteris sp.	Bamboo Bat sp.	Mammal	LC	VU	T02
Macaca fascicularis	Long-tailed Macaque	Mammal	EN	LC	Incidental
Pycnonotus zeylanicus	Straw-headed Bulbul	Bird	CR	EN	T01 & T02
Nisaetus cirrhatus	Changeable Hawk-eagle	Bird	LC	VU	Incidental
Copsychus saularis	Oriental Magpie-robin	Bird	LC	VU	Incidental

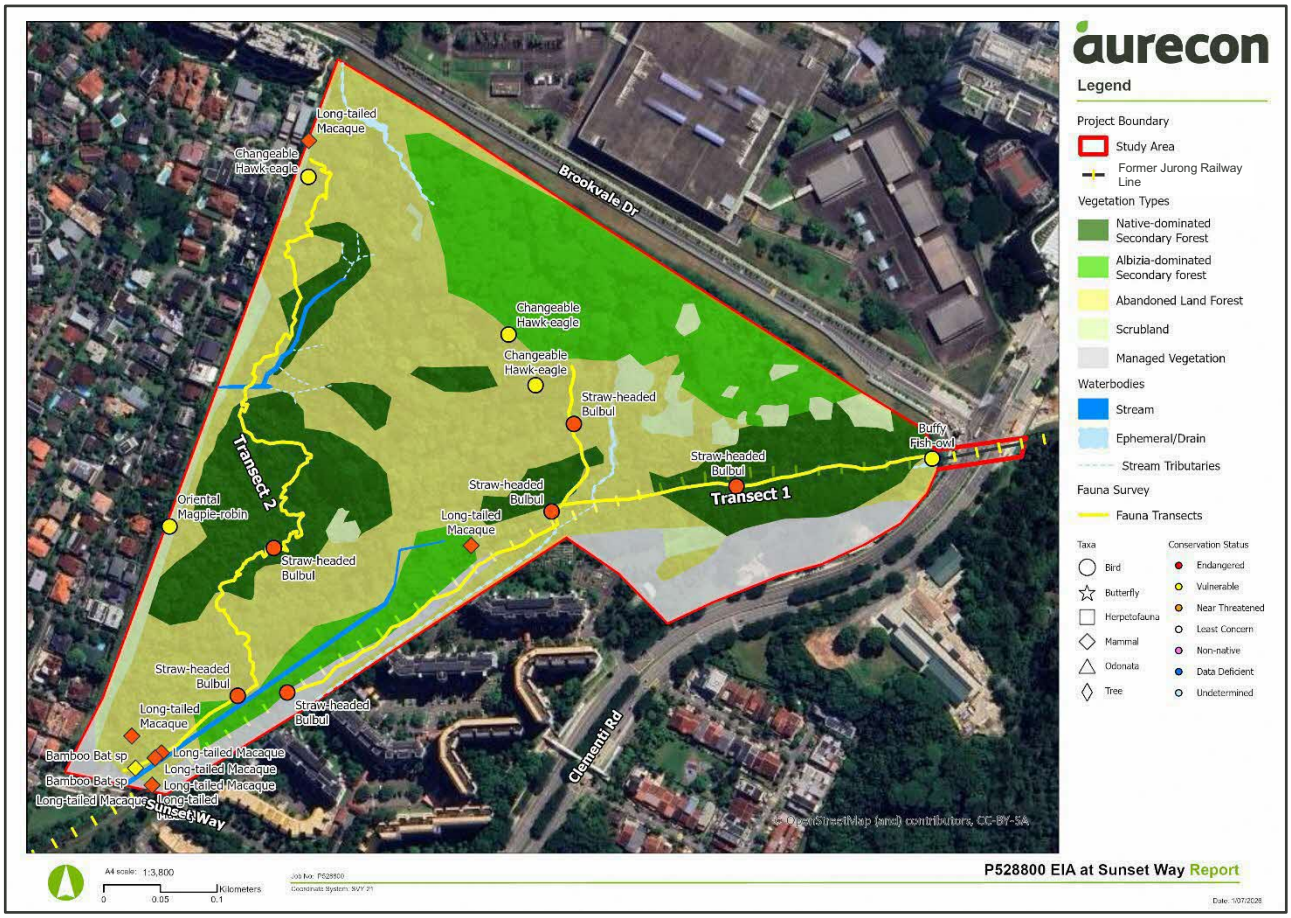


Figure 3-24 Map of CS Fauna Species across the Study Area

3.3.2 Transect Surveys

Methodology

The terrestrial fauna surveys for birds, mammals, amphibians, reptiles, odonates, and butterflies were conducted using walking line transect surveys with the aid of binoculars and torches. The surveyors walked along the pre-determined transects at a steady pace, recording all direct and indirect wildlife observations at appropriate distances on both sides and ahead of the transects. All fauna surveys were conducted in accordance with the NParks' BIA guidelines.

Species of conservation significance were identified based on their status as outlined in the Singapore Red Data Book (SRDB) (NParks, 2024) and the International Union for Conservation of Nature (IUCN) Red List of Threatened Species for their national and international statuses, respectively. The encounter locations of conservation-significant species were also recorded. The relevant ecological and geographical data were formatted in accordance with the national Standardisation Guide for Terrestrial Environmental Impact Assessment and/or Environmental Monitoring and Management Program Data, where applicable. *Species of conservation significance are those with local or international status of Vulnerable (VU) and above*.

A total of two transects were established, Transect 1 (760 m long) along the eastern side and Transect 2 (920 m long) on the western side (Figure 3-24; Table 3-13). One replicate of surveys was done across the Study Area between the two transects. The data collection was conducted between 5 June – 31 August 2025.

These transects were established following the paths taken by the EIA done by AECOM in 2022 for comparative relevance (AECOM, 2022), and guidance was also taken from NParks' BIA guidelines (NParks, 2024). It should be noted that the current baseline survey serves as a revalidation survey to the previous flora and fauna survey conducted by AECOM from November 2019 to March 2020, which included the migratory bird season.

Opportunistic observations of wildlife within the Study Area and the surroundings were also recorded, with an emphasis on avifaunal communities, herpetofauna (reptiles and amphibians), butterflies and odonates. A summary of the taxa surveyed, and their respective survey methodologies is presented in Table 3-12 below.

Table 3-12 Overview of Terrestrial Fauna Taxa and Their Associated Survey Methods

Taxon	Timing	Survey Type	Survey Technique	Sampling Frequency (per transect/point)
Herpetofauna (Amphibians and reptiles)	0700 – 1000 1900 – 2200	Diurnal and nocturnal transect surveys	Field survey – Visual and auditory	One (1) diurnal survey One (1) nocturnal survey
Birds		Diurnal and nocturnal transect surveys		One (1) diurnal survey One (1) nocturnal survey
Mammals (Non-volant)		Diurnal and nocturnal transect surveys		One (1) diurnal survey One (1) nocturnal survey
	Continuous	Camera Trapping (6 points, 1 trap at each point)	-	24 hours; 60 days
Mammals (Bats)	1900 – 0700	Nocturnal surveys	Bioacoustics trap surveys (4 points, 1 trap at each point)	Two (2) continuous nights; One (1) deployment
	1900 – 2200		Field survey – Visual and bioacoustics	One (1) nocturnal survey
Odonates and Butterflies	1000 – 1200	Diurnal transect surveys	Field survey – Visual	One (1) diurnal survey
Aquatic fauna	-	-	Push or scoop netting; Baited traps	One (1) survey per stream



Figure 3-25 Locations of Fauna Sampling Locations

Table 3-13 Transect Locations for Fauna Survey

Station ID		Latitude	Longitude
T01	Start	1°19'27.31"N	103°46'11.98"E
	End	1°19'33.98"N	103°46'30.25"E
T02	Start	1°19'25.06"N	103°46'7.12"E
	End	1°19'42.45"N	103°46'12.54"E

Results

A total of 103 fauna species were recorded from transect surveys. This comprised five (5) main taxa: birds, mammals, herpetofauna, butterflies, odonata; and others (five (5) moths, a Common Walking Catfish, and an un-identified Hemiptera) (Table 3-14; Figure 3-26). The full list of fauna species can be found in Appendix C. Of which, three (3) CS species were recorded during the transect surveys, and the remaining three (3) from incidental observations (Table 3-11).

Table 3-14 Summary of Recorded Species for Each Faunal Group During Transect Surveys

Taxa	Transect 1	Transect 2	Incidental	Total
Birds	18	19	16	35
Mammals	4	4	3	9
Herpetofauna	13	9	9	20
Butterflies	9	17	5	24
Odonates	4	7	2	8
Others	0	0	7	7
Total	**48**	**56**	**42**	**103**

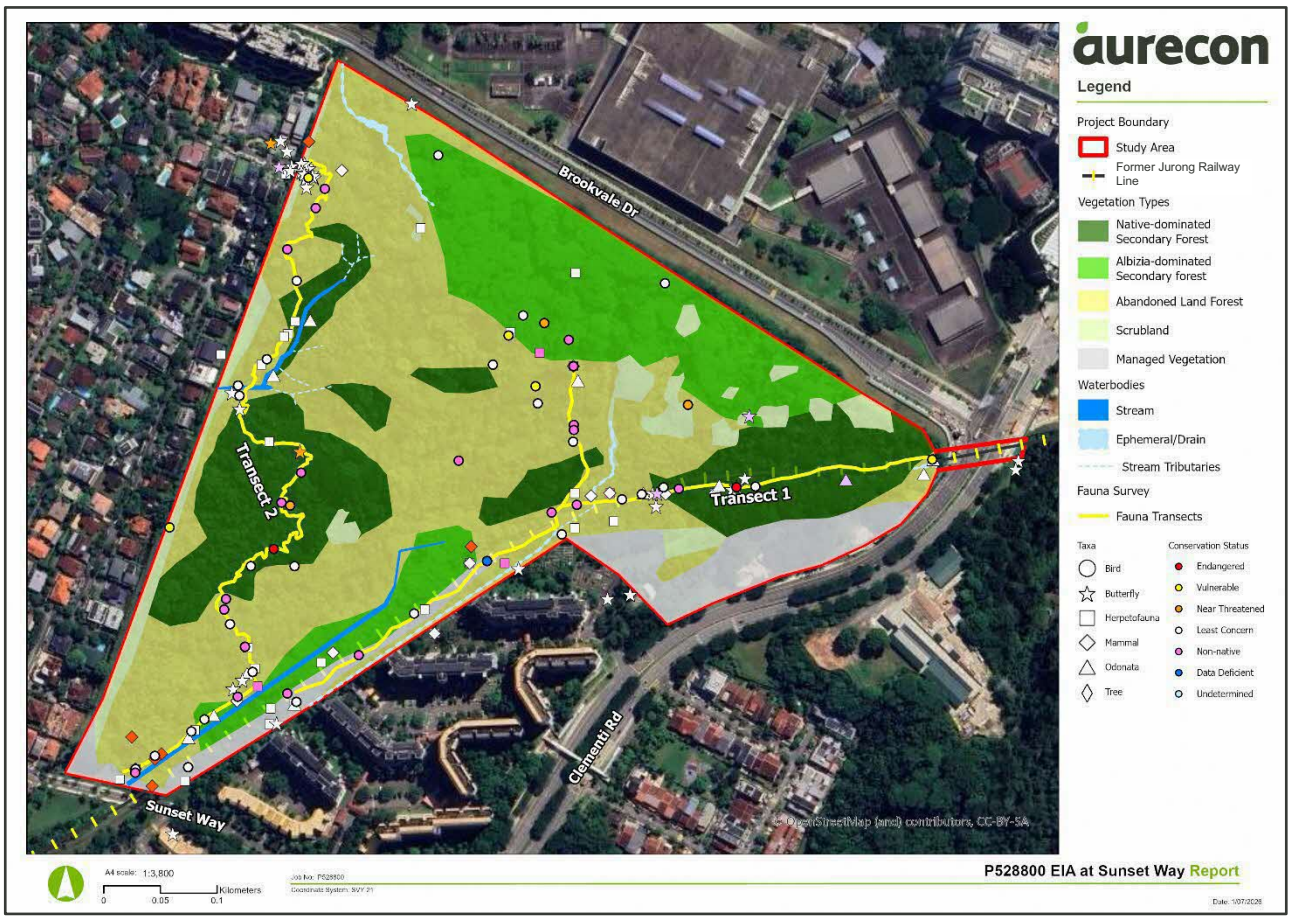


Figure 3-26 Map of Fauna Records with Respective Conservation Status

Birds

The field assessment recorded a total of 35 species. 22 of the species were of the status Least concern (LC), three (3) Near threatened (NT), three (3) Vulnerable (VU), one (1) Data Deficient (DD), one (1) Endangered (EN) and five (5) non-native species (Figure 3-28; Appendix C). Twelve (12) bird species were found in both transects: The Olive-winged Bulbul (*Pycnonotus plumosus*), Pin-striped Tit-Babbler (*Mixornis gularis*), Yellow-vented Bulbul (*Pycnonotus goiavier*), Asian Glossy Starling (*Aplonis panayensis*), Dark-necked Tailorbird (*Orthotomus atrogularis*), Javan Myna (*Acridotheres javanicus*), Lineated Barbet (*Psilopogon lineatus*), Ornate Sunbird (*Cinnyris ornatus*), Red Breasted-parakeet *(Psittacula alexandri*), Spotted Dove (*Spilopelia chinensis*), Straw-headed Bulbul (*Pycnonotus zeylanicus*) and White-crested Laughingthrush (*Garrulax leucolophus*).

Four (4) species of conservation significance were recorded in the field assessment (Figure 3-28; Table 3-11). The Straw-headed Bulbul (*Pycnonotus zeylanicus*), regarded as the largest bulbul species in Singapore, was recorded nine (9) times during the field assessment through visual sightings and call detections across both transects. The species is nationally Endangered, globally Critically Endangered, and protected under CITES Appendix I. Major threats include trapping for the songbird trade and habitat loss, which contributed to its global status being uplisted to Critically Endangered in 2018. In Singapore, the population was estimated to hover at 573 (± 185) individuals in 2020, representing approximately 22.9% – 57.3% of the global population at the time (Chiok et al., 2020). The species is known to be gregarious and highly vocal, particularly at dawn and dusk timings. The species is also commonly associated with secondary forest edges and woodland habitats near rivers, often found perching near dense foliage overlooking waterbodies, indicating a preference for these environments.

The nationally Vulnerable Changeable Hawk-eagle (*Nisaetus cirrhatus*) was recorded three (3) times during the field assessment. Given its reliance on large trees for hunting and nesting, the large trees within the Study Area may serve as potential habitat for the species. The nationally Vulnerable Oriental Magpie-robin (*Copsychus saularis*) was also observed during the field assessment. The species is regarded as a common resident in Singapore and is known to forage in forest edge and scrubland habitats, and occasionally within urban environments – where it is also a commonly sighted in parks, gardens and forest edges. The nationally Vulnerable Buffy Fish-owl (*Ketupa ketupu*) was recorded once in a waterlogged area that was part of the former Jurong Railway Line. This was a new record for the study, as the past EIA study did not register this species during the surveys. This species is mainly active during dawn and dusk hours and commonly occurs near waterways and urban canals with fishes.



Figure 3-27 Yellow-vented Bulbul (*Pycnonotus goiavier*) and Pin-striped Tit-Babbler (*Mixornis gularis*)

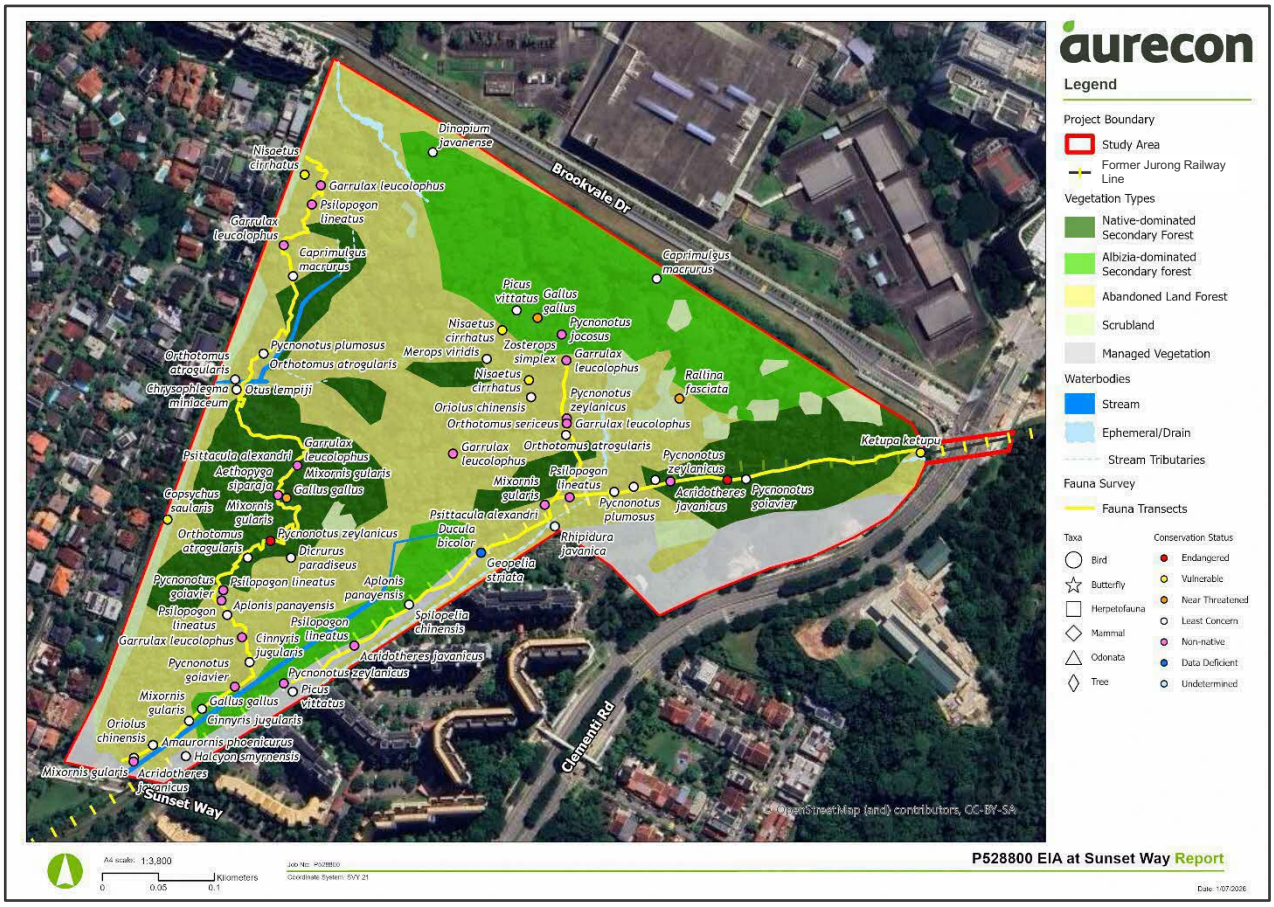


Figure 3-28 Map of the Distribution of Bird Records across the Study Area

Mammals

A total of nine (9) species of mammals were recorded, where 120 individuals were spotted (Figure 3-29; Figure 3-30). Of which, three (3) were non-volant mammals and the remaining six (6) were bats, which were all recorded during the transect surveys or incidentally (to be elaborated in the Bat Bioacoustics section). All the species were of the status Least Concern (LC) except for one species - the Long-tailed Macaque (*Macaca fascicularis*) that is considered Least Concern in the Singapore Red Data Book but Endangered under the IUCN Red List. Even though the species is globally Endangered, they are regarded as a common primate species in Singapore – and had a total of 96 records during the transect surveys.



Figure 3-29 Long-tailed Macaque (*Macaca fascicularis*) Observed during Surveys

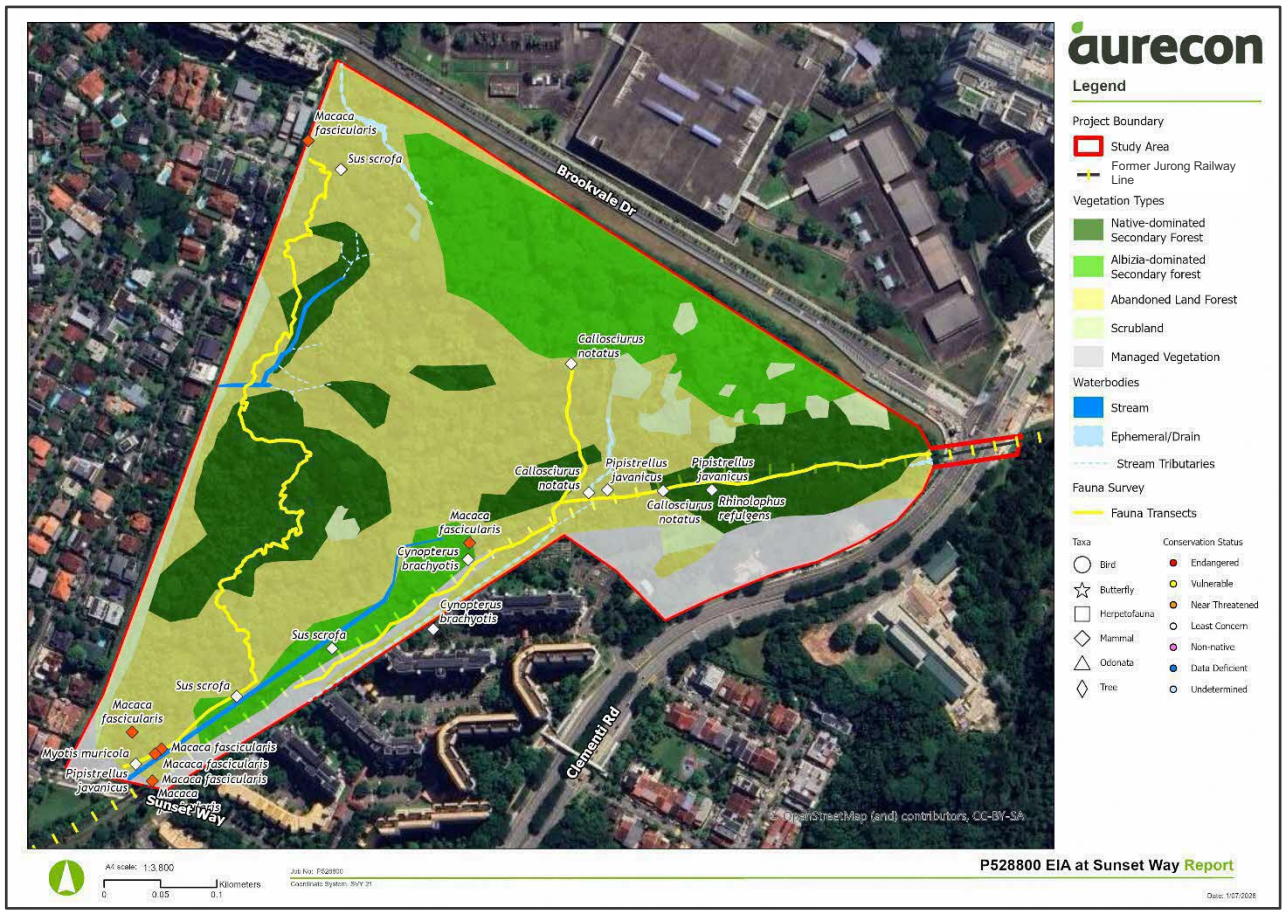


Figure 3-30 Distribution of Mammal Records from transect surveys across the Study Area

Butterflies

A total of 48 butterfly records were documented within the Study Area, representing multiple families (Figure 3-31; Figure 3-32). This comprised 24 species, of which 20 of these species were Least Concern (LC), one (1) Near Threatened (NT) and three (3) species which could not be identified to species level. The most frequently encountered species were the Common Palmfly (*Elymnias hypermnestra*; family *Nymphalidae*) with four (4) records, four (4) records of the Common Five-ring *(Ypthima baldus*; family *Nymphalidae),* and five (5) records of the Branded Imperial (*Eooxylides tharis*; family *Lycaenidae*). No species of conservation significance were recorded. Four (4) species were recorded in both Transect 1 and 2: Orange Awlet (*Bibasis harisa consobrina*), Common Palmfly (*Elymnias hypermnestra agina*), Branded Imperial (*Eooxylides tharis distanti*) and Chocolate Pansy (*Junonia hedonia ida*). Although *Ardisia elliptica*, the host plant for the Critically Endangered Harlequin Butterfly (*Taxila haquinus haquinus*), was recorded during floristic surveys, the butterfly itself was not recorded during fauna surveys.

Butterfly abundance and diversity depend largely on the availability of specific larval host plants. Although the butterfly diversity recorded in the Study Area was relatively low, this is likely influenced by habitat characteristics that affected butterfly activity and detectability during the survey. The survey transects, situated mainly within shaded forested areas, lacked an abundance of flowering plants, which are key nectar sources for many butterfly species. According to Khew and Tan (2019), limited floral resources in such environments can substantially reduce butterfly abundance, as nectar-feeding species are less attracted to these habitats.

Two charismatic species, the Common Birdwing (*Troides helena;* SRDB3 status as *Vulnerable*) and Common Rose (*Pachliopta aristolochiae;* SRDB3 status as Near Threatened) which have a stronghold in the Clementi forest and are frequently observed in the area, were not recorded during the surveys. These butterflies are highly dependent on the planting of its host plant *Aristolochia acuminata* (Jain et al., 2021). Such plants have been incorporated in the proposed planting palette for the development area.



Figure 3-31 Examples of Butterfly Species Documented in Study Area. (Left) Common Five Ring (*Ypthima baldus*) and (Right) Red Edge (*Semanga superba*)

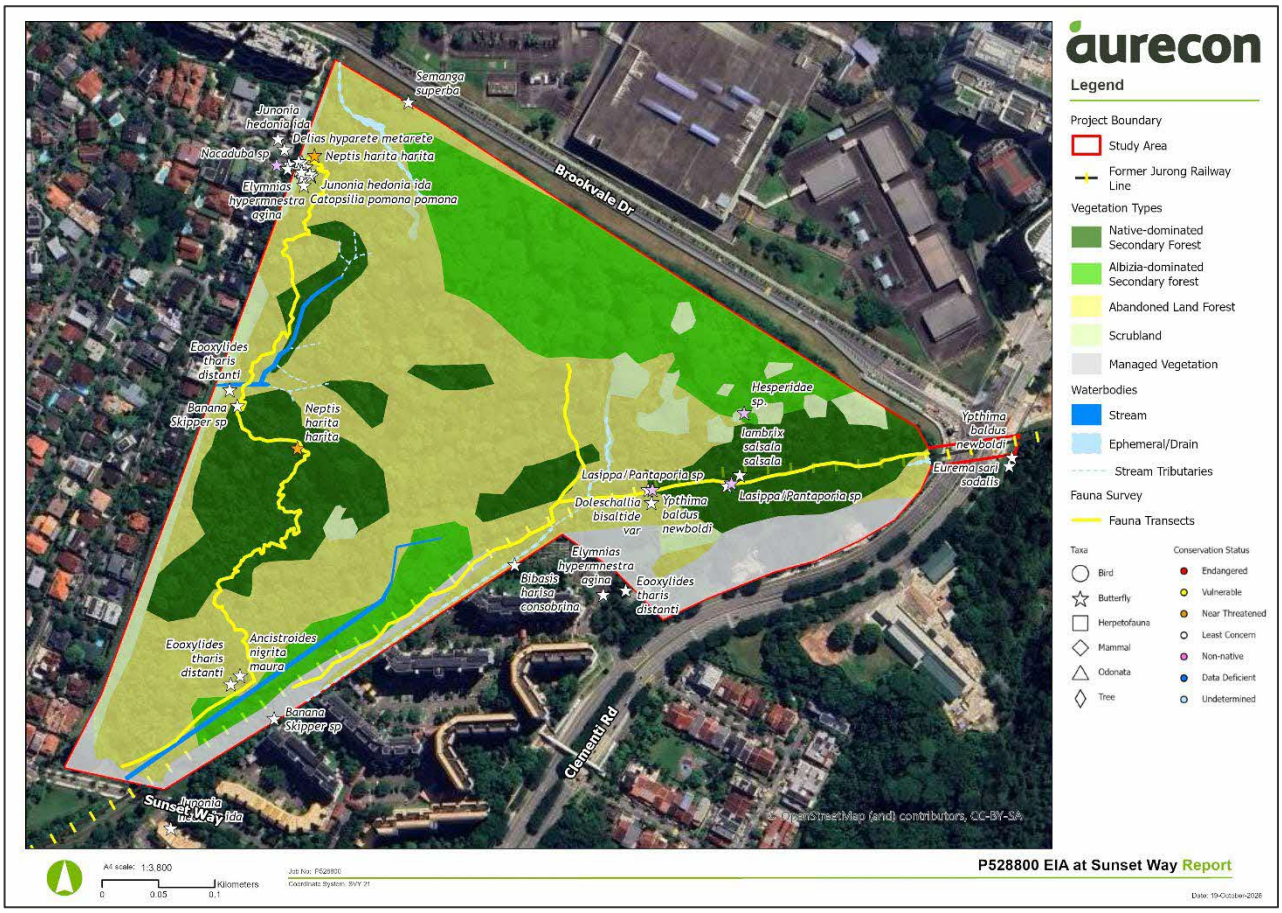


Figure 3-32 Distribution of Butterfly Records across the Study Area

Odonates

A total of eight (8) species and 35 records of Odonates were recorded (Figure 3-33; Figure 3-34). Of these, seven (7) species were of Least Concern status, and one (1) was an unidentified species. The Grenadier (*Agrionoptera insignis*), Dingy Duskhawker (*Gynacantha subinterrupta*) and Spine-tufted Skimmer (*Orthetrum chrysis*) were found in both Transects 1 and 2.

The *Libellulidae* family was the most abundant group recorded, with species such as the Grenadier (*Agrionoptera insignis*) and Scarlet Skimmer (*Crocothemis servilia*). As these species are commonly associated with open and disturbed habitats, their presence suggests that the Study Area provides suitable environmental conditions for such species (Ngiam & Cheong, 2016). All odonate species observed were of Least Concern or had no assigned conservation status, and no endangered species were recorded.

Odonate distribution within the Study Area appears closely linked to habitat characteristics. Abandoned land forest was the dominant habitat type, while the prevalence of *Libellulidae* is consistent with their adaptability to open and modified landscapes. Scrubland and abandoned forest habitats, characterised by tall grasses, herbaceous vegetation, and scattered saplings, provide suitable habitats for dragonflies (Murphy, 1997). The prevalence of *Libellulidae* aligns with other Singapore studies indicating that this family thrives in open freshwater and urban environments. For instance, the Common Parasol (*Neurothemis fluctuans*) and Common Scarlet (*Crocothemis servilia*) are both commonly found in ponds across local parks and gardens (Sebastian, 2025).

The relatively low odonate diversity observed may possibly reflect limited aquatic habitats, suboptimal water quality, and urbanisation pressures, factors that have been linked to declines in more sensitive species (Ngiam & Cheong, 2016). Seasonal variation may have also potentially influenced the odonate diversity observed during the surveys, as odonate activity depends on temperature, humidity, and water availability, which in turn affect breeding cycles and habitat suitability (Cai et al., 2018).



Figure 3-33 Example of Odonate Species Documented in Study Area. (Left) Striped Grenadier (*Nesoxenia lineata*) and (Right) Dingy Duskhawker (*Gynacantha subinterrupta*)

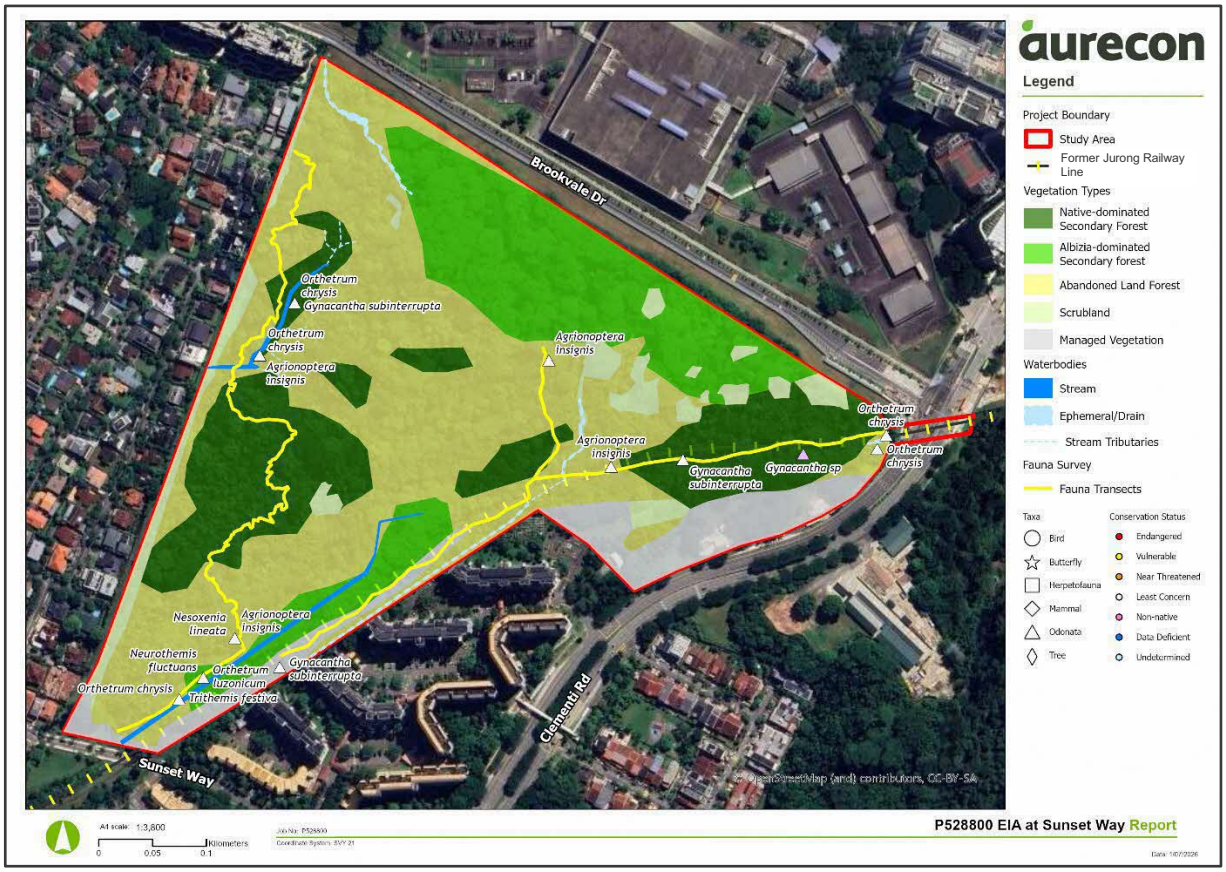


Figure 3-34 Distribution of Odonata Records across the Study Area

Herpetofauna

The field assessment recorded 20 herpetofauna species, where ten (10) were amphibians, three (3) were snakes and seven (7) lizards (Figure 3-35; Figure 3-36). This comprised 16 native and four (4) non-native species, none of which have conservation significance (Appendix C). The majority of species recorded were common and widespread, and are typical of urban and parkland habitats in Singapore, such as the Changeable Lizard (*Calotes versicolor*), Malayan Giant Frog (*Limnonectes blythii*) and Asian Toad (*Duttaphrynus* cf. *melanostictus*).

Seven (7) species were recorded across both transects: Common Tree Frog (*Polypedates leucomystax*), Dark-sided Chorus Frog (*Microhyla heymonsi*), Field Frog (*Fejervarya limnocharis*), Greenhouse Frog (*Eleutherodactylus planirostris*), Malayan Giant Frog (*Limnonectes blythii*), Spotted House Gecko (*Gekko monarchus*), and Supple Skink (*Lygosoma bowringii*). It is to be noted that Transect 1 houses a drain and waterbodies along the transect, which provide suitable habitats for most of the recorded species.



Figure 3-35 Herpetofauna Species documented during the Field Surveys in Transect 2. Copper-cheeked Frog (*Hylarana labialis*) (left), and Oriental Whip Snake (*Ahaetulla prasina*) (right)

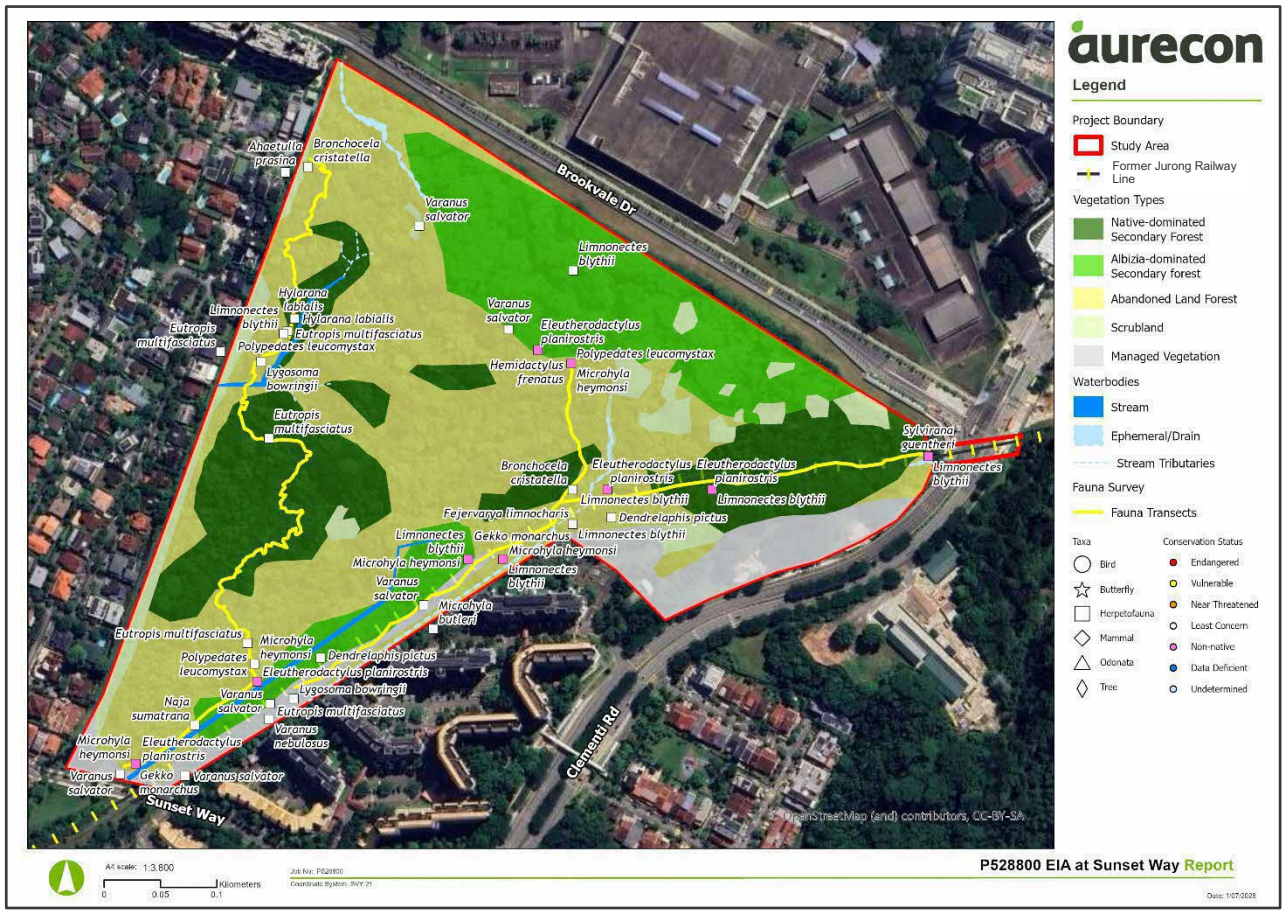


Figure 3-36 Distribution of Herpetofauna Records across the Study Area

3.3.3 Roadkill Surveys

Methodology

Two (2) roadkill survey transects were conducted (Figure 3-25; Figure 3-37), with each sampled once. While roadkill can occur regardless of the timing, animals that are more active at night (i.e. nocturnal species) such as amphibians (Hels & Buchwald, 2001) and pangolins (Nash et al., 2018) are likely more prone to vehicular collisions during these timings, due to lower nighttime visibility. As such, the surveys took place in the morning from between 7 – 9 am to account for potential roadkill incidences that may have occurred the night before.

The roadkill surveys comprised visual walking transects along the proposed routes abutting the Study Area, where roadkill will be documented and identified. During the survey, both sides of the transect was surveyed visually for up to 25 m on each side for any occurrences of roadkill.

A request for roadkill and sighting data pertaining to pangolins was also made to the Singapore Pangolin Working Group (SPWG; https://singaporepangolinwg.wordpress.com/) on 30 September 2025, and reference was made to a recent research paper on pangolin roadkill (Aziz et al., 2024). While no roadkill records were reported along Sunset Way, Brookvale Drive and Clementi Road, two (2) roadkill records were reported in the vicinity of the site, within a 1 km radius. One roadkill was recorded near Blackmore Drive, whilst the other along King Albert Park.

Results

No roadkill was recorded during the surveys (Table 3-15).

Table 3-15 Summary of Roadkill Survey Data

Transect ID	Date Conducted / Recorded	Start	End	Roadkill Recorded
RK01 – Sunset Way	13 Jun 2025	1°19'25.46"N, 103°46'3.42"E	1°19'22.74"N, 103°46'11.60"E	0
RK02 – Brookvale Drive & Clementi Road	24 Jun 2025	1°19'28.16"N, 103°46'21.54"E	1°19'45.90"N, 103°46'13.31"E	0
SPWG Records (Aziz et al., 2024)	No roadkill recorded for the Study Area. However, two records in the vicinity within a 1 km radius: ■ Blackmore Drive (2017) ■ King Albert Park (2011)			



Figure 3-37 Roadkill Survey Locations

3.3.4 Camera Traps

Methodology

Camera traps in the figure below were deployed over a period of at least 60 days (Figure 3-38; Figure 3-39; Table 3-16). Explicit labels for biodiversity monitoring with contact labels were added on the camera traps to discourage public tampering. The cameras were mounted 30 to 50 cm off the ground, at an angle which gave a clear and direct view of a possible wildlife trail or relatively open area. The trigger speed of the camera was 1/10th of a second or faster, with colour photographs taken during the day and infrared photographs taken at night. Cameras were placed approximately one (1) per every 4 ha, covering all representative habitats, giving a total of six (6) camera traps in the Study Area of approximately 23 ha. Photos captured will have information such as time and behaviour of animals reported.

Table 3-16 Deployment Locations and Period for Camera Traps

Station ID	Latitude	Longitude	Deployment Period	Days Deployed
CT01	1°19'30.00"N	103°46'14.00"E	5/6/2025 – 13/8/2025	69
CT02	1°19'28.00"N	103°46'10.00"E	5/6/2025 – 12/8/2025	68
CT03	1°19'34.00"N	103°46'19.00"E	26/6/2025 – 5/9/2025	71
CT04	1°19'37.00"N	103°46'19.00"E	5/6/2025 – 13/8/2025	69
CT05	1°19'31.00"N	103°46'10.00"E	10/6/2025 – 12/8/2025	63
CT06	1°19'41.00"N	103°46'13.00"E	10/6/2025 – 5/8/2025 12/8/2025 – 28/8/2025	72



Figure 3-38 Photos of Deployed Camera Traps



Figure 3-39 Deployed Camera Trap Locations

Results

Based on an average of 69 trapping nights, a total of 22,788 footages (photos and videos) was obtained. Six (6) species of small- to medium-sized terrestrial mammals were identified (Table 3-17) from the footage. The majority of mammals captured by camera traps were recognised as Least Concern based on the global IUCN Red List Conservation Status, except for the Long-tailed Macaque.

Table 3-17 Species List and Conservation Status of Mammals Encountered

S/N	Family	Common Name	Scientific Name	IUCN	RDB3	Camera Trap No.
1	Tupaiidae	Common treeshrew	*Tupaia glis*	LC	LC	All
2	Sciuridae	Plantain squirrel	*Callosciurus notatus*	LC	LC	All
3	Viverridae	Common palm civet	*Paradoxurus musangus*	LC	LC	CT02
4	Suidae	Wild boar	*Sus scrofa*	LC	LC	CT05, CT06
5	Cercopithecidae	Long-tailed macaque	*Macaca fascicularis*	EN	LC	CT02, CT05, CT06
6	-	Rat sp.	*Rattus* sp.	-	-	All



Figure 3-40 Species Accumulation Curve of Mammal from the Camera Trapping Survey

As shown in Figure 3-40 the species accumulation curve reached the asymptote on the 21 July 2025 with a total of six (6) species of mammals. The Study Area is mostly surrounded by development, except for the eastern side which is the Clementi Forest. The species that were recorded during the baseline surveys so far are mostly recognised as urban wildlife species and are commonly found in developed areas due to their adaptability. However, despite being an isolated forest, conservation significant species like the Sunda Pangolin (*Manis javanica*) has been recorded in a previous environmental impact study by AECOM in 2022.

Mammals (non-volant) - Camera Traps

The identification of the species documented in the camera trapping survey were confirmed based on photographs taken (Figure 3-41) and cross-referenced with a fauna guidebook (Francis, 2019). The Common Treeshrew (*Tupaia glis*) is the most detected Mammalia species from the camera trapping with 65 detections and the Plantain Squirrel (*Callosciurus notatus*) in second with 36 detections. Both species were detected at all six camera trap locations. The largest Mammalia species detected in the camera trapping study is the Wild Boar (*Sus scrofa*), which was only detected at CT05 and CT06 with a total of nine (9) detections. All these species are highly adaptable species that can be found in a wide range of environments, including human-modified landscapes.

Long-tailed Macaque (*Macaca fascicularis*) was detected at CT02, CT05 and CT06, with a total of seven (7) detections. Although listed as globally Endangered, it is considered Least Concern in Singapore and remains a common primate species. However, it is frequently involved in human-wildlife conflicts, particularly in urban areas where interactions with residents can lead to nuisance issues. This is likely linked to habitat degradation and the species' adaptation to human-dominated landscapes.



Figure 3-41 Mammal Species Documented During the Camera Trap Survey.
(A) Sumatran palm civet (*Paradoxurus musangus*), (B) Long-tailed macaque (*Macaca fascicularis*), (C) Wild boar (*Sus scrofa*) and (D) Plantain squirrel (*Callosciurus notatus*)

3.3.5 Bat Bioacoustics

Methodology

Acoustic recordings are mainly to identify the diversity of bats in the Study Area. The recording devices (Song Meter SM4BAT; Figure 3-42) were spaced approximately 100 – 200 m apart. Four (4) bat stations were set up, each over a period of two (2) consecutive nights for one (1) cycle, totalling twelve (12) detection nights (Figure 3-43; Table 3-18). The recording devices were placed in an area where a high chance of bat activity was expected and elevated approximately 2 m above the ground on a secured structure/tree. The devices will have a flat frequency response from the lowest (18 kHz) to highest (150 kHz) expected frequencies and have a continuous minimum sampling rate of 384 kHz. Microphones were orientated slightly less than horizontal to prevent pooling of water on the microphone membrane. Timers were setup for the recordings starting from half hour before sunset to half hour past sunrise.

In addition to the fixed location sonagram survey, visual and bioacoustics surveys via walking line transects were also carried out. Nocturnal surveys (1830–2100) were carried out for bats at dusk along the two (2) fauna transects (same transects as other fauna taxa were followed; Figure 3-25). One (1) replicate was conducted per walking transect. A point count survey was conducted for 30 minutes, followed by the walking transect survey. Bats were observed visually, and bat calls were observed on a handheld Echo Meter Touch 2 Pro. The Echo meter was used to record, stream, and attenuate ultrasonic calls between 18 and 192 kHz (kHz) at a sampling frequency of 384 kHz.

Bat recordings were processed using Kaleidoscope v.4.5.4 (Wildlife Acoustics, Inc.) to separate extraneous noise from files with bat echolocation calls. The signal parameters for recognising a potential bat echolocation call were configured as follows: frequency range of 20 – 200 kHz, duration of 2 – 500 millisecond (ms), maximum inter-syllable gap of 500 ms and a minimum of two (2) pulses (Figure 3-44). These files were visually processed to identify bat species based on call structures, peak frequency, minimum frequency and call duration (Figure 3-44). They were compared with traits from Pottie (1996), Kingston et al. (2006) and Pottie et al. (2009) for accurate identification to species. Call characters used to identify bats in the analysis included pulse duration, inter-pulse interval, peak frequency, end frequency.



Figure 3-42 Song Meter SM4BAT-FS Deployed in the Study Area



Figure 3-43 Song Meter SM4BAT-FS Deployment Locations

Table 3-18 GPS Location of Song Meters for Bioacoustics Data Collection

Station ID	Type of Habitat Present	Latitude	Longitude
BT01	Non-native Dominated Secondary Forest	1°19'26.98"N	103°46'10.02"E
BT02	Scrubland	1°19'34.23"N	103°46'9.30"E
BT03^	Managed Vegetation	1°19'25.22"N	103°46'9.87"E
BT04	Abandoned Land Forest	1°19'42.57"N	103°46'13.16"E
^It is to be noted that BT03 was shifted from its original deployment location (1.326405° 103.772112°), as two nights of deployment yielded no bat data.			

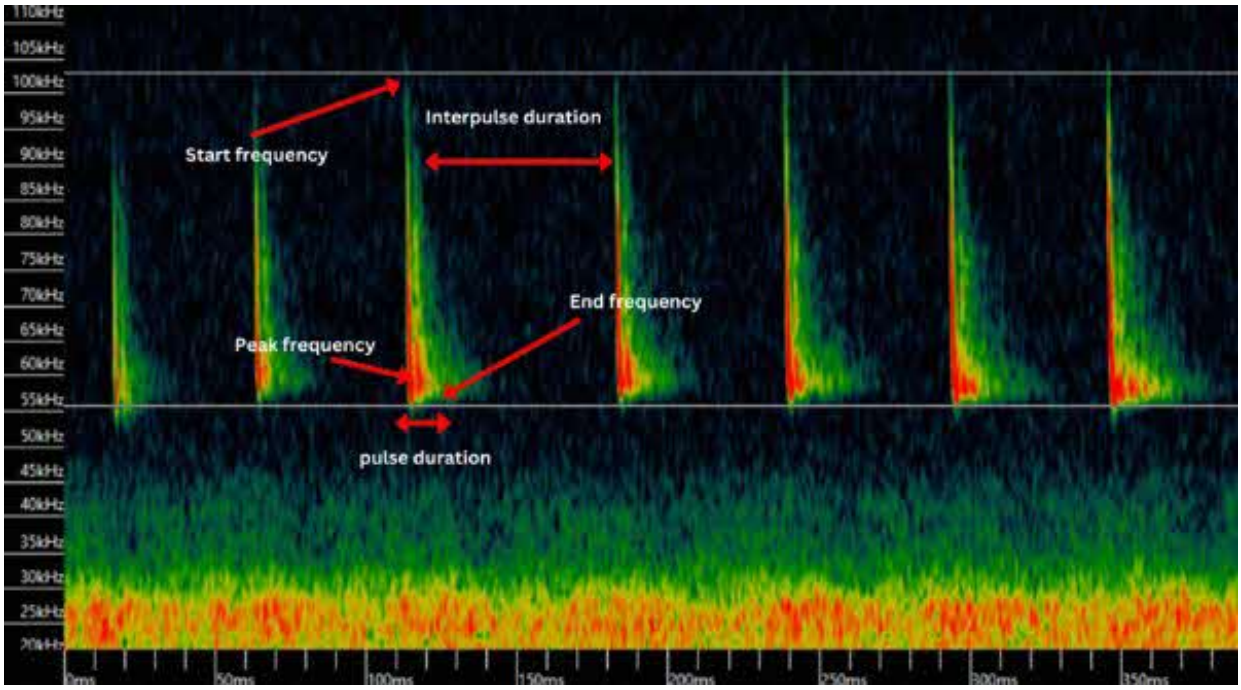


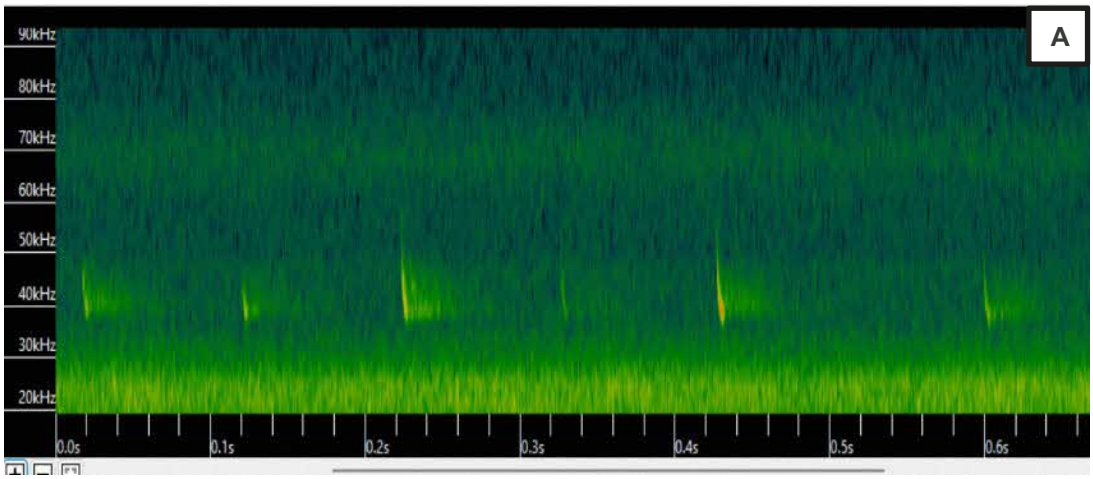
Figure 3-44 Call Characteristics used in the Identification of Bats

Results

Overview of Bat Species Recorded

Overall, the four (4) bat stations and two (2) walking transects yielded a total of nine (9) species of bats (25% of bats in Singapore): namely the Lesser Asian House Bat (*Scotophilus kuhlii*), Pouched Tomb Bat (*Saccolaimus saccolaimus*), Horsfield's Myotis (*Myotis horsfieldii*), Asian Whiskered Myotis (*Myotis muricola*), Javan Pipistrelle (*Pipistrellus javanicus*), Narrow-winged Pipistrelle (*Pipistrellus stenopterus*), Glossy Horseshoe Bat (*Rhinolophus refulgens*), Lesser Short-nosed Fruit Bat (*Cynopterus brachyotis*) and the Bamboo Bat (*Tylonycteris* sp.) (Figure 3-45). Megachiropterans were visually identified and consisted of only the Lesser Short-nosed Fruit Bat (*Cynopterus brachyotis*). Only *Tylonycteris* sp. was of conservation significance, regarded as "Vulnerable", while the rest of the species detected are regarded as "Least Concern" by the Singapore Red Data Book (NParks, 2024).

The Microchiropteran assemblage reflects the land use history and current condition of the Study Area—a former plantation that was left to regenerate after it was cleared and consists of early non-native dominated secondary forest with patches of grass scrub land interspersed throughout. The bats present were mostly common urban species. The absence of forest specialist bats such as *Hipposideros* spp (Lane et al., 2006, Leong & Lim, 2009, Leong & Chan, 2011) suggest the lack of good quality forest habitats or connectivity to the forests of the Central Catchment Nature Reserve.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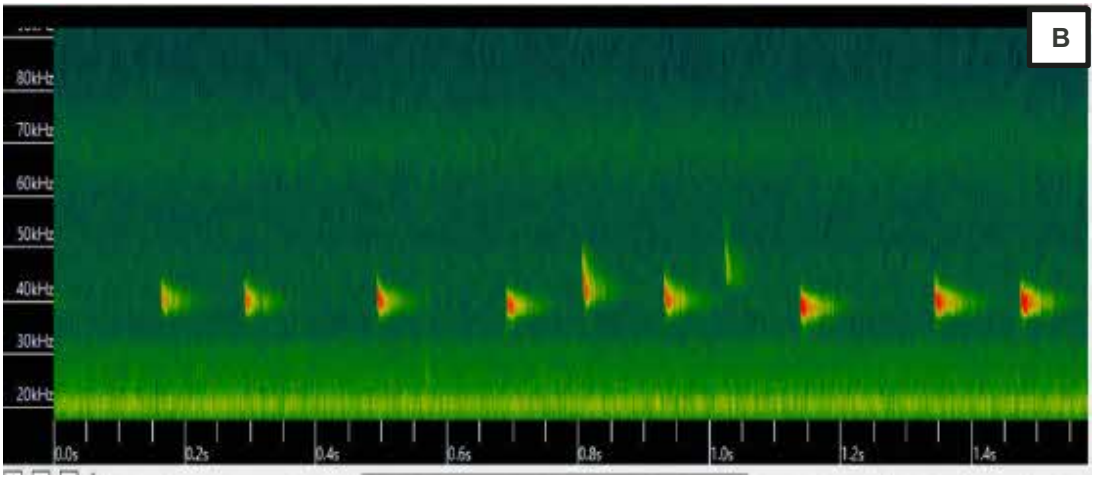
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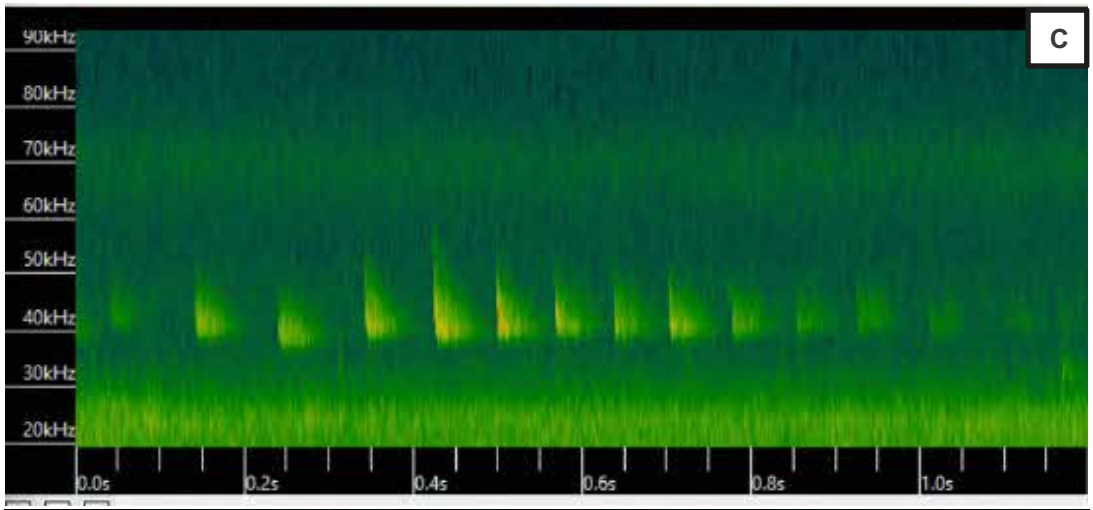
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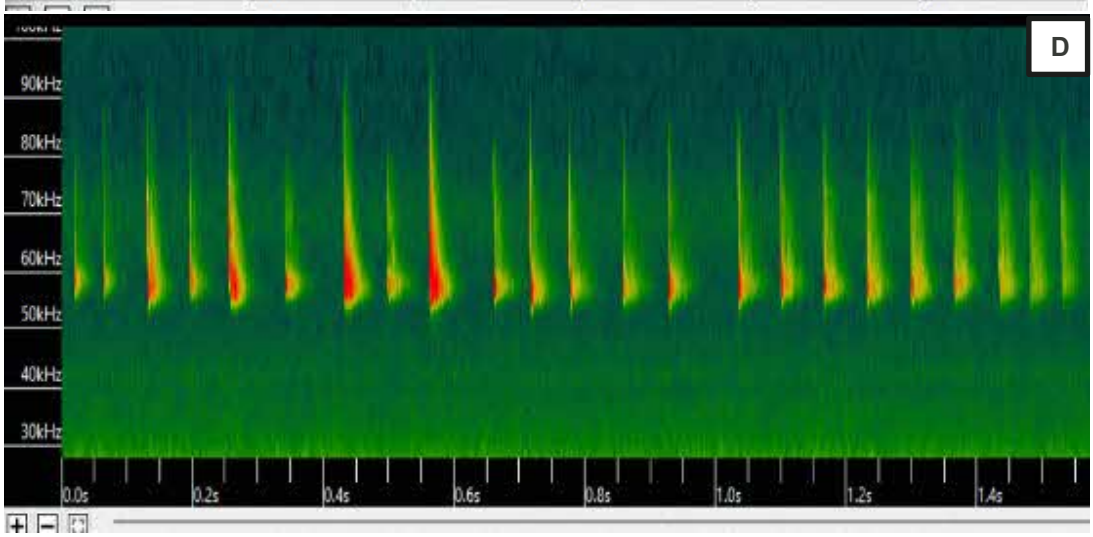
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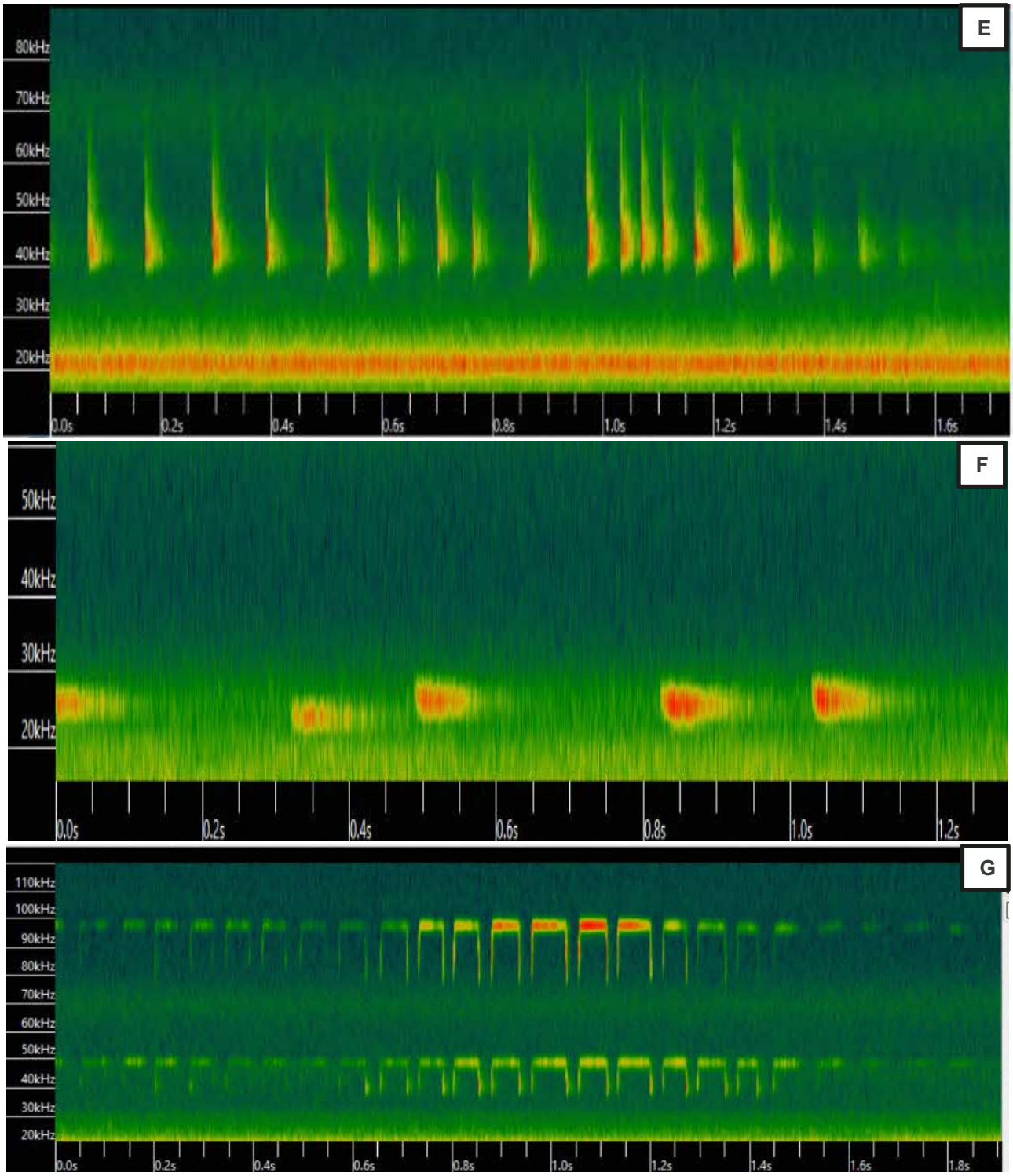


Figure 3-45 Spectrograms of Bats Recorded. (A) *Pipistrellus javanicus*, (B) *Pipistrellus stenopterus*, (C) *Scotophilus kuhlii*, (D) *Myotis horsfieldii,* (E) *Myotis horsfieldii*, (F) *Saccolaimus saccolaimus*, (G) *Rhinolophus refulgens*

The presence of a single species of forest specialist bat, the Glossy Horseshoe Bat (*Rhinolophus refulgens*) (Figure 3-45G), is unsurprising as it has been recorded along the rail corridor in the past and is speculated to originate from roosts within Bukit Timah Nature Reserve (Chao, 2024). The sighting of this species suggests some level of connectivity between the Study Area, the Rail Corridor and Bukit Timah Nature Reserve. Species such as the Lesser Asian House Bat (*Scotophilus kuhlii*), Pouched Tomb Bat (*Saccolaimus saccolaimus*), Javan Pipistrelle (*Pipistrellus javanicus*), Narrow-winged Pipistrelle (*Pipistrellus stenopterus*) forage above the canopy in relatively open spaces (Chan et al., 2009; Leong et al., 2010; Yap & Chua, 2014; Tan, 2016), while species such as Horsfield's Myotis (*Myotis horsfieldii*) prefers to forage across large bodies of water (Lim & Leong, 2014), and the Asian Whiskered Myotis (*Myotis muricola*) forages in both open and semi-closed canopy

areas (Leong & Chan, 2011). Finally, species like the Glossy Horseshoe Bat (*Rhinolophus refulgens*) tend to forage in closed canopy areas and is considered a forest specialist bat (Pottie et al., 2009).

The Megachiropteran assemblage which could not be detected via passive ultrasonic devices (as this group does not call in ultrasound (Heffner et al., 2006)) consisted of a single species, the Lesser Short-nosed Fruit Bat (*Cynopterus brachyotis*), confirmed by several visual sightings during walking transects. The sole frugivorous species, the Lesser Short-nosed Fruit Bat forages on fruits, presumably *Terminalia catappa*, *Syzygium* spp., and *Ficus* spp., and is an important seed disperser in the region (Corlett, 2002).

Summary of Findings from Passive Song Meter Stations

Across all four (4) bat stations, we recorded a total of 10,076 calls over a trapping period of twelve (12) nights (144 hours) across various habitat types, open scrubland and Albizia-dominated secondary forest. The bat calls recorded from the area comprised of eight (8) species of bats (Figure 3-45). The stations with the highest chiropteran assemblage were BT01 and BT03 with a total of six (6) species detected (Table 3-19).

Two (2) bat detectors (BT01 and BT03) had the highest chiropteran assemblage with a total of six (6) species detected.

Table 3-19 Bat Species Recorded Across Passive Song Meter Stations

Station ID	Species (P = Present, A = Absent)*								
	Pj	Ps	Rr	Sk	Ss	Mh	Mm	Ty	No. of species recorded
BT01	P	A	P	P	P	P	P	A	6
BT02	P	A	P	P	A	P	A	A	4
BT03	P	P	P	P	A	P	P	A	6
BT04	P	A	P	P	A	P	P	A	5

**Abbreviated names are: Pj - Pipistrellus javanicus, Ps - Pipistrellus stenopterus, Rr - Rhinolophus refulgens, Sk - Scotophilus kuhlii, Ss - Saccolaimus saccolaimus, Mh - Myotis horsfieldii, Mm - Myotis muricola, Ty - Tylonycteris* sp.

Summary of Findings for Nocturnal Walking Transects

The transect with the highest chiropteran assemblage was T02 with a total of four (4) species detected (Table 3-20)

Table 3-20 Bat Species Recorded across Walking Transects (T01 & T02)

Station ID	Species (P = Present, A = Absent)*									
	Pj	Ps	Rr	Sk	Ss	Mh	Mm	Ty	Cb	No. of species recorded
T01	P	A	P	A	A	A	A	A	P	3
T02	P	A	A	P	A	A	P	P	A	4

**Abbreviated names are: Pj - Pipistrellus javanicus, Ps - Pipistrellus stenopterus, Rr - Rhinolophus refulgens, Sk - Scotophilus kuhlii, Ss - Saccolaimus saccolaimus, Mh - Myotis horsfieldii, Mm - Myotis muricola, Ty - Tylonycteris* sp., Cb - *Cynopterus brachyotis*

3.3.6 Aquatic Surveys

Methodology

The aquatic fauna surveys were carried out for water bodies found in the Study Area over a period of two (2) days. Nine (9) points (Figure 2-41; Figure 3-47; Table 3-21) were sampled in the Study Area. All freshwater aquatic surveys took guidance from NParks' BIA guidelines (NParks, 2024). All fish caught were immediately released after information was obtained and recorded.



Figure 3-46 Aquatic Fauna Surveys at the Study Area



Figure 3-47 Location of the Aquatic Sampling Stations

Table 3-21 Coordinates of the Aquatic Sampling Stations

Stream ID	Station ID	Survey Method	Survey Date	Latitude	Longitude
D/S24	AQ01	Sweep Net	16 & 17 June 2025	1°19'27.56"N	103°46'9.84"E
		Baited Minnow Trap			
	AQ02	Sweep Net	16 & 17 June 2025	1°19'28.22"N	103°46'10.73"E
		Baited Minnow Trap			
	AQ03	Sweep Net	16 & 17 June 2025	1°19'28.93"N	103°46'11.92"E

Stream ID	Station ID	Survey Method	Survey Date	Latitude	Longitude
		Baited Minnow Trap			
D/S23	AQ04	Sweep Net	16 & 17 June 2025	1°19'29.59"N	103°46'13.91"E
		Baited Minnow Trap			
	AQ05	Sweep Net	16 & 17 June 2025	1°19'30.83"N	103°46'14.78"E
		Baited Minnow Trap			
	AQ06	Sweep Net	16 & 17 June 2025	1°19'32.05"N	103°46'15.70"E
		Baited Minnow Trap			
D/S25	AQ07	Sweep Net	16 & 17 June 2025	1°19'36.02"N	103°46'10.37"E
		Baited Minnow Trap			
	AQ08	Sweep Net	16 & 17 June 2025	1°19'37.01"N	103°46'11.99"E
		Baited Minnow Trap			
	AQ09	Sweep Net	16 & 17 June 2025	1°19'38.35"N	103°46'12.60"E
		Baited Minnow Trap			

Freshwater Fish

Fish were identified in the Study Area in a white container and photographed for record. Fish specimens were obtained using two methods:

- Fine mesh sweep nets (< 1 cm) (Small ponds and streams):
  - For smaller and cryptic fishes that take shelter in vegetation along pond/stream banks.
  - Sweep net was extended from the pond's edge and swept towards the shore.
  - The frame of the net was used to gently agitate plants and scare the animals out of their hiding places into the net. Small fish caught were transferred to a pail of water and recorded.
- Baited Minnow Traps (Ponds):
  - For fish that are attracted to bait. (Streams).
  - Minnow traps typically consist of funnel-shaped entrances of a mesh box or cylinder.
  - Traps were baited, set overnight and worked on the assumption that scent from the bait will attract fish which will eventually swim down the funnels and become trapped.
  - Fish caught in traps were carefully removed and transferred to a pail of water for further identification.

Decapod Crustaceans

Decapod crustacean specimens were obtained using the following two methods (if applicable):

- Hand-catching/Fine-mesh sweep nets (< 1 cm):
  - For crustaceans and molluscs visible along the water's edge or in shallow pond areas.
  - Sweep net was extended from the pond's edge and swept towards the shore.
  - The frame of the net was used to gently agitate plants and scare the animals out of their hiding places into the net.
- Overnight baited Minnow Traps:
  - For crustaceans that are attracted to bait. (Streams).
  - Traps were deployed in nine sampling points.

- Clear marker/buoys were used to locate the traps, and explicit labels for biodiversity monitoring with contact labels were added to discourage public tampering.
- Cylindrical traps were modified such that openings do not exceed 10 cm to reduce bycatch of terrapins

Results

Overall aquatic fauna diversity recorded from the surveys was low. This is likely due to lack of connectivity to waterbodies with higher biodiversity. The streams were also relatively shallow and drying up at the time of the surveys.

Freshwater Fish

Three (3) species of freshwater fish were recorded overall. During the sweep net surveys, only one (1) freshwater fish species was recorded. The non-native Guppy (*Poecillia reticulata*) was recorded at station AQ04. Both male and female Guppies were caught by the sweep net. The baited minnow traps caught one (1) species of freshwater fish. The native Sunda swamp eels (*Monopterus javanensis*) were recorded at stations AQ07 and AQ09. Separately, the native Common walking catfish (*Clarias batrachus*) was encountered incidentally during flora/fauna surveys. No fish species of conservation significance were captured during the aquatic surveys (Table 3-22).

The non-native Guppies that were caught at station AQ04 are likely to have appeared due to the release of unwanted aquarium pets into canals upstream of the Study Area. Representative photographs of the various fish species captured during the aquatic survey are presented in Figure 3-48 below.

Table 3-22 Species List and Conservation Status of Freshwater Fish Recorded

S/N	Family	Common Name	Scientific Name	Origin	Caught in		IUCN	SRDB3
					Sweep Net	Minnow Trap		
1	Synbranchidae	Sunda swamp eel	*Monopterus javanensis*	Native	-	AQ07 and AQ09	LC	LC
2	Poeciliidae	Guppy	*Poecilia reticulata*	Non-native	AQ04	AQ04	Not Listed	Not Listed
3	Clariidae	Common walking catfish	*Clarias batrachus*	Native	Incidental		LC	NT



Figure 3-48 Representative Photographs of the various Freshwater Fish recorded during the Aquatic Survey

Freshwater Molluscs

During the aquatic surveys, only one (1) mollusc was captured, located at station AQ08 (Figure 3-49). A Bioluminescent Land Snail (*Quantula striata*) was caught by the minnow trap, and is listed as locally Least Concern and unlisted in the IUCN Red List.

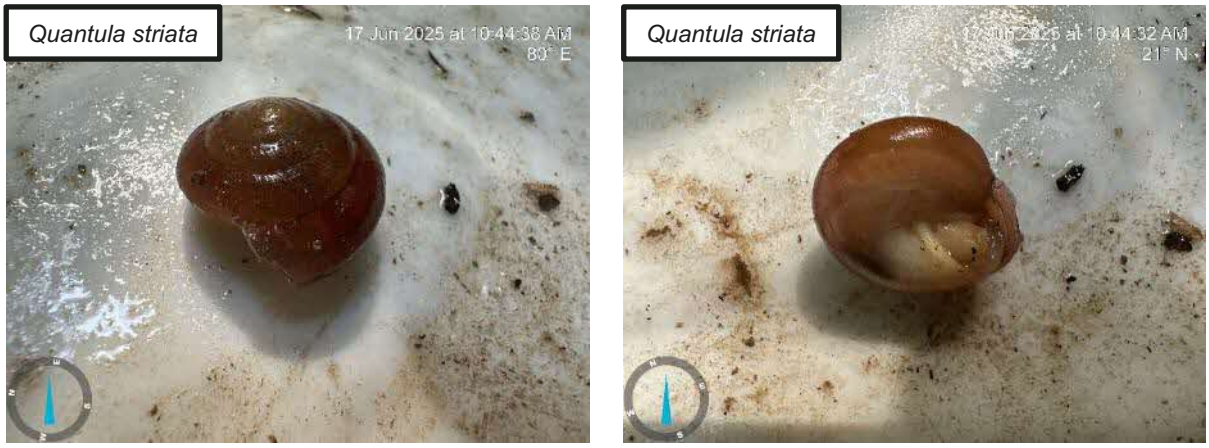


Figure 3-49 Photographs of the Mollusc Species recorded during the Aquatic Survey

Freshwater Decapod Crustaceans

During the aquatic surveys, no decapod crustaceans were caught at the Study Area. The streams were relatively shallow and drying up at the time of the surveys.

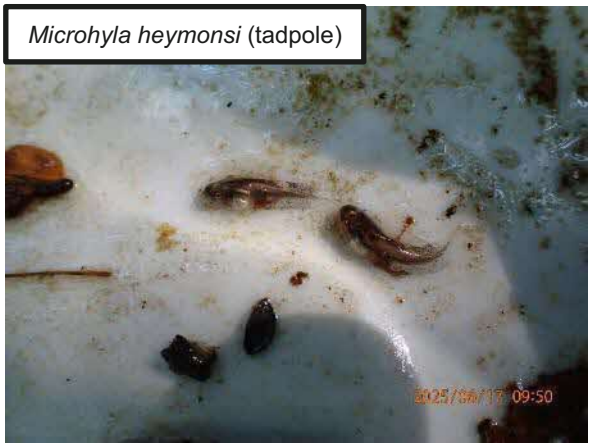
Other Fauna

During the aquatic surveys, six (6) other fauna species were recorded (Figure 3-50). This was made up mainly of amphibians, comprising of two (2) frogs (*Polypedates leucomystax* (AQ03) and *Fejervarya limnocharis* (AQ07)), two tadpoles (*Microhyla heymonsi* (AQ02, AQ06) and *Microhyla butleri* (AQ06)) species. The other two fauna species found during aquatic sampling were the Malayan Water Monitor (*Valanus salvator*) caught at AQ09, and Water Scorpion (*Laccotrephes simulatus*) found at AQ02 and AQ06. None of the other fauna captured are listed as conservation significant species.









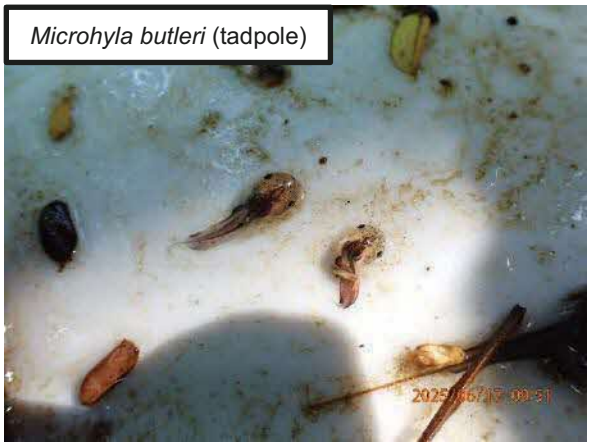


Figure 3-50 Photographs of the other fauna species recorded during the baseline survey

3.3.7 Comparison with Past EIA

Based on IUCN and SRDB3 statuses, a total of eight (8) fauna species of Conservation Significance (CS) were recorded in the Study Area across both the current and past studies: Aurecon 2025 and AECOM 2022 (Table 3-23). The current Aurecon 2025 study recorded six (6) CS species.

Three (3) CS species that were previously undocumented in the AECOM 2022 study were recorded for the first time in the present study. They are the Buffy Fish-owl (*Ketupa ketupu*), Bamboo Bat sp. (*Tylonycteris* sp.) and Oriental Magpie-robin (*Copsychus saularis*). The Sunda Pangolin (*Manis javanica*), recorded in the AECOM 2022 study, is the species with the most heavily threatened status across both baseline studies. However, it was not recorded in the present study.

Table 3-23 Comparison of CS Fauna Species across Current and Past EIA Studies

S/N	Common Name	Taxa	IUCN	SRDB3	Aurecon '25	AECOM '22
1	Buffy Fish-owl^	Bird	LC	VU	**Present**	-
2	Bamboo Bat sp.^	Bat	-	VU	**Present**	-
3	Chocolate Sailor*	Butterfly	-	NT	Present	Present
4	Crested Goshawk*	Bird	LC	NT	-	Present
5	Changeable Hawk-eagle	Bird	LC	VU	**Present**	**Present**
6	Red Junglefowl*	Bird	LC	NT	Present	Present
7	Blue-crowned Hanging Parrot*	Bird	LC	LC	-	Present
8	Straw-headed Bulbul	Bird	CR	EN	**Present**	**Present**
9	Oriental Magpie-robin^	Bird	LC	VU	**Present**	-
10	Red-legged Crake*	Bird	LC	NT	Present	Present
11	Long-tailed Parakeet	Bird	VU	NT	-	**Present**
12	Sunda Pangolin	Mammal	CR	CR	-	**Present**
13	Long-tailed Macaque	Mammal	EN	LC	**Present**	**Present**
				Total CS species for study (SRDB2)	9	10
				Overall CS Species (SRDB2)	13	
				Total CS species for each study (SRDB3)	**6**	**10**
				Overall CS Species (SRDB3)	**8**	

^ Not recorded in previous studies
* Species were considered CS in SRDB2 during 2022 and 2020 studies

3.4 Areas of High Ecological Value (AHEV)

3.4.1 Habitats of High Ecological Value

Areas of High Ecological Value (AHEVs) was developed in this study to assess habitats with high ecological value. AHEVs were referred to as an indicator for establishing the Proposed Retained Area (PRA). The ecological values of five (5) habitat types, three (3) waterbodies, 286 plant species and 113 faunal species encountered during this study (as well as relevant faunal data in previous studies) present within the Study Area were assessed.

After an initial analysis of canopy species composition and abundance of CS species within the Study Area, the ecological values of two (2) habitat types and one (1) waterbody were found to be higher than those of other habitat types. These are:

- i. Native-dominated secondary forest
- ii. Abandoned land forest
- iii. a natural stream (D/S25) situated within one of the native-dominated secondary forest patches

The remaining three terrestrial habitats were assessed to have lower ecological value.

i. Native-dominated Secondary Forest (High Ecological Value)

The native-dominated secondary forest occupies 4.7 ha (21.05%) and is the second most dominant habitat type, comprising seven distinct patches within the Study Area. It also cuts through the former Jurong Railway Line, an important ecological corridor that links with the main Rail Corridor, which connects critical habitats in the north via the Clementi Forest and Bukit Timah Nature Reserve (Ho et al., 2019). In the south, the former Jurong Railway Line connects with the Ulu Pandan Park Connector. These habitats were also found to support a high abundance of CS flora species and other native species indicative of early and mid-stage succession.

More broadly, many old-growth forests in Singapore have been largely disturbed and/or cleared to give way to development. Many younger forests that have regenerated since abandonment tend to be dominated by non-native species. This makes native-dominated forests a relatively less common habitat in Singapore, echoing the assessment made by AECOM (2022) and existing literature (Yee et al., 2016; Gaw et al., 2019; Sankar & Ang 2024).

ii. Abandoned Land Forest (High Ecological Value)

The abandoned land forest occupies 9.98 ha (44.71%), making it the dominant habitat type in the Study Area. This habitat type exists as a series of interconnected patches distributed across the Study Area and is contiguous with other vegetation types. Thus, it provides high value in terms of ecological linkage for flora and fauna species to disperse or move across the Study Area. Fruits of some of the trees present in this habitat also provide food for fauna residing within or moving in between these patches. Amongst the habitats assessed in the Study Area, it has a relatively high species richness of fruit trees – i.e. *Nephelium lappaceum*, *Dimocarpus lichi*, *Baccaurea motleyana*. The habitat also houses CS plant species like, *Xanthophyllum ellipticum* (CR), *Eurycoma longifolia* (EN), *Oncosperma horridum* (VU) and *Ficus apiocarpa* (EN).

A number of native fauna and conservation-significant fauna species were recorded across this habitat as well. This includes faunal species such as the Sunda pangolin and the Straw-headed bulbul, that were recorded in the AECOM 2022 and Aurecon 2025 studies respectively.

iii. Waterbodies (D/S25; High Ecological Value)

There are three (3) natural streams present within the Study Area. Of which, one stream in particular, known as D/S25, is surrounded by a significant number of riparian and nationally restricted CS flora species (Figure 3-51). This waterbody is not connected to any larger waterbodies. Despite that, such natural stream habitats

are uncommon in Singapore (largely restricted to Central Catchment and Bukit Timah forests; Tan 2022; Sankar & Ang 2024) and provide important habitats for a range of taxa; and are thus still considered of high ecological value, echoing the findings of the AECOM 2022 study.



Figure 3-51 Images taken along D/S25. (A) Tail end of stream, which drains out westwards into PUB drainage, (B) Midway along stream, with banks on both sides vegetated

3.4.2 AHEV Assessment Criteria

Native-dominated secondary forest patches (one including the stream D/S25), abandoned land forest patches were assessed for AHEVs (Figure 3-52), and were further reviewed following a set of criteria (Table 3-24; Table 3-25) to determine their AHEV scores, in order to quantitatively assess their priority of retention. The final AHEVs are shown in Figure 3-52 below.

Table 3-24 Ecological value scoring system for individual vegetation assessed within AHEV, with score modification criteria

Criteria Group	Criteria	Scoring System
Initial Ecological Value – Flora (at individual tree level)	Initial Grouping - Non-Native: 1, Native non-CS: 2, Native CS: 3	1-3
Ecological Value Modifications (at individual tree level)	Large specimens (> 3 m girth)	+1
	Association w important fauna (bamboo cluster, butterfly host plant)	+1
	Keystone species (non-large, non-CS: i.e. *Ficus variegata*)	+1
	Tree health, form, arborist assessment (poor health/form)	-1
	Nationally Restricted distribution	+1
	Storm vulnerable, softwood or prone to failure	-1

Table 3-25 Overall scoring system for AHEVs at patch level, showing weightage of each component

Criteria Group	Criteria	Scoring System	Weightage
Normalized overall Ecological Value (at patch level)	1 (Low): 0 – 0.33; 2 (Moderate): 0.34-0.66; 3 (High): 0.67-1	1-3	40%
Site Condition (at patch level)	Replaceability score	1-3	10%
	Tree species richness	1-3	10%
	Native vegetation density (trees 0.3 m to < 1 m girth)	1-3	10%

Criteria Group	Criteria	Scoring System	Weightage
	Native Recruitment Score (saplings and shrubs < 0.3 m girth)	1-3	10%
	General health of saplings/shrubs	1-3	10%
	Presence of undesirable/invasive plants species	1-3	10%
	Fauna value (density of fauna observed per patch) *Fauna scores given for applicable patches only (where fauna transect intersects patch) & are calculated for relative comparison via the following: Ecological Value: 30%, Site Condition Criteria Total:70%	1-3	10%*



Figure 3-52 Map of Selected AHEV Patches in Study Area

3.5 Recommendations and Considerations for Conservation (Proposed Mitigation Measures)

3.5.1 Retention Considerations for Native-dominated Secondary forests

With reference to the discussion and assessment of Areas of High Ecological Value (AHEV), the following factors were also taken into consideration for determining the Proposed Retained Area (PRA).

Forest Restoration

Terrestrial forests, such as the native-dominated secondary forests in AHEVs serve as important habitats, given that secondary forests in Singapore take decades to regenerate and to transition to mature secondary forests.

Research has shown that Singapore's secondary forests are regenerating at a very slow pace, with the structure and composition of mature secondary forests contrasting starkly with those of primary forests even after more than a century of recovery (Corlett, 1992). Forest succession in such fragmented habitats is likely hindered by the lack of seedling recruitment and the persistence of early successional species. Despite being in the early stages, the native-dominated secondary forests within the Study Area show promising signs of succession, with the observations of indicator species like *Anisophyllea disticha* and *Rhodamnia cinerea* (Yee et al., 2016), and the seedling recruitment of native species like *Elaeocarpus petiolatus* and *Limacia scandens* among others. If cleared, such ecosystems, which had likely taken over 50 years to evolve to its current state (Yee et al., 2016), would be difficult to replace or replicate due to their complex structure and species composition.

Forest restoration efforts have been taking place in Singapore under the NParks Nature Conservation Masterplan (NCMP) to enhance biodiversity and enhance ecological functions of forests in Singapore (Chan et al., 2023). Other nature groups and volunteer organizations such as NSS and WWF have also contributed to these efforts (Begum, 2023). These restoration efforts can create green buffers along the retained native-dominated secondary forests, providing protection against forest edge effects. If given time and the right environmental stimuli via methods like assisted natural regeneration, these forests would likely progress into mature secondary forests, while recovering biodiversity and ecosystem functioning in the process.



Figure 3-53 Native-dominated secondary forest patch with tall *Ixonanthes reticulata* trees dominating canopy

Ecological Connectivity Considerations

In 2021, NParks announced plans for the Clementi Nature Corridor, curated based on the area's ecological profile with input from a Scientific Advisory Panel as part of NParks' island-wide Ecological Profiling Exercise (EPE). The nature corridor connects vegetated sites at Clementi, Toh Tuck, and Maju, along with the Rail Corridor, linking Bukit Timah Nature Reserve and the Southern Ridges. This initiative complements existing Nature Park Networks at Bukit Timah Nature Reserve, Central Catchment Nature Reserve and the Bukit Batok Nature Corridor (Figure 3-54; Figure 3-55). Additionally, agencies are working towards safeguarding a sizeable nature park within the western half of Ulu Pandan, that would serve as a stepping-stone between the Clementi Forest and the Southern Ridges (Kent Ridge).

The retention of selected vegetated tracts within the Study Area, would allow for ecological connectivity to be retained. The existing former Jurong Railway Line and segment of Park Connector along Sungei Ulu Pandan offer opportunities for ecological connectivity beyond the Study Area, linking the Study Area to adjacent forest habitats, i.e. Clementi Forest, Toh Tuck forest. We therefore recommend measures to restore ecological connectivity to facilitate ground-dwelling fauna, such as studying the restoration of the bridge (across Sunset Way) along the former Jurong Railway Line (running through the Study Area; Figure 3-56). This aligns with the overall connectivity recommendations linking the Study Area to adjacent forest habitats and park connectors.



Figure 3-54 Illustration of Ecological Connectivity around the Study Area

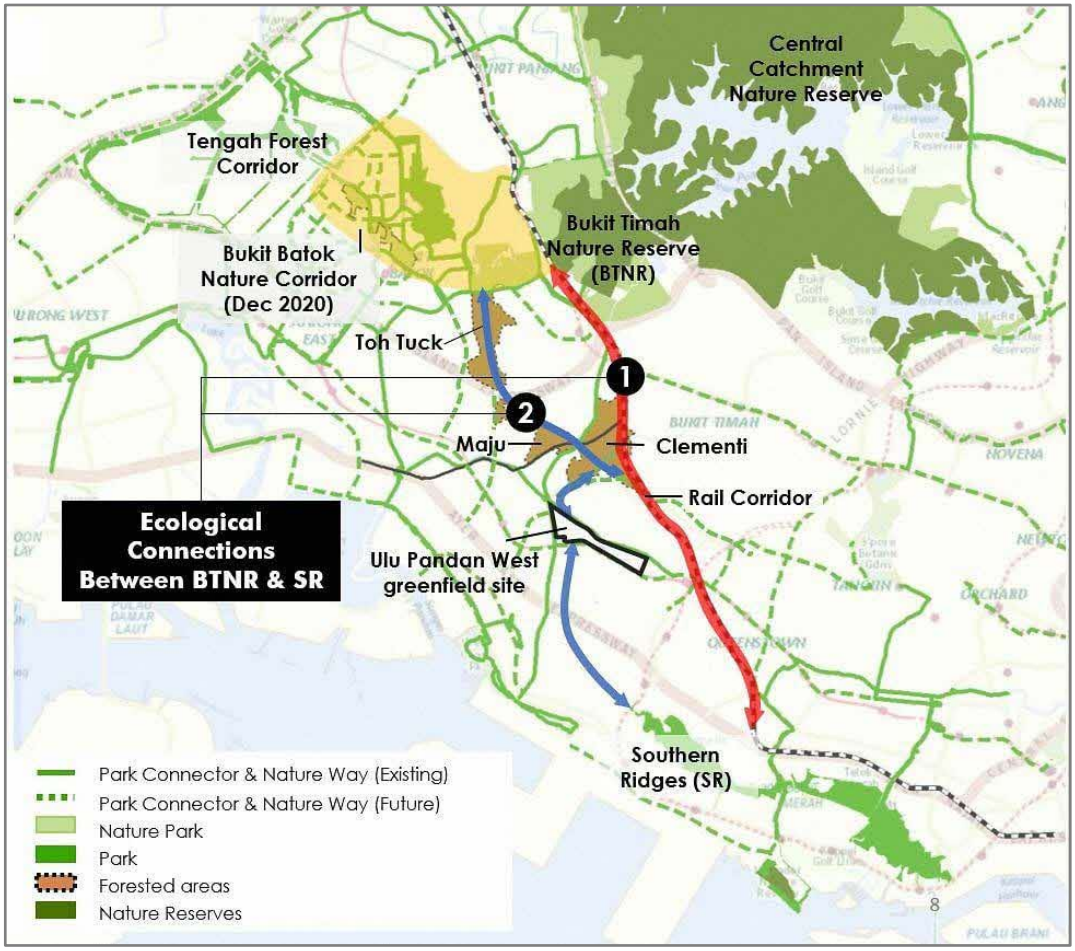


Figure 3-55 Clementi Nature Corridor and Surrounding Nature Ways and Park Connectors (Source: NParks)

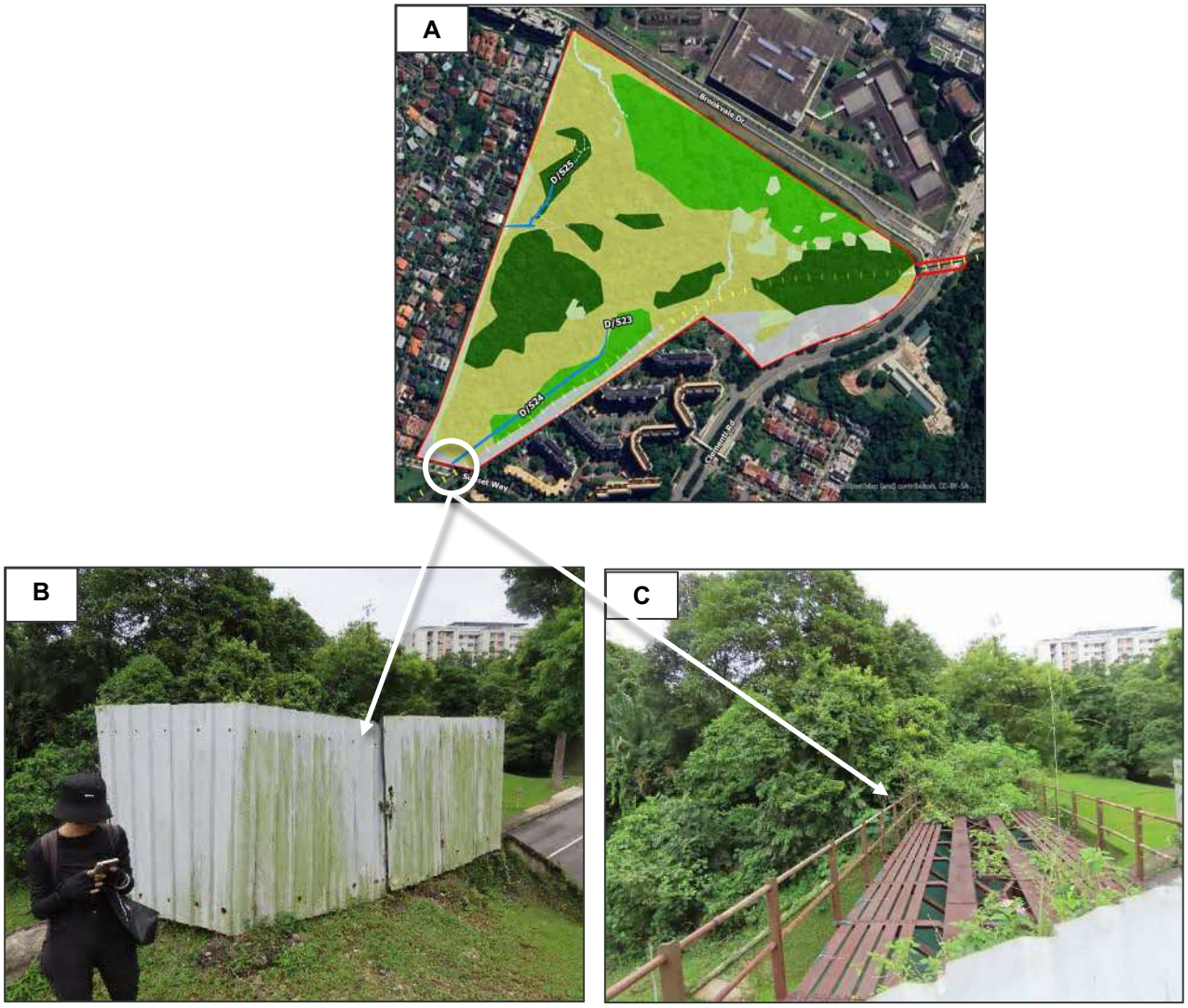


Figure 3-56 Former Jurong Railway Line Bridge Linkway south of the Study Area towards Ulu Pandan Park connector. (A) Map showing linkway location; (B) Hoarded up linkway bridge; (C) Photo taken above hoarding pointing towards the Study Area.

3.5.2 Retention Considerations for Riparian Buffers of Retained Stream D/S25

The retention of a riparian buffer should be directed by its primary objective or design intent (Fischer & Fischenich, 2000; Majumdar & Avishek, 2025). This can include water quality protection, stabilisation of streambank, flood attenuation, or provision of wildlife habitat or ecological corridors (Table 3-26). Accordingly, the widths of riparian buffers vary depending on their site context (Fischer & Fischenich, 2000; Majumdar & Avishek, 2025).

In a forest context, a multi-layered canopy with native vegetation and relatively undisturbed soil with natural, high-organic content are ideal for riparian buffers, as these enhance connectivity and retain the microclimate of the stream (Majumdar & Avishek, 2025). Further soil and hydrology studies can also be done in around stream D/S25 to determine the floor morphology of the stream and surrounding riparian areas to determine erosion potentials of this habitat to better refine these buffer areas (Fischer & Fischenich, 2000).

Overall, the abovementioned discussion pertaining to literature regarding the ideal riparian buffer widths, as well as the earlier section on the importance of riparian zones (see Section 3.2.5) were taken into consideration for the PRA in the following section of this report.

Table 3-26 General Riparian buffer strip width and size guidelines (Fischer & Fischenich, 2000)

Function	Description	Recommended Width
Water Quality Protection	Buffers, especially dense grassy or herbaceous buffers on gradual slopes, intercept overland runoff, trap sediments, remove pollutants, and promote ground water recharge. For low to moderate slopes, most filtering occurs within the first 10 m, but greater widths are necessary for steeper slopes, buffers comprised of mainly shrubs and trees, where soils have low permeability, or where NPSP loads are particularly high.	5 – 30 m
Riparian Habitat	Buffers, particularly diverse stands of shrubs and trees, provide food and shelter for a wide variety of riparian and aquatic wildlife.	30 – 500 m or more
Stream Stabilisation	Riparian vegetation moderates soil moisture conditions in stream banks, and roots provide tensile strength to the soil matrix, enhancing bank stability. Good erosion control may only require that the width of the bank be protected, unless there is active bank erosion, which will require a wider buffer. Excessive bank erosion may require additional bioengineering techniques (see Allen & Leach, 1997).	10 – 20 m
Flood Attenuation	Riparian buffers promote floodplain storage due to backwater effects, they intercept overland flow and increase travel time, resulting in reduced flood peaks.	20 – 150 m
Detrital Input	Leaves, twigs and branches that fall from riparian forest canopies into the stream are an important source of nutrients and habitat.	3 – 10 m

3.5.3 Proposed Retained Area (PRA)

The Proposed Retained Area (PRA) was determined based on several factors, including development considerations, baseline findings, topography of the area and ecological connectivity, as follows:

a) Ecological connectivity was a crucial consideration for the PRA, as the Study Area serves as an ecological connection to Clementi Forest – by virtue of the former Jurong Railway Line and Rail Corridor – allowing fauna to move across the different forest patches.

   Thus, the PRA aims to retain the overall ecological connectivity within the Study Area (Figure 3-57) and between surrounding forest patches, i.e. Clementi Forest. The former Jurong Railway Line within the Study Area has been designated as the primary ecological corridor and will be retained as part of the PRA. The interface with former Jurong Railway Line was also adjusted wider to account for the topography of the site (i.e. existing slopes at the side of former Jurong Railway Line), thereby allowing for more greenery to be retained.

b) In addition, the PRA also considered the retention of the natural freshwater stream D/S25 and its surrounding riparian buffer along the north-western part of the Study Area, as well as a portion of native-dominated secondary forest in the south mapped out during the EIA study. Given its higher biodiversity value amongst the identified waterbodies, only the freshwater stream D/S25 will be retained.

c) Part of the PRA further bolsters ecological connectivity between the two identified refugia – namely the retained stream D/S25 in the northwest and the proposed retained native-dominated secondary forest in the south-western patch (south of stream D/S25). It provides an ecologically feasible corridor consisting of closed canopy, forming a contiguous green area which connects the northwestern and southern refugia towards the former Jurong Railway Line. The increased PRA at the southern area will assist in reducing the edge effect on the proposed retained native-dominated secondary forest, while conserving more conservation significant plants and keystone species. This allows for a larger contiguous green habitat to allow forest-dependent fauna species such as the Pin-striped Tit-babbler, Green Crested lizard, and those of conservation significance such as the Straw-headed Bulbul, Red legged Crake, Chocolate Sailor butterfly, and Bamboo bats to reside and forage in.

d) The southern area of the PRA also retains several instances of conservation significant plants, including the nationally critically endangered *Cryptocarya rugulosa*, and the vulnerable *Gynochthodes rigida* amongst others.

e) The PRA also considered the existing topography of the area (Figure 3-58) – which is highly undulating and subjected to soil investigation and geotechnical analysis. Some areas within the PRA may be affected for the soil investigation works and slope stabilisation works, which includes construction of routes of temporary access and necessary working area (for contractors and machines; the path with least environmental impact shall be undertaken).

However, the extent of the affected areas will be developed as well as reviewed and elaborated on during the detailed EMMP stage. These areas within the PRA will nonetheless be retained, and habitat restoration works (i.e. replanting with a native planting palette as suggested in Section 3.5.3) will be done as part of the reinstatement works. The proposed works are thus subject to the measures stated in this EIA (Table 3-27), as well as the EMMP (Section 8.4.1), subject to further review during the detailed EMMP stage and authorities' approvals.

The impact assessment has accounted for the temporary habitat loss due to slope stabilisation works, with the consideration that reforestation at the affected areas within the PRA will be carried out subsequently. Mitigation measures during reinstatement (after slope stabilisation works) will include measures such as reforestation in the form of replanting with a native palette, designs with minimal disturbance to surrounding biodiversity and to deter encroachment/trespassing.

Overall, the PRA represents a strategically optimized land retention approach that balances development objectives with environmental stewardship. Following the public disclosure and feedback period, the conceptual plan has been refined taking into account both the EIA findings and the feedback received, and the EIA has been updated accordingly to reflect these refinements.



Figure 3-57 Map of PRA with Habitat Mapping

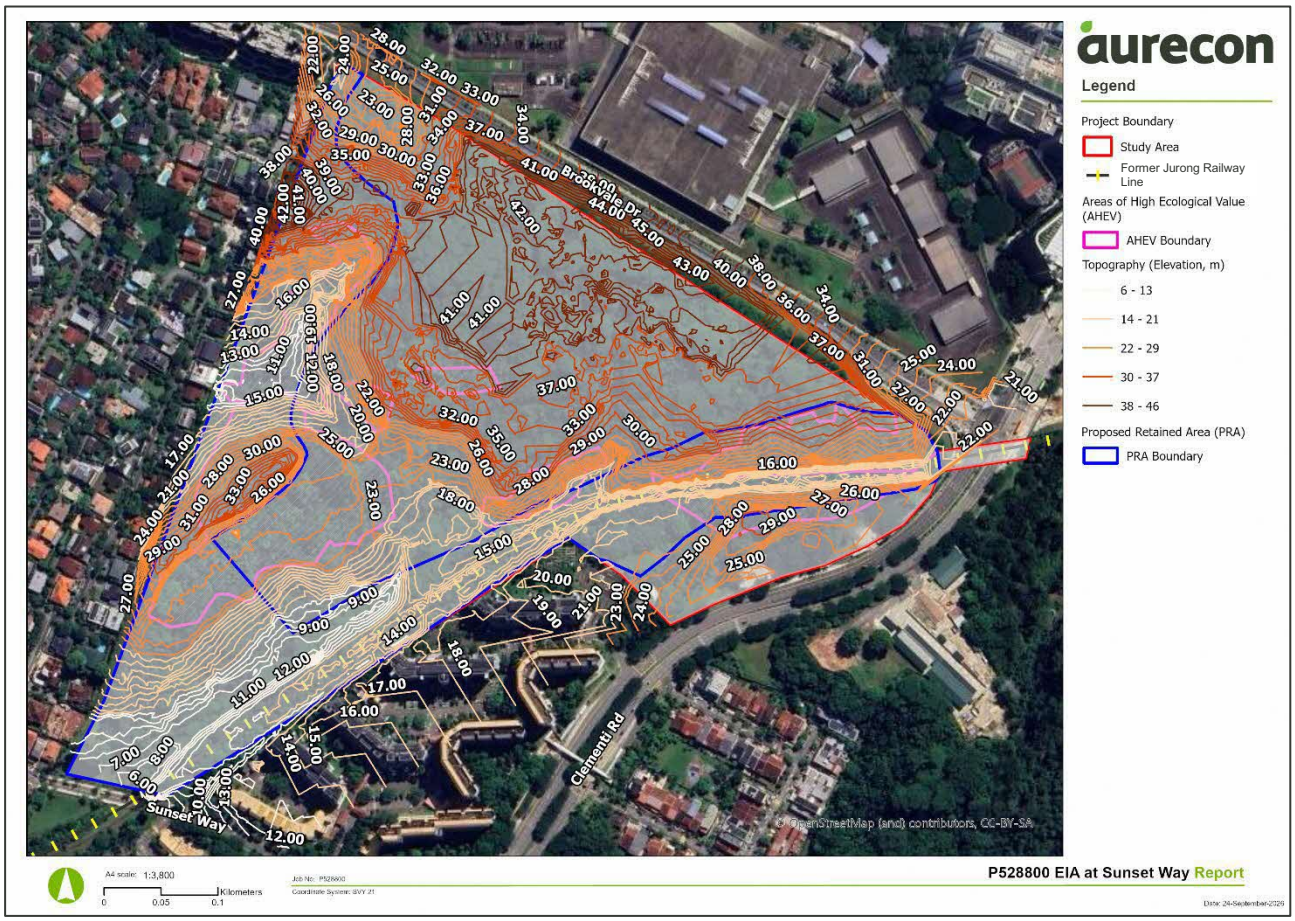


Figure 3-58 Map of PRA with Topography

3.5.4 Enhancement and Compensatory Measures through Ecological Design

Proposed Planting Palette

In consideration of the biodiversity impacts that the Project can have on local ecosystems, it is imperative to integrate strategies that not only enhance biodiversity but also sustain biodiversity within the PRA. While most habitats within the existing forest may be earmarked for development, the report recommends the incorporation of specific features into the planting palette as a compensatory measure. The following paragraphs detail the proposed planting palette, as well as general planting guidelines, which are recommended for adoption during the planning and design stage.

A selection of plants has been proposed for the replanting of forest edges and scrublands within and abutting the PRA, with the aim of enhancing ecological connectivity for fauna, whilst restoring forest structure to sustain ecological function of these enhancements (refer to Appendix D for proposed planting palette). Most of the proposed plant species have been found within the Study Area.

i) PRA - Forest edges and Scrublands / Managed Vegetation

Canopy

In the southern tip of the Study Area, a managed turf consists of herbs and grasses, as well as a few small shrubs and irregularly formed trees. In order to maintain and enhance connectivity upon development commencement, a palette of native species can be planted during the pre-construction phase to restore ecological function to the otherwise bare canopy. Fast-growing *Macaranga* species are recommended to be

planted to establish an early canopy layer, with shade cooling the soil while leaf litter allows decomposition and mycorrhizal re-establishment, allowing some restoration of soil structure. *Sterculia parviflora*, a cultivated species with prior planting on site, could also be used to enhance this area, further buffering the PRA's peripheral forest from edge effects. It also serves to attract birds and provides aesthetic value to the edges, especially near roadsides or residential areas. Other larger native trees like *Terminalia catappa* could also be established (subject to NParks' inputs), and once mature, epiphytes like *Asplenium nidus* (Birds' Nest Fern) can be planted within the crown to provide refugia for fauna.

Understorey

The understorey could also be enhanced with smaller trees and tall shrubs like *Ardisia elliptica*, *Ixora congesta*, *Leea indica* and *Leea rubra*. The *Leea* species in particular have flowers which attract butterflies and other insects. The Red Lipstick Palm (*Cyrtostachys renda*), a threatened, ornamental native palm, could also enhance the forest structural diversity while providing food for fauna. Other smaller trees, like *Mallotus paniculatus* and *Trema cannabina*, could be planted further inland. The latter are indicators of forest succession and could potentially initiate forest succession by enhancing structural diversity and providing early perches for birds, leading to more seed dispersal and better establishment of species diversity later on.

Undergrowth/Ground Cover

Grasses and shrubs already within the Study Area can be enhanced or replaced with native species like *Piper sarmentosum* (edges), and ferns like *Taenitis blechnoides*, *Alsophila latebrosa* or *Nephrolepis biserrata*, can provide shade for small fauna traversing the site.

ii) Former Jurong Railway Line

Forest species are recommended to be planted to restore the habitat and the connectivity after site investigation and potential slope stabilisation works are completed. The following considerations were made for species recommended for this area: fast growing, of ecological value and typically functioning as pioneer species. Examples include *Macaranga griffithiana*, *Caryota mitis*, *Melastoma malabathricum*, *Ardisia elliptica* and *Syzygium zeylanicum*.

General Planting Guidelines

Planting of Native Trees

The selection of native trees is essential as they are well-adapted to the local climate and soil conditions, fostering a stronger resilience against pests and diseases. Native trees also provide crucial habitats and food sources for a variety of wildlife, including birds, mammals, and insects (Shono et al., 2007; Lok et al., 2013).

Planting of Plants that Attract Birds

To create an ecologically sensitive environment for bird species within the Project, it is recommended to include a diverse range of native plants known to attract birds. This can lead to a potential increase in bird populations, enriching nature appreciation for future residents. A detailed list of suitable plants that serve as food sources and nesting sites for birds is recommended by NParks: https://www.nparks.gov.sg/docs/default-source/resources/2009/bird-attracting-plants-may2009.pdf. Incorporating these plants will not only enhance the visual appeal of the landscape but also support local avifaunal biodiversity.

Planting of Plants that Attract Butterflies

Butterflies are vital pollinators in ecosystems and considered bioindicators of ecosystem health. Therefore, incorporating native plants that attract butterflies into the landscape can be beneficial. These plants can provide nectar and habitat for various butterfly species, supporting their life cycles. A list of suitable plants that effectively attract butterflies is recommended by NParks: https://www.nparks.gov.sg/docs/default-

source/resources/2009/butterfly-attracting-plants-may2009.pdf. The typical planting strategies that have been proposed by NParks is presented in Figure 3-59 & Figure 3-60 below.

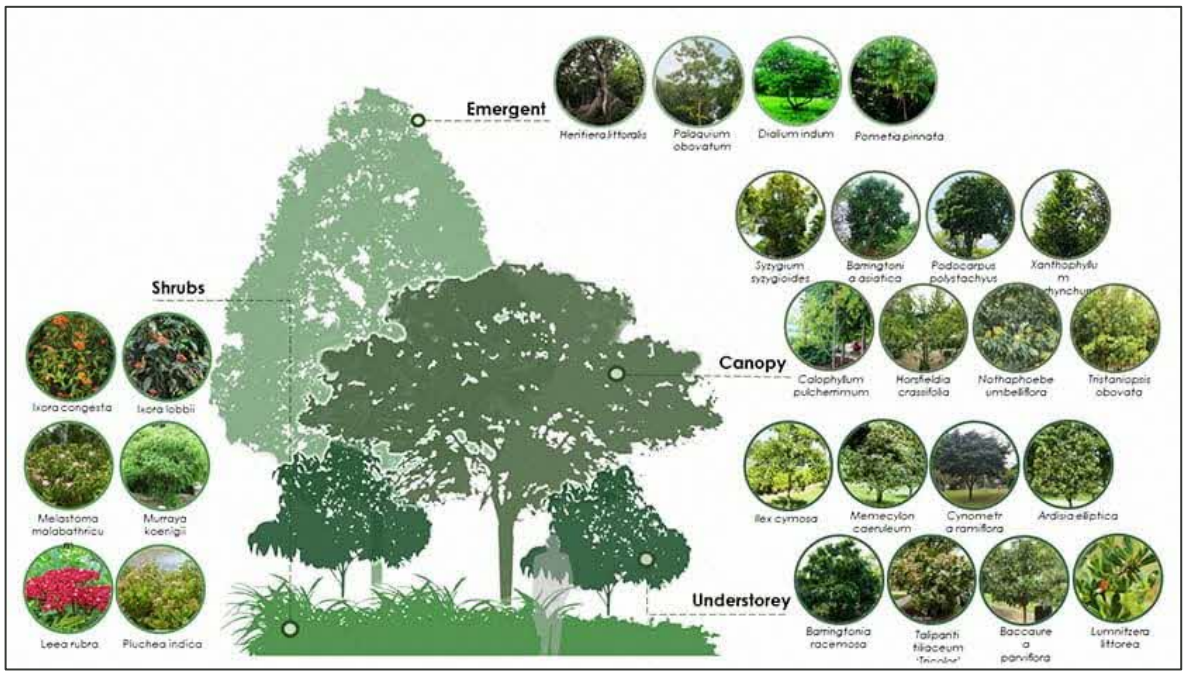


Figure 3-59 Indicative Native Planting Palette (Source: NParks)



Figure 3-60 NParks' Recommended Multi-tiered Planting (Source: NParks)

Bird and Bat Friendly Design

The design of the Project should aim to enhance biodiversity while ensuring the safety of both wildlife and humans. To achieve this, careful consideration must be given to architectural features and environmental design strategies that mitigate potential conflicts with wildlife, particularly birds and bats. Where feasible and practicable, the exterior of all buildings shall incorporate visible structural details and bird-friendly features to reduce avian collisions. The following materials and techniques are recommended and should be incorporated into the design of the Project where applicable and practicable. Bird-friendly design guidelines have also been recommended by NParks: https://www.nparks.gov.sg/docs/default-source/resources/2024/bird-safety-guidelines-jun2024.pdf.

- Ultraviolet and Low Reflectance Glass - All windows and glass facades are recommended to utilize ultraviolet (UV) and low reflectance glass that are visible to birds and prevent deadly collisions (NParks, 2024). This type of glass should be designed to minimise reflection while providing natural light. Additionally, low reflectance materials such as frosted glass are also recommended.
- Fritted Glass - Use fritted glass with ceramic patterns that are visible to birds to enhance their ability to perceive the glass surfaces (Figure 3-61). The frit patterns should be strategically placed to ensure visibility for avian species.

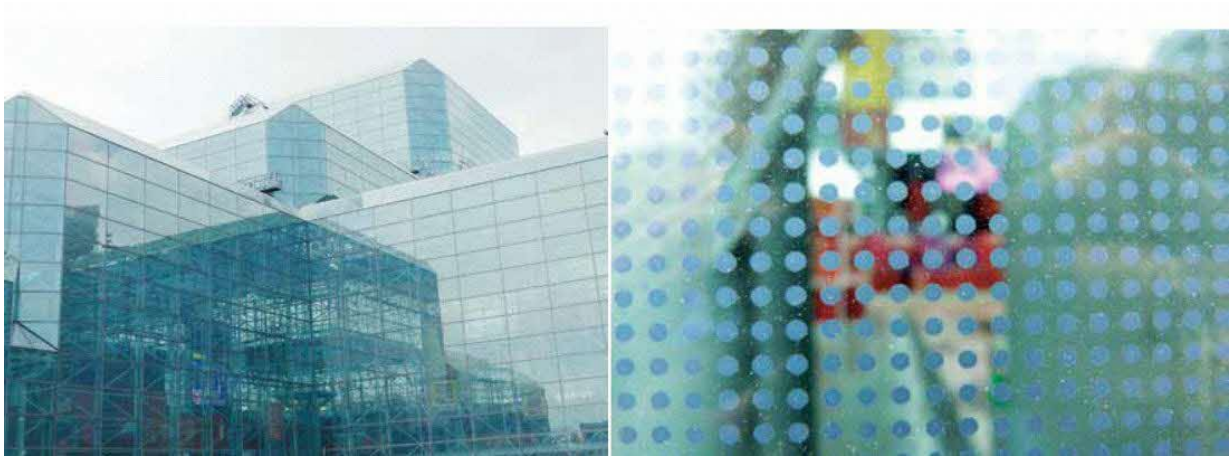


Figure 3-61 Example of Fritted Glass Surfaces of New York City's Javits Convention Centre (Image credits: Glenn Phillips)

- Decals and Stickers - Decals and stickers are recommended to be applied to exterior glass surfaces (Figure 3-62) to create visual markers that enhance the visibility of potential hazards to birds (NParks, 2024).



Figure 3-62 Example of Decals applied on the exterior glass surfaces of building at HortPark and the Singapore Botanic Gardens (right) (Image credits: Soh Leng Hionng (Left) and Voon Tin Keat (Right))

Lighting Design for Wildlife

The lighting layout for the Project should minimise disruption to wildlife. Designers shall, where practicable and feasible, work with agencies to implement the following strategies to minimise light pollution and disorientation:

- Directed Lighting - All outdoor lighting fixtures should be designed to direct light only to the intended areas. Lighting must be focused downward and shielded to prevent upward light pollution (Figure 3-63).

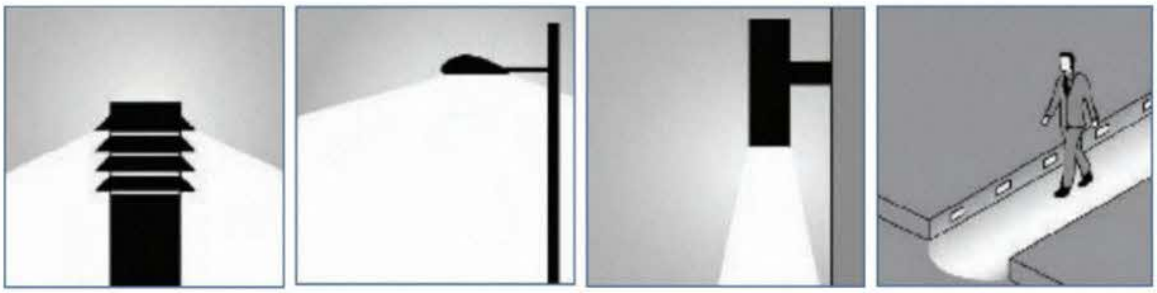


Figure 3-63 Example of Lighting Fixture Designs that Minimise Light Spill (Image credit: San Francisco Planning Department 2011)

- Use of Warm Colour Temperatures - Utilize warm colour temperature fixtures (3000 K or lower) for outdoor lights to minimize glare and disrupt nocturnal wildlife less as compared to cooler, harsher lighting options (Figure 3-64).

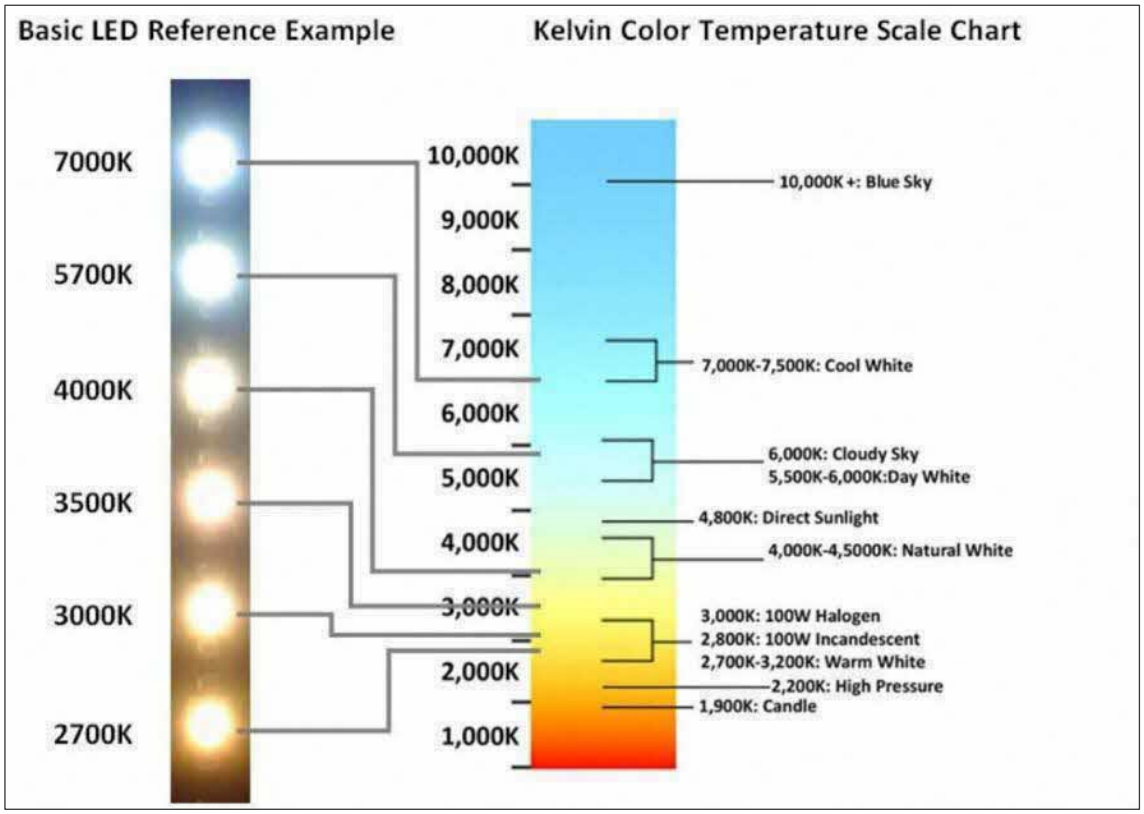


Figure 3-64 Colour Temperature of Light

The above recommended design features aim to ensure that the Project not only attract biodiversity but also minimise wildlife-human conflict. The implementation of these measures is crucial in creating a harmonious coexistence between the built environment and the natural ecosystem.

Other Considerations

Bamboo cluster

Bamboo clusters should also be considered for protection as it is a likely habitat for the vulnerable Bamboo bats recorded in the Study Area. The area can be enhanced by planting new bamboo clusters that can grow and become habitat for the bats in the future where feasible.

3.6 Impact Assessment Matrix with Mitigation Measures – Ecology and Biodiversity (based on PRA)

Table 3-27 Impact Assessment Matrix with Mitigation Measures for Ecology and Biodiversity

Work Activity	Environmental Aspect	Environmental Impacts	Sensitive Receptors	Impact Evaluation without Mitigation Measures							Recommended Mitigation Measures	Impact Evaluation with Mitigation Measures			Remarks
				A1 – Importance A2 – Magnitude		B1 – Permanence B2 – Recoverability B3 – Cumulative Impact			ES – Environmental Score						
				A1	A2	B1	B2	B3	ES	ES Class		A2	ES	ES Class	
Pre-construction Phase / Advance works Site clearance Construction Phase Operational Phase	Deforestation, loss of habitat, loss of fauna	Unplanned or rushed vegetation clearing can result in significant loss of habitat and disruption of ecological connectivity, which may potentially lead to increased risk of wildlife displacement or mortality	Scrubland	2	-2	3	2	3	-32	Slight negative impact	**Pre-Construction Phase / Advance Works** *Plant Salvaging* ■ The **salvaging of conservation significant (CS) species terrestrial and riparian plants** ■ **Retain CS flora species** and implement **Tree Protection Zone (TPZ)** should the trees be retained. ■ **Translocation** of terrestrial/aquatic fauna ■ **Biodiversity awareness training** should be carried out by the EMMP Consultant. *Soil Investigation Works* ■ Where practicable, borehole locations should remain within Project and be at least **5 m from tree structures** to protect roots. ■ Only **minimal site clearance**, if required; undergrowth clearance and pre-clearance inspections may be conducted to form access routes. ■ Access paths and routes are to be clearly marked/demarcated with rope and/or tape, including path widths, thereby deterring unauthorized entry into forested areas. ■ Use **mini excavators** and **small portable drilling rigs** where feasible to reduce habitat disturbance. ■ Conduct soil investigation and ancillary works only **during daylight hours on workdays**. ■ Where practicable and to best effort, SI work sites shall be clearly demarcated with portable hoarding (or next best alternative such as orange netting) and **enclosed with acoustic barriers/screens, where practicable.** ■ Contain and properly dispose of all waste (solid, liquid, construction, drilling, human/food) via licensed contractors. ■ Deploy **sandbags and/or silt fencing** around worksite perimeters to prevent waste discharge into surrounding areas.	-1	-16	Slight negative impact	Importance is assigned 2 as all species recorded were classified as least concern or had no assigned conservation status. The overall area is only approximately 1.21 ha (5.42%).
			Managed Vegetation	1	-2	2	2	2	-12	Slight negative impact		-1	-6	No significant impact	Importance is assigned 1 as the land is managed. Clementi Neighbourhood Park is designated as Managed Vegetation and will be retained as part of the PRA.
			Albizia-dominated Secondary Forest	3	-4	3	3	2	-96	Moderate negative impact		-3	-72	Minor negative impact	Importance is assigned 3 as the habitat type makes up ~20% of the overall Study Area, and there are several nationally threatened trees found within the habitat.
			Abandoned Land Forest	3	-4	3	3	2	-96	Moderate negative impact		-2	-48	Minor negative impact	Importance is assigned 3 as the habitat type accounting for AHEV scoring, and there are several nationally threatened trees found within the habitat.
			Native-dominated Secondary Forest	5	-4	3	3	3	-180	Major negative impact		-3	-135	Major negative impact	Importance is assigned 5 as there are several nationally threatened trees found within the habitat. The habitat type is also of high importance to Singapore's biodiversity.

Work Activity	Environmental Aspect	Environmental Impacts	Sensitive Receptors	Impact Evaluation without Mitigation Measures							Recommended Mitigation Measures	Impact Evaluation with Mitigation Measures			Remarks
				A1 – Importance A2 – Magnitude		B1 – Permanence B2 – Recoverability B3 – Cumulative Impact			ES – Environmental Score						
				A1	A2	B1	B2	B3	ES	ES Class		A2	ES	ES Class	
			Mammals	5	-4	3	3	2	-160	Major negative impact	*Slope Stabilisation Works* ■ Boundary for slope stabilisation works (if required), to be **demarcated properly** within PRA, and where practicable, be at **least 5 m away from tree structures** to protect roots. ■ Should SI works be required within slope stabilisation work boundary, the SI work measures shall be adhered to. ■ Similar to SI works, access routes and machinery used to be **non-intrusive and minimal disturbance**, where practicable. ■ Salvaging of **CS flora** and **fauna translocation**, where applicable and practicable ■ Pre-site clearance/tree felling inspections to be conducted. ■ Reinstatement of vegetation and replanting with **native planting palette.** ■ **Restrict access** to PRA during reinstatement period, which includes but is not limited to: – 'No Entry' signages along appropriate locations around the periphery of the PRA. **Proposed Retained Area** ■ The retention of the vegetated area (PRA) – Natural stream D/S25 to be retained ■ A large tract of contiguous vegetation in the southern part of the Study Area is to be retained as well. – Comprising a mix of mainly native-dominated secondary forest and abandoned land forest.	-2	-80	Minor negative impact	Importance is assigned 5 as the globally critically endangered Sunda Pangolin was recorded in AECOM 2022 EIA study, although it was not observed in the current study. Additionally, > 50% of the habitat will be lost.
			Odonate	2	-3	3	3	2	-48	Minor negative impact		-1	-16	Slight negative impact	Importance is assigned 2 as all species recorded were classified as least concern or had no assigned conservation status. Stream D/S25 is proposed to be retained.
			Butterfly	2	-3	3	3	2	-48	Minor negative impact		-2	-32	Slight negative impact	Importance is assigned 2 as all species recorded were classified as least concern or had no assigned conservation status.
			Herpetofauna	2	-3	3	3	2	-48	Minor negative impact		-2	-32	Slight negative impact	Importance is assigned 2 as all species recorded were classified as least concern or had no assigned conservation status.

Work Activity	Environmental Aspect	Environmental Impacts	Sensitive Receptors	Impact Evaluation without Mitigation Measures							Recommended Mitigation Measures	Impact Evaluation with Mitigation Measures			Remarks
				A1 – Importance A2 – Magnitude		B1 – Permanence B2 – Recoverability B3 – Cumulative Impact			ES – Environmental Score						
				A1	A2	B1	B2	B3	ES	ES Class		A2	ES	ES Class	
			Avifauna	5	-3	3	3	2	-120	Major negative impact	**Construction Phase** ■ Land clearance direction and sequence of events should be carried out following the recommended wildlife shepherding plan during the EMMP stage. ■ Pre-felling fauna inspections should be carried out prior to land clearance to identify active bird nests or other wildlife. ■ Before land clearance, hoarding should be installed starting from the most disturbed areas, such as roads, to prevent any roadkill and then progressively move inwards. ■ The hoarding shall be installed with no gaps between panels and should extend at least 300 mm into the ground to prevent ground-dwelling animals from entering the site. ■ Access gates should be designed to close tightly with no gaps between panels and positioned as close to the ground as possible. ■ If any wildlife, especially birds, reptiles, or mammals, is spotted at or around the site during construction and cannot be safely guided out, a licensed Wildlife Management Company should be engaged for the safe rescue and relocation of the animal. ■ If a wild boar is spotted at or around the site at any time during construction, NParks must be notified immediately at nparks_wildlife_management@nparks.gov.sg. A licensed wild boar removal contractor must also be engaged to safely trap and remove the animal. The trapping and removal process may take about 4 – 8 weeks. Once it is confirmed that no wild boars remain within the forest patch, the wildlife shepherding plan outlined in the EMMP may proceed. **Operation Phase** ■ Habitat restoration should be conducted for the retained areas. – Invasive species should be removed and checked for periodically. – Native species to be replanted in place.	-2	-80	Minor negative impact	Importance is assigned 5 as the globally Critically Endangered Straw-headed Bulbul was recorded.
	Loss of waterbodies	The waterbodies running through the Study Area contain aquatic fauna and CS riparian flora species. The waterbodies are likely to be cleared during the land preparation	Waterbodies	4	-4	3	3	2	-128	Major negative impact	**Proposed Retained Area** ■ The retention of the vegetated area (PRA). – Natural stream D/S25 to be retained.	-1	-32	Slight negative impact	Importance is assigned 4 as some of waterbodies are natural freshwater streams. Stream D/S25 is to be retained.

Work Activity	Environmental Aspect	Environmental Impacts	Sensitive Receptors	Impact Evaluation without Mitigation Measures							Recommended Mitigation Measures	Impact Evaluation with Mitigation Measures			Remarks
				A1 – Importance A2 – Magnitude		B1 – Permanence B2 – Recoverability B3 – Cumulative Impact			ES – Environmental Score						
				A1	A2	B1	B2	B3	ES	ES Class		A2	ES	ES Class	
		phase, and the fauna species might not be mobile enough to move upstream or downstream to avoid the construction, leading to animal mortality and loss of aquatic fauna and flora species.	Riparian Flora	3	-4	3	2	3	-96	Moderate Negative Impact	– Ferns and riverine plants should be planted (e.g. *Magnolia singapurensis*, a locally critically endangered native swamp species) by stream banks to prevent soil erosion and to improve the stream's health to improve the ecosystem for aquatic species. – Native aquatic/riparian plants will help to filter and clarify the water, creating a more conducive ecosystem for the aquatic fauna community.	-1	-24	Slight negative impact	Importance is assigned 3 as there are multiple nationally threatened species recorded in the riparian survey. The natural stream D/S25 and is to be retained, along with a riparian buffer.

Work Activity	Environmental Aspect	Environmental Impacts	Sensitive Receptors	Impact Evaluation without Mitigation Measures							Recommended Mitigation Measures	Impact Evaluation with Mitigation Measures			Remarks
				A1 – Importance A2 – Magnitude		B1 – Permanence B2 – Recoverability B3 – Cumulative Impact			ES – Environmental Score						
				A1	A2	B1	B2	B3	ES	ES Class		A2	ES	ES Class	
			Freshwater Aquatic Fauna	2	-4	3	2	2	-56	Minor negative impact	▪ A large tract of contiguous vegetation in the southern part of the Study Area is to be retained as well. – Comprising a mix of mainly native-dominated secondary forest and abandoned land forest. **Pre-Construction Phase / Advance Works** ▪ Salvaging of CS riparian plants can be carried out before any construction works starts, where applicable and practicable. ▪ Salvaging of freshwater aquatic fauna can be carried out by an aquatic fauna expert. The fishes should then be released in a suitable environment, with the location to be decided following consultation with NParks, where applicable and practicable. **Construction Phase** ▪ Bund walls and silt fences should be set up at appropriate locations if to prevent flow of pollution of waterbodies outside of the Project. If necessitated by NParks, these waterbodies (i.e. D/S25) will be monitored monthly. Parameters to be monitored should follow the EIA baseline water sampling parameters. ▪ If water quality parameters exceed the pre-construction baseline levels or appropriate legislation, necessary steps shall be taken to ensure that water quality parameters return to acceptable levels. ▪ Backfilling of streams should start from upstream and proceed downstream, to allow for aquatic fauna to swim downstream. **Operation Phase** ▪ Water quality should be monitored monthly at the assigned locations (i.e. ECM discharge points), post-construction for 3 months. Parameters to be monitored should follow the EIA baseline water sampling parameters. ▪ If water quality parameters exceed the pre-construction baseline levels or appropriate legislation, necessary steps shall be taken to ensure that water quality parameters return to acceptable levels.	-1	-14	Slight negative impact	Importance is assigned 2 as there were no CS species recorded during the EIA study. The natural stream D/S25 and is to be retained, along with a riparian buffer.

Work Activity	Environmental Aspect	Environmental Impacts	Sensitive Receptors	Impact Evaluation without Mitigation Measures							Recommended Mitigation Measures	Impact Evaluation with Mitigation Measures			Remarks
				A1 – Importance A2 – Magnitude		B1 – Permanence B2 – Recoverability B3 – Cumulative Impact			ES – Environmental Score						
				A1	A2	B1	B2	B3	ES	ES Class		A2	ES	ES Class	
	Introduction and proliferation of weeds/ invasive species	Potential for habitat degradation due to the proliferation of invasive species, which may compete with native species in areas cleared for construction Introduction of new invasive species (e.g., through landscaping efforts or from vehicles and other transmission pathways such as humans and fauna) could occur during the construction phase	Forest habitats immediately surrounding the Project	4	-2	3	2	3	-64	Minor negative impact	▪ Only native plants should be used for landscaping along the forest edge to prevent non-native species from outgrowing native vegetation. ▪ A weed management protocol should be incorporated into the EMMP to identify and remove invasive species during the construction stage. ▪ A washing bay should be present at the construction site entrance to ensure that vehicles do not track out debris containing invasive species.	-1	-32	Slight negative impact	Importance is assigned 4 as the PRA surrounding the development area comprise a mix of native-dominated secondary forest, Albizia-dominated secondary forest and abandoned land forest.
Construction Phase General construction activities	Vehicle movement / usage of machinery	Soil compaction can negatively impact root systems	Retained flora within the Project	4	-1	3	2	3	-32	Slight negative impact	▪ In general, TPZ requirements and management measures specified in the Guidelines on Greenery Provision and Tree Conservation for Developments by NParks shall be adhered to, and further advice to be sought from the Certified Arborist. – Tree Protection Zones (TPZs) should be established to safeguard the trees and their root systems where reasonably practicable. – TPZ should be hoarded up (i.e. bright orange polyethylene fencing or other effective tree protection fencing) to demarcate TPZ boundary clearly to restrict entry and prevent construction works from encroaching into the TPZ. ▪ The health of retained trees and trees 10 m along the Project should be checked monthly by a certified arborist, and, if the health of the trees deteriorates, the arborist and appointment Contractor should work together to cease or reverse the deterioration if possible.	0	0	No significant impact	Importance is assigned 4 as the proposed retained area houses multiple nationally threatened flora individuals.
	Heat and light reflection from open/ cleared spaces into adjacent vegetated areas	Edge effects will affect habitats in vegetated areas adjacent to the construction site. These impacts may include heat and light reflection, which may dry out the forest edges, as well as dust emissions from construction activities that may deposit on surrounding vegetation	Trees 10 m along the Project	4	-2	3	2	3	-64	Minor negative impact		-1	-32	Slight negative impact	Importance is assigned 4 as the PRA contains nationally threatened trees.
	Hunting and poaching	Potential risk of fauna mortality from hunting and poaching due to the influx of workers and improved road access. This could lead to the mortality of individual animals and a reduction in local populations	Fauna in and around the Project	5	-2	3	2	2	-70	Minor negative impact	▪ All Project personnel shall attend biodiversity awareness training, to be carried out by the EMMP Consultant. ▪ The appointed Contractor shall keep a register of personnel who have undertaken the training. ▪ A bi-annual refresher for the biodiversity awareness training should be done for all Project personnel. ▪ Hoarding shall be put up once wildlife shepherding is completed, and the appointed Contractor is to ensure that workers do not enter the forest unless necessary (e.g. fire in the construction site)	0	0	No significant impact	Importance is assigned 5 as the globally Critically Endangered Straw-headed Bulbul is found within the Study Area

Work Activity	Environmental Aspect	Environmental Impacts	Sensitive Receptors	Impact Evaluation without Mitigation Measures							Recommended Mitigation Measures	Impact Evaluation with Mitigation Measures			Remarks
				A1 – Importance A2 – Magnitude		B1 – Permanence B2 – Recoverability B3 – Cumulative Impact			ES – Environmental Score						
				A1	A2	B1	B2	B3	ES	ES Class		A2	ES	ES Class	
	Human-wildlife incidents/ conflicts	The interface between wildlife and humans may increase, leading to potential conflicts in the fauna were to enter the construction site. Fauna species that may require attention within the Project include: ▪ Long-tailed Macaque (*Macaca fascicularis*); ▪ Wild boar (*Sus scrofa*); ▪ Rodents (non-native mice and rats)	Fauna in the Study Area	4	-2	2	2	2	-48	Minor negative impact	▪ All Project personnel shall attend biodiversity awareness training, to be carried out by the EMMP Consultant. ▪ The appointed Contractor shall keep a register of personnel who have undertaken the training. ▪ A bi-annual refresher for the biodiversity awareness training should be done for all Project personnel. ▪ Workers should be briefed on a weekly basis during toolbox meetings and reminded not to stray beyond the Project. ▪ Rubbish bins should be securely enclosed to prevent monkeys from accessing the food waste. ▪ Bins at open areas should be monkey-proof to discourage wildlife from scavenging food waste. ▪ Ensure that garbage, recyclables, and food waste are not left outside. ▪ Feeding monkeys or any other wildlife is strictly prohibited. ▪ The worker assembly area, rest area, worksite entrances, and access routes should be located away from the edge of the forested area where possible. ▪ Engage a licensed Wildlife Management Contractor for the safe rescue and relocation of any wildlife that cannot be safely guided out at or around the site during construction. – The Wildlife Management Contractor and NParks shall be engaged in advance to mitigate human-wildlife conflict beyond and prior to wildlife shepherding – Conduct biodiversity awareness and educational talks, and monkey guarding, if necessary.	-1	-24	Slight negative impact	Importance is assigned 4 as fauna which are likely to enter the construction site to search for food are Long-tailed macaques, which are globally Endangered.

Work Activity	Environmental Aspect	Environmental Impacts	Sensitive Receptors	Impact Evaluation without Mitigation Measures							Recommended Mitigation Measures	Impact Evaluation with Mitigation Measures			Remarks
				A1 – Importance A2 – Magnitude		B1 – Permanence B2 – Recoverability B3 – Cumulative Impact			ES – Environmental Score						
				A1	A2	B1	B2	B3	ES	ES Class		A2	ES	ES Class	
	Wildlife entrapment within the site	Wildlife may become trapped within the site due to man-made structures, such as hoardings, nettings of ECBs, or ECM ponds, resulting in fauna mortality due to overexertion and stress	Fauna in the Project	2	-2	2	2	2	-24	Slight negative impact	▪ All site personnel shall attend biodiversity awareness training. Regular refresher sessions during toolbox meetings are recommended to enhance awareness among construction personnel. ▪ Hoarding should be installed, with no gaps between the panels and extended at least 300 mm into the ground, to prevent ground-dwelling animals from entering the site. Installation should commence from the development's roadside boundary and progress inward to prevent any roadkill. ▪ Daily inspections should be conducted by the Environmental Checker / Environmental Control Officer / Earth Control Measures Officer on site in areas where Erosion Control Blankets (ECB)s and Earth Control Measure (ECM)s are implemented to check for any trapped animals. Gaps in hoarding are to be checked too and promptly sealed. ▪ Any incidents of animal entrapment should be promptly reported. ▪ The EMMP shall include a Wildlife Response Plan should any fauna be spotted on site. ▪ Only biodegradable ECBs are to be used within the Project.	-1	-12	Slight negative impact	Importance is assigned 2 as the fauna likely to be trapped are snakes, where no snakes of conservation significance were recorded during the surveys.
Operational Phase Operation of access road(s) Operation of Pedestrian Linkages	Vehicle collisions with animal	Animal mortality from roadkill	Fauna in and around the Project	5	-2	3	2	2	-80	Minor negative impact	**Construction & Operation Phase** ▪ A vehicle speed limit of 15 km/h should be imposed within the Project. ▪ A road hump should be installed at the entrance of the Project and to control vehicle speed. ▪ Adequate wildlife warning signage should be prominently displayed along access roads to prevent wildlife-vehicle collisions. ▪ Daily checks of access roads and roads within the construction site should be conducted to monitor for roadkill. Site personnel should report any roadkill encountered, and mitigation measures should be reassessed to ensure their effectiveness.	-1	-40	Minor negative impact	Importance is assigned 5 as the globally critically endangered Sunda Pangolin was recorded during the AECOM 2022 EIA study, although it was not observed in the current study.

Work Activity	Environmental Aspect	Environmental Impacts	Sensitive Receptors	Impact Evaluation without Mitigation Measures							Recommended Mitigation Measures	Impact Evaluation with Mitigation Measures			Remarks
				A1 – Importance A2 – Magnitude		B1 – Permanence B2 – Recoverability B3 – Cumulative Impact			ES – Environmental Score						
				A1	A2	B1	B2	B3	ES	ES Class		A2	ES	ES Class	
	Loss of Ecological Connectivity Human-wildlife incidents/ conflicts	Different groups of wildlife will respond to the loss of ecological connectivity to other parts of the Study Area in various ways. The loss of ecological connectivity could lead to changes such as decrease in foraging/hunting grounds, population decline, and disruption in ecological processes. It is likely that more mobile taxa might fare better than less mobile taxa, especially if they are able to disperse to other adjacent forests.	Non-volant mammals and herpetofauna	5	-2	3	3	3	-90	Moderate negative impact	**Proposed Retained Area** ■ The retention of the vegetated area (PRA). – Natural stream D/S25 to be retained. ■ A large tract of contiguous vegetation in the southern part of the Study Area is to be retained as well. – Comprising a mix of mainly native-dominated secondary forest and abandoned land forest. ■ Provide and maintain ecological connectivity between the Project and surrounding green patches by planting native, biodiversity-attracting plants as part of the landscape. **Operation Phase** ■ Recommendation to place crossings at locations with narrowest vegetated/green buffer widths. ■ Replanting of areas cleared for works and green buffers. ■ Crossings should ideally be elevated walkways that pose minimal impacts/disturbance to wildlife and vegetated area, where the terrain allows. ■ Wildlife-proof refuse bins. ■ The NParks-certified Wildlife/Animal Management Contractor shall be engaged in advance, together with NParks, to plan and implement management plans to mitigate human-wildlife conflict, such as: – Human-wildlife conflict awareness and educational talks, as well as monkey guarding, if necessary.	-1	-45	Minor negative impact	Importance is assigned 5 as the globally critically endangered Sunda Pangolin was recorded during the AECOM 2022 EIA study, although it was not observed in the current study. The PRA also aims to retain ecological connectivity.
			Birds, Bats, Butterflies, and Odonates	5	-2	3	3	3	-90	Moderate negative impact		-1	-45	Minor negative impact	Importance is assigned 5 as the globally Critically Endangered Straw-headed Bulbul was recorded during the study.
			Freshwater Aquatic Fauna	2	-3	3	3	3	-54	Minor negative impact		-1	-18	Slight negative impact	Importance is assigned 2 as no CS species were recorded during the EIA study. The natural stream D/S25 and a riparian buffer is also to be retained.

4 Surface Water Quality

4.1 Applicable Legislation and Standards

4.1.1 Water Quality

The Pollution Control Department (PCD) of National Environment Agency (NEA) is responsible for the control of water pollution, hazardous substances, and toxic industrial wastes in Singapore. The main legislative instruments governing water pollution are the *Environmental Protection and Management Act (EPMA) (Part V – Water Pollution Control)*, the *Environmental Protection and Management (Trade Effluent) Regulations* and the *Sewerage and Drainage Act*. The Director-General of Environmental Protection is responsible for the implementation and administration of the *EPMA* regulations, while PUB is responsible for the administration of the *Sewerage and Drainage Act*. The provisions given under each of these *Acts* or *Regulations* are described below, whilst a summary of allowable limits for trade effluent discharge applicable to a watercourse (as prescribed by the *EPMA*) is presented in Table 4-1 below.

EPMA (Part V – Water Pollution Control) 2008 includes the following measures to protect water bodies from pollution:

1. Penalties for the discharge of polluting matter into inland waters;

2. Licensing requirements for the storage, removal, and disposal of toxic industrial waste and trade effluent;

3. Measures to be undertaken to prevent water pollution due to storage or transportation of toxic substances or other polluting matters; and

4. A written permission is required from the Director-General for any discharge of trade effluent, oil, chemical, sewage or other polluting matters into any drain or land.

The *EPMA (Trade Effluent) Regulations* establish regulatory control over industrial, trade premises and other activities that may have adverse impacts on water quality. The regulations provide details on trade effluent quality standards for discharge of trade effluent into watercourses or land but does not cover the discharge of trade effluent into the public sewer system (as it is covered under the *Sewerage and Drainage (Trade Effluent) Regulations*). The regulations state that no trade effluent shall be discharged into watercourses or land without obtaining NEA's permission. Trade effluent standards and permitting requirements are stipulated in the Regulations and all trade effluent 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 water catchment areas.

The *Public Utilities (Reservoirs, Catchment Areas and Waterway) Regulations* may also be referred to for the definitions of water catchment areas, and activities prohibited within Catchment Area Parks.

Table 4-1 NEA's Allowable Limits for Trade Effluent Discharge Standards

Items of Analysis	Watercourse (Units in mg/L or otherwise stated)	Controlled Watercourse[1] (Units in mg/L or otherwise stated)
Temperature of discharge	45°C	45°C
Colour	7 Lovibond Units	7 Lovibond Units
pH value	6-9	6-9
Conductivity	µS/cm	
Dissolved Oxygen (DO)	-	
Biochemical Oxygen Demand (BOD) (5 days at 20^0C)	50	20

Items of Analysis	Watercourse (Units in mg/L or otherwise stated)	Controlled Watercourse[1] (Units in mg/L or otherwise stated)
Chemical Oxygen Demand (COD)	100	60
Turbidity	NTU	
Salinity	ppt	
Total Phosphorus (TP)	-	
Total Nitrogen (TN)	-	
Total Organic Carbon (TOC)	-	
Total Suspended Solids	50	30
Total Dissolved Solids	-	1,000
Chloride (as chloride ion)	-	250
Sulphate (as SO_4)	-	200
Sulphide (as sulphur)	0.2	0.2
Cyanide (as CN)	0.1	0.1
Detergents	15	5
Grease and Oil	10 (Total) 10 (Hydrocarbons)	1 (Total)
Arsenic	0.1	0.01
Barium	2	1
Tin	-	5
Iron (as Fe)	10	1
Beryllium	-	0.5
Boron	5	0.5
Manganese	5	0.5
Phenolic Compounds (expressed as phenol)	0.2	Nil
*Cadmium	0.1	0.003
*Chromium (trivalent and hexavalent)	1	0.05
*Copper	0.1	0.1
*Lead	0.1	0.1
*Mercury	0.05	0.001
*Nickel	1	0.1
*Selenium	0.5	0.01
*Silver	0.1	0.1
*Zinc	1	0.5
*Metals in Total	1	0.5
Chlorine (Free)	1	1
Phosphate (as PO_4)	5	2
Ammonia (as NH_4)	-	-
Calcium (as Ca)	-	150
Magnesium (as Mg)	-	150
Nitrate (NO_3)	-	20
Enterococcus	cfu/100mL	

[1]The set allowable limited for controlled watercourse, as defined by the *Environmental Protection Management Act.*
*The concentration of Toxic Metal shall not exceed the limits as shown, individually or in total.
"-" indicates no specified maximum concentrations under the Regulations.

Construction Surface Water Runoff

Under the requirements stipulated by Public Utilities Board (PUB) in the *Sewerage and Drainage Act*, effective Earth Control Measures (ECM) shall be implemented at all construction sites to prevent silty discharge from construction sites.

Before commencement of construction and earthworks, Contractors are required to engage a Qualified Erosion Control Professional (QECP) to plan, design, supervise and review a system of earth control measures (ECM) to meet the requirements cited in the Code of Practice on Surface Water Drainage and to comply with the Sewerage and Drainage Act. The QECP is required to submit the detailed ECM proposal, on behalf of the site owner/ developer to the PUB, prior to the commencement of works

4.2 Survey Methodology

Three (3) streams/waterbodies (D/S23, D/S24, and D/S25) have been identified based on past EIA; as presented in Table 4-2 and Figure 4-1. Water quality sampling was carried out at the start, middle and confluence points of each stream, with measurements taken at 50 m intervals before any runoff entered public drains, in accordance with NParks' BIA Guidelines (NParks, 2024). This provided a total of nine (9) sampling points across the three (3) identified streams within the Study Area (Figure 4-1).

At each sampling point, three (3) replicate samples were collected – two (2) during dry weather and one (1) during wet weather (Figure 4-2; Figure 4-3). Dry weather was defined as a continuous 48-hour period without precipitation, while wet weather was defined as three (3) hours after a significant rainfall event (more than 10 mm). The water quality results were benchmarked against NEA's Allowable Limits for Trade Effluent Discharge to controlled watercourses (Table 4-1).

In-situ water quality parameters were measured using a multiparameter probe, while water samples for physico-chemical analysis were collected from mid-depth at each sampling station. Samples were transferred into pre-labelled containers provided by the analytical laboratory, stored at < 4°C, and dispatched to a SAC-SINGLAS accredited laboratory for analysis.

Table 4-2 Surface Water Quality Sampling Locations

Stream ID	Station ID	Latitude	Longitude	Dry Sampling	Wet Sampling
D/S24	WQ01	1°19'27.56"N	103°46'9.84"E	12 June 2025 16 June 2025	17 June 2025
	WQ02	1°19'28.22"N	103°46'10.73"E		
	WQ03	1°19'28.93"N	103°46'11.92"E		
D/S23	WQ04	1°19'29.59"N	103°46'13.91"E		
	WQ05	1°19'30.83"N	103°46'14.78"E		
	WQ06	1°19'32.05"N	103°46'15.70"E		
D/S25	WQ07	1°19'36.02"N	103°46'10.37"E		
	WQ08	1°19'37.01"N	103°46'11.99"E		
	WQ09	1°19'38.35"N	103°46'12.60"E		



Figure 4-1 Surface Water Quality Sampling Points



WQ01



WQ02



WQ03



WQ04



WQ05



WQ06



WQ07



WQ08



WQ09

Figure 4-2 Water Quality Sampling at the Study Area during Dry Weather Conditions



WQ01



WQ02



WQ03



WQ04



WQ05



WQ06



WQ07



WQ08



WQ09

Figure 4-3 Water Quality Sampling at the Study Area during Wet Weather Conditions

4.3 Results and Discussion

The water quality results are summarised in Table 4-3 and Table 4-4 below, and the laboratory reports are provided in Appendix E. Overall, the water quality assessment showed that most parameters across all monitoring points remained within the NEA EPMA (Trade Effluent) guideline limits for controlled watercourses. However, several exceedances were observed, with the respective values highlighted in **red**.

Table 4-3 Surface Water Quality Baseline Results (WQ01 to WQ05)

Parameter	Unit	NEA EPMA (Trade Effluent) Regulations (Controlled Watercourses)	Monitoring Point														
			WQ01			WQ02			WQ03			WQ04			WQ05		
			12 Jun 2025 (Dry)	16 Jun 2025 (Dry)	17 Jun 2025 (Wet)	12 Jun 2025 (Dry)	16 Jun 2025 (Dry)	17 Jun 2025 (Wet)	12 Jun 2025 (Dry)	16 Jun 2025 (Dry)	17 Jun 2025 (Wet)	12 Jun 2025 (Dry)	16 Jun 2025 (Dry)	17 Jun 2025 (Wet)	12 Jun 2025 (Dry)	16 Jun 2025 (Dry)	17 Jun 2025 (Wet)
Temperature (*in-situ*)	°C	<45	27.24	27.37	27.07	27.03	26.79	26.83	26.95	27.09	26.68	27.33	26.87	26.86	27.28	27.05	26.84
pH (*in-situ*)	-	6 – 9	5.11	5.90	6.25	5.92	5.34	5.80	4.71	5.71	5.36	6.19	6.17	6.42	6.90	6.58	6.06
Conductivity (*in-situ*)	µS/cm	-	54.32	79.02	78.24	32.33	38.59	37.76	30.32	89.53	47.65	150.50	159.68	114.52	155.82	105.37	103.89
Dissolved Oxygen (*in-situ*)	mg/L	-	2.54	6.15	4.58	4.30	1.36	5.04	2.65	3.25	4.53	7.16	6.46	7.52	6.75	6.54	7.24
Salinity (*in-situ*)	ppt	-	0.025	0.037	0.036	0.014	0.017	0.017	0.013	0.042	0.021	0.071	0.076	0.054	0.075	0.049	0.049
Biochemical Oxygen Demand (BOD)	mg/L	20	<2	2.7	<2	<2	2.3	3.4	<2	13.9	3.5	<2	<2	<2	<2	<2	<2
Chemical Oxygen Demand (COD)	mg/L	60	6.1	37.9	24.9	4.5	17.8	27.9	10.5	32.1	36.2	3.4	4.8	15.1	5.9	3.7	18.1
Turbidity	NTU	-	50	170	60	6.1	20	110	9.5	700	290	6.6	5.6	26	8.3	15	35
Total alkalinity as $CaCO_3$	mg/L	-	9.55	13.1	5.00	<2	4.52	2.50	<2	22.1	3.00	41.2	40.2	37.0	39.2	36.2	32.0
Total Phosphorus (TP)	mg/L	-	0.16	0.31	0.093	0.023	0.19	0.20	0.074	0.70	0.28	0.0068	<0.003	0.022	0.011	<0.003	0.015
Total Nitrogen (TN)	mg/L	-	0.48	1.22	0.83	1.45	0.81	2.99	0.44	6.35	2.91	0.42	0.43	1.02	0.38	0.36	0.91
Total Organic Carbon (TOC)	mg/L	-	3.62	4.22	3.76	1.31	3.19	3.73	3.06	10.4	7.46	2.02	1.90	3.31	2.04	1.83	3.24
Nitrate (NO_3-N)	mg/L	20	<0.015	<0.015	0.25	0.37	<0.015	0.99	0.096	<0.015	1.06	0.26	0.28	0.47	0.25	0.23	0.48
Ammonia (NH_3-N)	mg/L	-	0.21	0.45	0.25	0.11	0.25	0.045	0.099	2.15	0.19	0.058	0.066	0.14	0.057	0.044	0.14
Orthophosphate (PO_4-P)	mg/L	-	<0.025	0.048	<0.025	<0.025	<0.025	<0.025	<0.025	0.10	0.039	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Total Dissolved Solids (TDS)	mg/L	1,000	23.5	27.5	26.0	18.8	18.5	25.0	16.8	37.0	29.0	95.0	94.0	81.0	91.0	80.0	70.0
Total Suspended Solids (TSS)	mg/L	30	**57.3**	**154**	**45.0**	<10	26.7	**88.8**	10.8	**498**	**112**	<10	<10	<10	22.0	17.6	<10
Lead as Pb	mg/L	0.1	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
Zinc as Zn	mg/L	0.5	0.013	0.015	0.013	0.016	0.0098	0.021	0.024	0.16	0.075	0.0079	0.011	0.0095	0.0085	0.0091	0.0099
Mercury as Hg	mg/L	0.001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic as As	mg/L	0.01	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023
Barium as Ba	mg/L	1	0.014	0.021	0.014	0.016	0.011	0.017	0.020	0.073	0.030	0.017	0.019	0.015	0.015	0.017	0.014
Tin as Sn	mg/L	5	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009
Iron as Fe	mg/L	1	**7.47**	**13.3**	**3.14**	1.00	**4.14**	**4.12**	**1.49**	**23.7**	**6.03**	0.60	0.71	**1.67**	0.78	0.95	**1.81**
Boron as B	mg/L	0.5	0.010	0.016	0.014	0.0051	0.013	0.017	0.0070	0.032	0.030	0.015	0.016	0.021	0.015	0.016	0.020
Manganese as Mn	mg/L	0.5	0.068	0.072	0.045	0.084	0.070	0.061	0.19	0.33	0.10	0.049	0.061	0.042	0.053	0.051	0.050
Cadmium as Cd	mg/L	0.003	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012
Chromium as Cr (trivalent)	mg/L	0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chromium as Cr (Hexavalent)	mg/L	0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.024	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Copper as Cu	mg/L	0.1	<0.0015	0.0025	0.0022	<0.0015	<0.0015	0.0050	0.0022	0.026	0.0082	<0.0015	<0.0015	0.0039	<0.0015	<0.0015	0.0032
Nickel as Ni	mg/L	0.1	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	0.011	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045
Silver as Ag	mg/L	0.1	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015
Beryllium as Be	mg/L	0.5	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006
Selenium as Se	mg/L	0.01	<0.045	<0.045	<0.045	<0.045	<0.045	<0.045	<0.045	<0.045	<0.045	<0.045	<0.045	<0.045	<0.045	<0.045	<0.045
Metals in Total	mg/L	0.5	<0.045	<0.045	<0.045	<0.045	<0.045	<0.045	<0.045	0.23	0.092	<0.045	<0.045	<0.045	<0.045	<0.045	<0.045
Enterococcus	cfu/100mL	-	<1	<1	130	2	<1	70	3	<1	220	1	1	30	<1	3	30
Oil and grease (Hydrocarbon)	mg/L	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Oil and grease (Total)	mg/L	1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Table 4-4 Surface Water Quality Baseline Results (WQ06 to WQ09)

Parameter	Unit	NEA EPMA (Trade Effluent) Regulations (Controlled Watercourse)	Monitoring Point											
			WQ06			WQ07			WQ08			WQ09		
			12 Jun 2025 (Dry)	16 Jun 2025 (Dry)	17 Jun 2025 (Wet)	12 Jun 2025 (Dry)	16 Jun 2025 (Dry)	17 Jun 2025 (Wet)	12 Jun 2025 (Dry)	16 Jun 2025 (Dry)	17 Jun 2025 (Wet)	12 Jun 2025 (Dry)	16 Jun 2025 (Dry)	17 Jun 2025 (Wet)
Temperature (*in-situ*)	°C	<45	27.19	26.84	26.76	28.05	27.45	25.61	27.79	27.64	25.41	28.24	27.46	25.17
pH (*in-situ*)	-	6 – 9	5.90	5.98	5.51	4.71	4.05	5.18	5.63	4.86	4.65	7.31	4.44	5.99
Conductivity (*in-situ*)	µS/cm	-	115.71	164.40	74.33	53.87	48.99	46.29	59.71	66.88	50.92	53.91	56.05	53.08
Dissolved Oxygen (*in-situ*)	mg/L	-	3.17	2.22	3.83	6.50	7.31	7.01	7.03	6.85	7.52	7.21	6.44	7.77
Salinity (*in-situ*)	ppt	-	0.054	0.078	0.034	0.024	0.022	0.021	0.027	0.031	0.023	0.025	0.025	0.024
Biochemical Oxygen Demand (BOD)	mg/L	20	<2	4.5	5.2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Chemical Oxygen Demand (COD)	mg/L	60	7.7	35.1	32.6	6.1	<2	14.5	3.6	4.5	10.5	<2	4.8	10.1
Turbidity	NTU	-	18	26	65	11	2.1	55	8.0	0.25	29	1.4	6.1	29
Total alkalinity as $CaCO_3$	mg/L	-	39.2	56.3	13.5	<2	<2	<2	<2	<2	<2	<2	<2	<2
Total Phosphorus (TP)	mg/L	-	0.029	0.087	0.032	0.015	<0.003	0.013	0.0039	0.0072	0.0041	0.012	0.015	0.0096
Total Nitrogen (TN)	mg/L	-	0.46	0.84	3.75	0.99	0.88	1.80	0.87	0.76	1.70	1.11	0.55	1.57
Total Organic Carbon (TOC)	mg/L	-	3.09	4.07	5.74	<1	<1	2.39	<1	<1	1.80	<1	1.03	1.78
Nitrate (NO_3-N)	mg/L	20	<0.015	<0.015	0.46	0.63	0.84	0.98	0.85	0.71	1.21	1.04	0.45	1.30
Ammonia (NH_3-N)	mg/L	-	0.40	0.57	0.30	0.064	0.023	0.062	<0.01	0.034	0.018	<0.01	0.060	0.022
Orthophosphate (PO_4-P)	mg/L	-	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Total Dissolved Solids (TDS)	mg/L	1,000	72.0	83.0	46.0	34.0	37.0	29.0	34.5	36.0	33.0	35.0	30.0	34.0
Total Suspended Solids (TSS)	mg/L	30	20.0	**58.6**	19.0	<10	<10	13.6	25.6	<10	<10	<10	20.0	<10
Lead as Pb	mg/L	0.1	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
Zinc as Zn	mg/L	0.5	0.010	0.0064	0.016	0.035	0.043	0.033	0.045	0.039	0.038	0.051	0.033	0.041
Mercury as Hg	mg/L	0.001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic as As	mg/L	0.01	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023
Barium as Ba	mg/L	1	0.013	0.012	0.014	0.027	0.032	0.026	0.032	0.032	0.029	0.031	0.027	0.028
Tin as Sn	mg/L	5	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009
Iron as Fe	mg/L	1	**7.94**	**9.78**	**2.89**	0.95	0.10	**1.83**	0.24	0.057	0.80	0.11	0.82	0.78
Boron as B	mg/L	0.5	0.016	0.022	0.021	0.0050	0.0071	0.011	0.0057	0.0072	0.014	0.0051	0.0099	0.012
Manganese as Mn	mg/L	0.5	0.14	0.16	0.071	0.080	0.12	0.071	0.082	0.089	0.078	0.099	0.090	0.089
Cadmium as Cd	mg/L	0.003	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012
Chromium as Cr (trivalent)	mg/L	0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chromium as Cr (Hexavalent)	mg/L	0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Copper as Cu	mg/L	0.1	<0.0015	<0.0015	0.0055	<0.0015	<0.0015	0.0039	<0.0015	0.0047	0.0041	<0.0015	0.0018	0.0024
Nickel as Ni	mg/L	0.1	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045
Silver as Ag	mg/L	0.1	<0.0015	<0.0015	<0.0015	0.0068	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015
Beryllium as Be	mg/L	0.5	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006
Selenium as Se	mg/L	0.01	<0.045	<0.045	<0.045	<0.045	<0.045	<0.045	<0.045	<0.045	<0.045	<0.045	<0.045	<0.045
Metals in Total	mg/L	0.5	<0.045	<0.045	<0.045	<0.045	<0.045	<0.045	0.045	<0.045	<0.045	0.054	<0.045	<0.045
Enterococcus	cfu/100mL	-	1	5	80	6	<1	40	9	1	50	2	2	40
Oil and grease (Hydrocarbon)	mg/L	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Oil and grease (Total)	mg/L	1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

4.3.1 Comparison with Past EIA

This section presents a comparative review of surface water quality conditions based on the findings from the current study and relevant past EIA studies conducted within and around the Study Area. The review aims to provide contextual understanding of existing baseline conditions, identify any notable temporal variations, and assess the consistency of observed water quality parameters over time. Table 4-5 summarises the water quality parameters tested across the current study and the previous studies reviewed, while Table 4-6 presents a detailed comparisons of water quality results between the current study and the respective baseline data from earlier studies.

Overall, the current water quality results are broadly consistent with those reported in AECOM's past EIA study. Any observed variations are likely attributable to temporal and methodological differences rather than indicative of any adverse trends. While baseline water quality data from earlier studies suggested the presence of conditions that may be less favourable for certain aquatic organisms within the Study Area, it is likely that aquatic communities present have adapted to these prevailing baseline conditions over time.

Table 4-5 Comparison of Tested Surface Water Quality Parameters across EIA Studies (Parameter tested = ✓)

S/N	Tested Parameter	Aurecon 2025	AECOM 2022
1.	Temperature	✓	✓
2.	pH	✓	✓
3.	Conductivity	✓	✓
4.	Dissolved Oxygen	✓	✓
5.	Salinity	✓	-
6.	Biochemical Oxygen Demand (BOD)	✓	✓
7.	Chemical Oxygen Demand (COD)	✓	✓
8.	Turbidity	✓	✓
9.	Total alkalinity as $CaCO_3$	✓	-
10.	Total Phosphorus (TP)	✓	✓
11.	Total Nitrogen (TN)	✓	✓
12.	Total Organic Carbon (TOC)	✓	-
13.	Nitrate (NO_3-N)	✓	✓
14.	Ammonia (NH_3-N)	✓	-
15.	Orthophosphate (PO_4-P)	✓	✓
16.	Total Dissolved Solids (TDS)	✓	✓
17.	Total Suspended Solids (TSS)	✓	✓
18.	Heavy Metals (Pb, Zn, Hg, As, Ba, Sn, Fe, B, Mn, Cd, Cr, Cu, Ni, Ag, Be, Se)	✓	-
19.	Metals in Total	✓	-
20.	Enterococcus	✓	-
21.	Oil and grease (Hydrocarbon)	✓	-
22.	Oil and grease (Total)	✓	-

Table 4-6 Comparison of Surface Water Quality Results across EIA Studies

Parameter	Unit	Weather Condition	NEA EPMA (Trade Effluent) Regulations (Controlled Watercourses)	Criteria for Aquatic Life	D/S23				D/S24				D/S25			
					Aurecon 2025			AECOM 2022	Aurecon 2025			AECOM 2022	Aurecon 2025			AECOM 2022
					WQ04	WQ05	WQ06	WQ33	WQ01	WQ02	WQ03	WQ34	WQ07	WQ08	WQ09	WQ35
Temperature	°C	Dry Average	<45	-	27.10	27.17	27.02	26.60	27.31	26.91	27.02	26.40	27.75	27.72	27.85	27.10
		Wet			26.86	26.84	26.76	25.40	27.07	26.83	26.68	25.40	25.61	25.41	25.17	25.40
pH	-	Dry Average	6 – 9	6.5 – 9	6.18	6.74	5.94	6.60	5.51	5.63	5.21	5.40	4.38	5.25	5.88	5.0
		Wet			6.42	6.06	5.51	6.60	6.25	5.80	5.36	5.40	5.18	4.65	5.99	5.50
Conductivity	µS/cm	Dry Average	-	-	155.09	130.60	140.06	193	66.67	35.46	59.93	51	51.43	63.30	54.98	66
		Wet			114.52	103.89	74.33	111	78.24	37.76	47.65	49	46.29	50.92	53.08	53
Dissolved Oxygen	mg/L	Dry Average	-	>4.0	6.81	6.65	2.70	5.10	4.35	2.83	2.95	0.40	6.91	6.94	6.83	3.0
		Wet			7.52	7.24	3.83	7.70	4.58	5.04	4.53	3.50	7.01	7.52	7.77	7.2
Biochemical Oxygen Demand (BOD)	mg/L	Dry Average	20	3	<2	<2	4.5	1.8	2.70	2.30	13.9	<1	<2	<2	<2	<1
		Wet			<2	<2	5.2	<1	<2	3.4	3.5	<1	<2	<2	<2	<1
Chemical Oxygen Demand (COD)	mg/L	Dry Average	60	25	4.1	4.8	21.4	5.0	22	11.2	21.3	41.5	6.1	4.1	4.8	<5
		Wet			15.1	18.1	32.6	83.0	24.9	27.9	36.2	48.0	14.5	10.5	10.1	35.0
Turbidity	NTU	Dry Average	-	50	6.1	11.7	22.0	5	110	13.1	354.8	97	6.6	4.1	3.8	4
		Wet			26	35	65	70	60	110	290	60	55	29	29	40
Total Phosphorus (TP)	mg/L	Dry Average	-	Eutrophic Limit: 0.075	0.0068	0.011	0.06	0.065	0.24	0.11	0.39	0.193	0.015	0.01	0.01	0.111
		Wet			0.022	0.015	0.032	0.039	0.093	0.20	0.28	0.040	0.013	0.0041	0.0096	0.034
Total Nitrogen (TN)	mg/L	Dry Average	-	Eutrophic Limit: 1.5	0.43	0.37	0.65	0.4	0.85	1.13	3.40	0.8	0.94	0.82	0.83	0.4
		Wet			0.91	1.02	3.75	1.6	0.83	2.99	2.91	1.3	1.80	1.70	1.57	1.6
Nitrate (NO_3-N)	mg/L	Dry Average	20	10	0.27	0.24	<0.015	0.2	<0.015	0.37	0.096	0.3	0.74	0.78	0.75	0.3
		Wet			0.47	0.48	0.46	1.5	0.25	0.045	0.19	1.3	0.98	1.21	1.30	1.5
Orthophosphate (PO_4-P)	mg/L	Dry Average	-	0.033	<0.025	<0.025	<0.025	0.046	0.048	<0.025	0.1	0.039	<0.025	<0.025	<0.025	0.047
		Wet			<0.025	<0.025	<0.025	0.037	<0.025	<0.025	0.039	0.034	<0.025	<0.025	<0.025	0.033
Total Dissolved Solids (TDS)	mg/L	Dry Average	1,000	1,000	94.5	85.5	77.5	121	25.5	18.7	26.9	33	35.5	35.3	32.5	41
		Wet			70.0	81.0	46.0	72	26.0	25.0	29.0	32	29.0	33.0	34.0	34
Total Suspended Solids (TSS)	mg/L	Dry Average	30	50	<10	19.8	39.3	3.0	105.7	26.7	254.4	84.5	<10	25.6	20.0	5.7
		Wet			<10	<10	19.0	25.9	45.0	88.8	112	16.2	13.6	<10	<10	6.7

4.3.2 Water Quality Exceedances

Notably, increased concentrations of Total Suspended Solids (TSS) were recorded at multiple locations (WQ01, WQ02, WQ03, and WQ06), while elevated iron (Fe) levels were detected across several monitoring points (WQ01 to WQ07).

Although most exceedances occurred during wet weather conditions, higher TSS concentrations were also recorded at certain sampling points, particularly WQ01 and WQ03, during dry weather. This is likely due to reduced flow rates in stream D/S24, which can cause suspended solids to accumulate rather than be flushed downstream. Field observations further revealed that stream D/S24 was relatively shallow with little to no water flow at the time of sampling, suggesting ephemeral flow conditions during dry days.

Additionally, the low water levels may have led to sediment resuspension during sample collection. The decomposition of leaf litter from the surrounding vegetation could also contribute to the elevated TSS concentrations, especially under dry weather conditions.

Further water quality testing is recommended to be carried out at the EMMP Stage to verify the parameter levels.

4.4 Impact Assessment Matrix with Mitigation Measures – Surface Water Quality

Table 4-7 Impact Assessment Matrix with Mitigation Measures for Surface Water Quality

Work Activity	Environmental Aspect	Environmental Impacts	Sensitive Receptors	Impact Evaluation without Mitigation Measures							Recommended Mitigation Measures	Impact Evaluation with Mitigation Measures			Remarks
				A1 – Importance A2 – Magnitude		B1 – Permanence B2 – Recoverability B3 – Cumulative Impact			ES – Environmental Score						
				A1	A2	B1	B2	B3	ES	ES Class		A2	ES	ES Class	
Surface Water Quality															
Pre-construction / Construction Phase															
General construction activities	Siltation due to silty surface runoff	Potential impact on water quality due to sediment runoff and siltation	Downstream Waterbodies & Natural Stream D/S25	4	-2	2	2	2	-48	Minor negative impact	▪ A QECP should be engaged to formulate and implement an ECM Plan in accordance with PUB's requirements. ▪ ECM infrastructure, including holding ponds and treatment tanks, should be fully commissioned and operational prior to the commencement of site clearance and earthworks. ▪ Various layers of silt fences should be provided along the watercourses to prevent silty runoff. ▪ ECM provisions and infrastructure should be inspected weekly and after heavy rainfall events and maintained as necessary. ▪ Appropriate housekeeping and handling practices should be implemented to prevent any spillage of cement, wet or uncured concrete, or grout. ▪ Concrete spillage during pile filling should be avoided through careful concrete handling and placement. If necessary, water will be pumped out of the pile to prevent overflow. ▪ Concrete and cement wash shall be collected and disposed of separately. These materials are not to be discharged or channelled into the ECM ponds, where feasibly practicable. ▪ Contaminated soil shall be disposed offsite at a designated facility for the treatment of hazardous chemicals. ▪ During construction, the Contractor shall implement a Continuous Monitoring System for total suspended solids (TSS) levels in treated discharge water. If TSS levels of 30 mg/L or above are detected, an alert shall trigger the suspension of work in the vicinity of watercourses. ▪ Regular water quality monitoring along any retained streams and final discharge point for all ECMs on a monthly basis. Parameters to be monitored shall follow those in Table 4-1. ▪ Contractor to ensure that pH for the retention pond water quality is within NEA's allowable limits (i.e. 6 <= pH <= 9) prior to discharge. This should be done at least on a weekly basis, where feasible and relevant. Should the pH of the retention pond exceed the pH range, the pond should be pumped out and contents disposed of at an appropriate waste disposal facility, where feasible.	-1	-24	Slight negative impact	-

Work Activity	Environmental Aspect	Environmental Impacts	Sensitive Receptors	Impact Evaluation without Mitigation Measures							Recommended Mitigation Measures	Impact Evaluation with Mitigation Measures			Remarks
				A1 – Importance A2 – Magnitude		B1 – Permanence B2 – Recoverability B3 – Cumulative Impact			ES – Environmental Score						
				A1	A2	B1	B2	B3	ES	ES Class		A2	ES	ES Class	
Material stockpiles or bare earth ground	Siltation due to silty surface runoff	Potential impact on water quality due to sediment runoff and siltation	Downstream Waterbodies & Natural Stream D/S25	4	-2	2	2	2	-48	Minor negative impact	▪ Cover stockpiles with biodegradable ECBs or tarpaulin to prevent runoff at the end of each day or upon onset of heavy rain. ▪ Cover materials, i.e., biodegradable ECBs or tarpaulin, should be stored nearby and readily available for use on the stockpiles. ▪ Exposed bare earth areas should be covered with biodegradable ECBs, concreted, or replanted with vegetation. ▪ An additional 0.5 m bunds or silt fences should be installed around stockpiles to contain runoff and direct it to the ECM treatment system.	-1	-24	Slight negative impact	-
Wheel washing of construction vehicles	Silty runoff generated from wheel washing activities	Potential impact on water quality due to sediment runoff and siltation	Downstream Waterbodies & Natural Stream D/S25	4	-2	2	2	2	-48	Minor negative impact	▪ Water used to wash truck and vehicle wheels should not be discharged into any receiving waterbody. The silty water in the wheel wash basin should be directed to the ECM plant for treatment. ▪ The silt collected at the bottom of the wheel wash basin should be regularly removed.	-1	-24	Slight negative impact	-
Washing of equipment/wheels in contact with concrete	Concrete wash runoff generated from washing equipment/wheels in contact with concrete pour	Potential impact on water quality due to concrete wash runoff	Downstream Waterbodies & Natural Stream D/S25	4	-2	2	2	2	-48	Minor negative impact	▪ Recommended best practices for management of cement wash-water: – After concrete is poured at a construction site, the agitator and chutes of ready-mix concrete trucks as well as the piping of concrete pumps shall, where practicable, be washed out to remove the remaining concrete before it hardens – only if there are the appropriate facilities available to capture the cement wash. – Should the equipment be washed on site, cement wash should not be diverted to retention ponds of ECM plant, but instead be collected in a dedicated facility for disposal. – Disposal of collected cement wash to an appropriate waste processing facility.	-1	-24	Slight negative impact	-
Fuel and chemical storage	Potential spillage of fuel and chemicals entering watercourses	Potential impact on water quality due to accidental spillages or infiltration of fuel and chemicals into the waterbodies	Downstream Waterbodies & Natural Stream D/S25	4	-2	2	2	3	-56	Minor negative impact	▪ Fuel and chemicals should be stored under shelter in kerbed or bunded areas with secondary containment. ▪ The secondary storage volume should ideally be large enough to contain the entire volume of chemicals or fuel stored in the area. Minimally, the containment should accommodate 110% of the largest tank volume. ▪ Sand and/or other spill control kits, including absorbents, should be readily available to manage any spills that may occur. ▪ Fuel and chemical storage should be located at least 10 m away from any watercourses.	-1	-28	Slight negative impact	-

Work Activity	Environmental Aspect	Environmental Impacts	Sensitive Receptors	Impact Evaluation without Mitigation Measures							Recommended Mitigation Measures	Impact Evaluation with Mitigation Measures			Remarks
				A1 – Importance A2 – Magnitude		B1 – Permanence B2 – Recoverability B3 – Cumulative Impact			ES – Environmental Score						
				A1	A2	B1	B2	B3	ES	ES Class		A2	ES	ES Class	
Use of generators	Potential drips from the generators	Potential impact on water quality due to contaminated runoff	Downstream Waterbodies & Natural Stream D/S25	4	-1	2	2	3	-28	Slight negative impact	▪ Generators should be equipped with drip trays and regularly maintained to ensure proper functioning. Where possible, generators should be kept under shelter. ▪ Drip trays should be regularly cleaned, and rainwater should be avoided from accumulating on the surface.	0	0	No significant impact	-
Operation Phase															
Operation phase of Project	Potential contamination from activities within Project	Potential impact on water quality due to contaminated runoff	Downstream Waterbodies & Natural Stream D/S25	4	-1	2	2	3	-28	Slight negative impact	▪ Provision and maintenance of vegetation cover along the watercourses. ▪ Installation of perimeter drain along the boundaries of Project. ▪ Recommendation of post-construction water quality monitoring for a designated period i.e., three (3) months.	0	0	No significant impact	-
Surface Hydrology															
Construction Phase															
General construction activities	Loss of waterbodies	The waterbodies running through the Study Area are likely to be backfilled during the land preparation phase	Downstream Waterbodies & Natural Stream D/S25	4	-3	3	3	3	-108	Moderate negative impact	▪ A QECP should be engaged to formulate and implement an ECM Plan in accordance with the PUB's requirements. ▪ Diversion or realignment of the waterbodies should be taken into consideration during the design and planning stages to retain the overall hydrological flow of the area upstream and downstream. ▪ Watercourse diversion design should be in line with PUB's Code of Practice on Surface Water Drainage.	-2	-72	Minor negative impact	Reduction of magnitude impact is primarily due to retention of stream D/S25
Operation Phase															
Operation phase of Project	Likelihood of flooding	Higher risk of localised flooding in nearby streams due to the increase in impervious surface areas	Residential Community	4	-3	2	2	3	-84	Moderate negative impact	▪ Design and construction should comply with established guidelines on limiting the extent of hard-paved surfaces within the development areas. Adequate green or porous areas should be incorporated to minimise surface runoff, enhance stormwater infiltration, and maximise groundwater recharge. ▪ Where possible and feasible, facilities such as rain gardens, green roofs, and detention ponds, can be considered to further slow runoff.	-2	-56	Minor negative impact	-

5 Airborne Noise

5.1 Applicable Legislation and Standards

Where developments are concerned, there exists a set of national and international environmental management requirements to be adhered to and/or referenced during the Environmental Impact Assessment (EIA). This comprises several Acts, Regulations and Guidelines as listed in Table 5-1. Where applicable and practicable, the list of regulations shall be referenced as part of the Project's EIA.

Table 5-1 List of Applicable Acts, Regulations and Guidelines Relevant to Noise

Applicable Acts, Regulations and Guidelines
Local
• Environmental Protection and Management Act, 2020 • Environmental Protection and Management (Control of Noise at Construction Sites) Regulations, 2008 • Code of Practice for Noise Control on Construction and Demolition Sites, 2014 • Technical Guideline for Land Traffic Noise Impact Assessment (NEA), 2023 • LTA's Noise Guidance: Developing a Noise Management Plan in LTA Projects, 2019
International
• British Standard 5228 Code of Practice for Noise and Vibration Control on Construction and Open Sites (BS 5228-2, 2009)

Noise emissions from construction sites are regulated by the National Environment Agency (NEA) under the *Environmental Protection and Management (Control of Noise at Construction Sites) Regulations* (refer to Table 5-2). These regulations set out the maximum allowable noise limits tailored for various time periods throughout the day and different categories of affected premises in the Study Area's vicinity.

Table 5-2 NEA Maximum Permissible Noise Levels on Building Receptors from Construction Sites

Period	Type of Affected Building	Work Site Operational Hours		
		Day (7 am – 7 pm)	Evening (7 pm – 10 pm)	Night (10 pm – 7 am)
Monday to Saturday	a) Hospital, School, University, Aged Care Facility	60 dB (LA_{eq}, 12 h)	50 dB (LA_{eq}, 12 h)	
		75 dB (LA_{eq}, 5 min)	55 dB (LA_{eq}, 5 min)	
	b) Residential (Within 150 m of construction site)	75 dB (LA_{eq}, 12 h)	65 dB (LA_{eq}, 1 h)	55 dB (LA_{eq}, 1 h)
		90 dB (LA_{eq}, 5 min)	70 dB (LA_{eq}, 5 min)	55 dB (LA_{eq}, 5 min)
	c) All other buildings	75 dB (LA_{eq}, 12 h)	65 dB (LA_{eq}, 12 h)	
		90 dB (LA_{eq}, 5 min)	70 dB (LA_{eq}, 5 min)	
Sunday and Public Holidays	a) Hospital, School, University, Aged Care Facility	60 dB (LA_{eq}, 12 h)	50 dB (LA_{eq}, 12 h)	
		75 dB (LA_{eq}, 5 min)	55 dB (LA_{eq}, 5 min)	
	b) Residential (Within 150 m of construction site)	75 dB (LA_{eq}, 12 h)	-	
		75 dB (LA_{eq}, 5 min)	55 dB (LA_{eq}, 5 min)	
	c) All other buildings	75 dB (LA_{eq}, 12 h)	65 dB (LA_{eq}, 12 h)	
		90 dB (LA_{eq}, 5 min)	70 dB (LA_{eq}, 5 min)	

Effective from 1st September 2011, construction sites are not allowed to start work between 7 pm every Saturday and 7 am on the following Monday, as well as from 10 pm on the eve of a public holiday to 7 am on the day following the public holiday, in accordance with the *Environmental Protection and Management (Control of Noise at Construction Sites) Regulations*.

At present, there are no specific standards, legislations, or widely recognised guidelines in Singapore that prescribe noise limits or threshold levels for wildlife. Given the fundamental differences in auditory capabilities and acoustic behaviours between humans and animals, the direct application of human-based noise criteria to fauna is not appropriate. Different animal taxa exhibit varying hearing ranges and sensitivities, which influence their ability to perceive social, behavioural, and survival-related acoustic signals (Bowles, 1995). Animal auditory systems are generally most sensitive to noise within their natural range, or the bandwidth they hear best, as summarised in Table 5-3 (Bowles, 1995). Notwithstanding the above, sustained noise levels above 70 dBA across a broad range of frequencies may adversely affect animal well-being and can result in behavioural changes, including habitat avoidance.

Table 5-3 Hearing Ranges of Different Taxa (Bowles, 1995)

Taxon	Hearing Range (Hz)
Amphibian	100 – 2000
Reptile	50 – 2000
Bird	100 – 10,000
Bat	2,000 – 110,000
Mammal	10 – 150,000
Humans	20 – 20,000

5.2 Desktop Study and Secondary Data Review

Although a baseline ambient noise assessment was not required for this study, potential noise impacts on Noise Sensitive Receivers (NSRs) were nevertheless evaluated, and appropriate noise mitigation measures are proposed to address potential construction-related noise impacts. NSRs generally consist of residential developments, educational institutes, hospitals, nursing homes, places of public worship, performing arts centres, hotels, and areas of specific ecological interest (e.g., parks and forests). These receptors are considered more sensitive to prolonged increases in airborne noise levels arising from constructions activities.

To provide contextual understanding of the existing ambient noise environment, secondary data from AECOM's 2022 EIA study conducted within and around the Study Area were reviewed. This review facilitated the identification of prevailing conditions, historical noise trends, and potential noise sources within the Study Area and its surroundings. Based on this review, the NSRs were then identified and are listed in Table 5-4.

Table 5-4 NSRs within and around the Study Area

NSR Description	Nature of Business	Distance to the Study Area
Fauna Receptor	Forest	Within the Study Area
Human Receptor	Residential	Within 200 m of the Study Area
Human Receptor	Educational Institution	Within 200 m of the Study Area
Human Receptor	Special Use	Within 200 m of the Study Area

5.2.1 Summary of Key Findings from AECOM 2022

As described in Section 5.2, four noise monitoring stations were established for the study, of which only one station (N01) was located in proximity to the Study Area. Therefore, only the noise monitoring results obtained at N01 are evaluated and discussed in this section. In general, the baseline noise monitoring indicates that the vicinity of N01 is generally characterised by relatively low to moderate ambient noise levels. Intermittent increases in noise were observed during night-time periods, which are likely attributable to nearby road traffic and occasional human activities in the surrounding area. Importantly, these elevated noise events were transient in nature rather than continuous, and baseline noise conditions were otherwise stable.

Table 5-5 Summary of Baseline Noise Monitoring Results for Construction Noise Impact (AECOM 2022)

ID / Location	Period	Monitoring Duration (14 January 2020 – 21 January 2020)																
		LAeq 5 min (dB)									LAeq 1 hr (dB)						LAeq 12 hr (dB)	
		7am – 7pm			7pm – 10pm			10pm – 7am			7pm – 10pm			10pm – 7am			7am – 7pm	7pm – 7am
		Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Overall	
N01: Landed housing along Clementi Crescent	Weekday	61	74	66	63	71	65	53	70	61	64	68	66	57	66	61	66	63
	Sunday	62	72	65	63	67	65	53	68	60	65	65	65	56	66	61	65	63
Permissible Level (Residential)	Weekday	90			70			55			65			55			75	-
	Sunday	75			55			55			-			-			75	-

5.3 Impact Assessment Matrix with Mitigation Measures – Airborne Noise

Table 5-6 Impact Assessment Matrix with Mitigation Measures for Airborne Noise

Work Activity	Environmental Aspect	Environmental Impacts	Sensitive Receptors	Impact Evaluation without Mitigation Measures							Recommended Mitigation Measures	Impact Evaluation with Mitigation Measures			Remarks
				A1 – Importance A2 – Magnitude		B1 – Permanence B2 – Recoverability B3 – Cumulative Impact			ES – Environmental Score						
				A1	A2	B1	B2	B3	ES	ES Class		A2	ES	ES Class	
Pre-construction / Construction Phase															
General construction activities	Noise generated from general construction activities and other machinery used	Loud noise generated from various construction activities, such as piling work and earthwork, as well as the use of construction equipment and machinery, can have adverse impacts on surrounding environment	Fauna in the Study Area	3	-3	2	2	3	-63	Minor negative impact	■ Continuous noise monitoring should be conducted in accordance with NEA requirements. ■ Noise barriers should be erected along the site boundary adjacent to the forested area. – Recommendation for a 6m noise barrier (STC20 specification) to be erected along the PRA boundary facing the construction site. ■ Installation of localised noise barriers around noisy equipment and machinery, such as pilling rig, to reduce loud noise. ■ Use of alternative equipment with less noise emission, such as rubber mallets instead of metal hammers. ■ Routine checks and maintenance of construction equipment and machinery. ■ Avoid parallel use of noisy equipment and machinery. ■ Turn off the equipment and machinery when not in use. ■ Construction works should be limited to daytime hours of 8 am to 6 pm daily and night works should be avoided whenever possible. Should night works be unavoidable, a Light Management Plan (LMP) should be prepared and submitted to NParks for approval.	-2	-42	Minor negative impact	-
			Residential Community	3	-3	2	2	3	-63	Minor negative impact		-2	-42	Minor negative impact	-
Operation Phase															
Operation phase of Project	Noise generated from residential activities	Potential noise generated from residential activities	Fauna in the Study Area	3	-3	3	2	3	-72	Minor negative impact	■ With reference to HDB guidelines, residents should be advised to avoid noisy recreational activities during the quiet hours between 10:30 pm and 7:00 am. – Signages to be placed across residential area at appropriate locations. ■ Planting native trees and shrubs to act as natural noise barriers to dampen the noise. ■ Sufficient setbacks for developments with air conditioning and mechanical ventilation (ACMV) systems should be established in front of NSRs (if applicable). ■ Noise attenuators and other Best Available Technology (BAT) and Best Environmental Practice (BEP) measures for noise control should be recommended. ■ Speed control measures, such as speed limits, speed bumps, and related signages, should be provided to minimise traffic noise.	-1	-24	Slight negative impact	-
			Residential Community	3	0	3	2	3	0	No significant impact		0	0	No significant impact	-

6 Illumination

6.1 Applicable Legislation and Standards

For development projects, particularly if construction activities are planned during nighttime hours, relevant national and international environmental management requirements should be considered and, where applicable, incorporated during the scoping phase of the Environmental Impact Assessment (EIA) to assess potential impacts from the pollution. Where appropriate and practicable, Table 6-1 should be referenced as part of the Project's EIA.

Table 6-1 List of Applicable Acts, Regulations and Guidelines Relevant to Light Pollution

Applicable Acts, Regulations and Guidelines
Local
• NParks' Technical Note of Light Management in Night Works, 2024 • NParks' Bird-Safe Building Guidelines, 2022 • LTA's Guidelines to the submission of design drawings for public street lighting, 2019
International
• Department of the Environment and Energy Australia – National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds, 2020 • Department of the Environment and Energy Australia – Updated National Light Pollution Guidelines for Wildlife, 2023

The following light management principles should be implemented to minimise disturbance to wildlife and reduce the ecological impact of artificial lighting:

(a) Minimise Disturbance to Wildlife:

- A minimum buffer of 10 m, free of task work lighting, should be provided between the construction site hoarding and the adjacent vegetated area. This requirement does not apply to internal construction access lighting or low-intensity ambient lighting used for general visibility and safety purposes.
- Nighttime construction activities should not be conducted within a 20 m radius of any identified active bat roosting site(s), where applicable and practicable.

(b) Direction:

- Lights shall be directed only at the intended object or area. Fixtures should be installed close to the ground, angled downwards, and shielded to avoid unnecessary light spill.

(c) Duration*:

- Task and work lighting shall only be used when required and typically provided via adjustable, portable light units with manual switches.
- Lighting required for equipment and machinery during operational hours should be switched off when not in use, except where required for obstacle avoidance or other essential safety purposes.

(d) Localised Control*:

- Lights should not be centralised and should be able to switch off when not required.

*Please note the duration and localised control measures apply only to lighting with a colour temperature of 5,000 K and above (refer to **Figure 6-1**) used during nighttime construction activities. Ambient lighting with a colour temperature of 3,000 K and below (refer to **Figure 6-1**), intended for the access road and footpath, will remain switched on during nights with construction activities, including beyond 12 midnight, for the duration of the construction period.

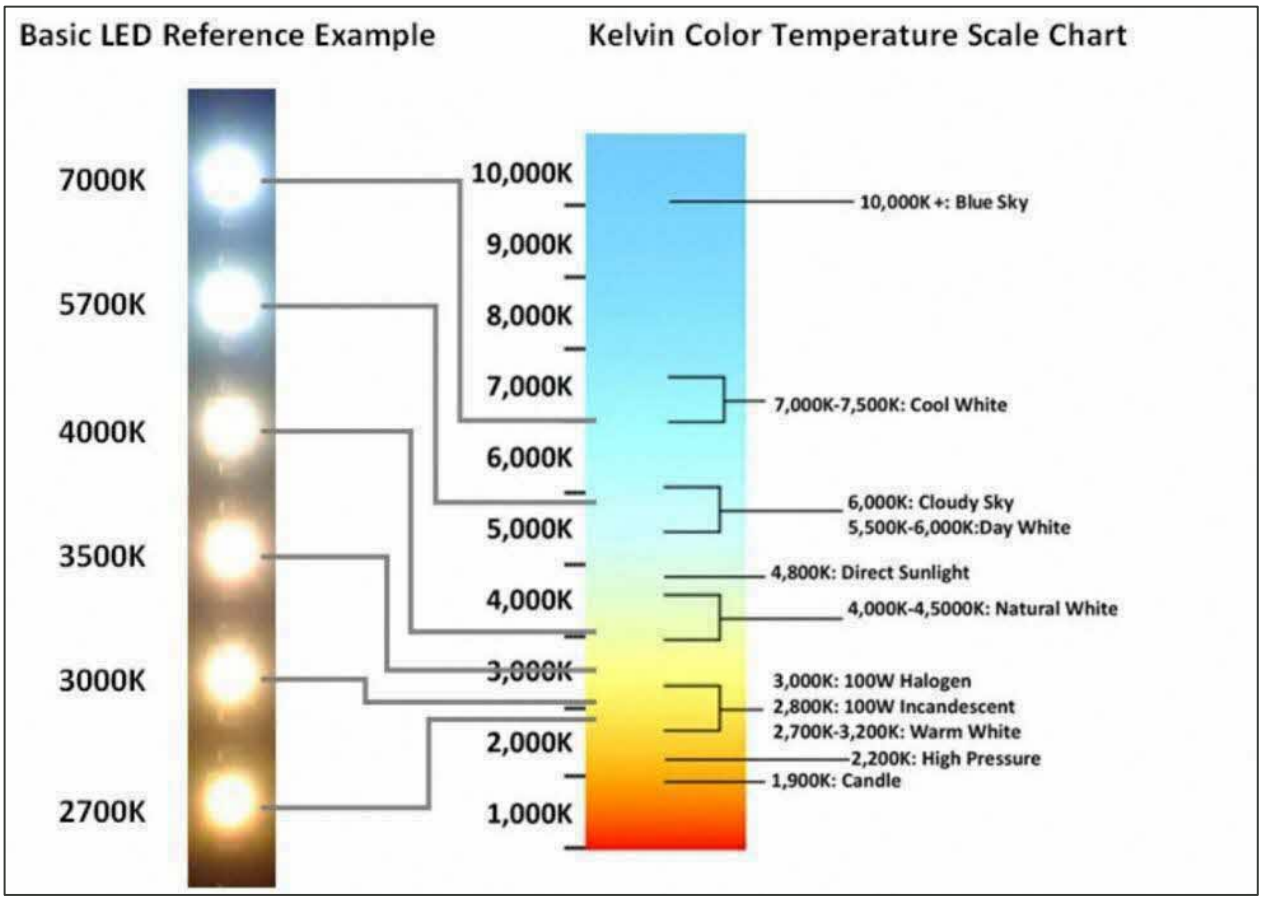


Figure 6-1 Reference Example of LED Colour Temperatures

6.2 Impact Assessment Matrix with Mitigation Measures – Illumination

Table 6-2 Impact Assessment Matrix with Mitigation Measures for Illumination

Work Activity	Environmental Aspect	Environmental Impacts	Sensitive Receptors	Impact Evaluation without Mitigation Measures							Recommended Mitigation Measures	Impact Evaluation with Mitigation Measures			Remarks
				A1 – Importance A2 – Magnitude		B1 – Permanence B2 – Recoverability B3 – Cumulative Impact			ES – Environmental Score						
				A1	A2	B1	B2	B3	ES	ES Class		A2	ES	ES Class	
Pre-construction / Construction Phase															
Light nuisance from nighttime construction works	Light pollution	Light pollution can have adverse impacts on biodiversity, particularly on light-sensitive species such as nocturnal birds and bats Light pollution can also negatively affect nearby (within 150 m radius) residential or hospital buildings, and lead to complaints	Light-sensitive fauna in the Project	4	-2	2	2	2	-48	Minor negative impact	▪ Construction works should be limited to daytime hours of 8 am to 6 pm daily, and night work should be avoided whenever possible. ▪ A Light Management Plan (LMP) should be developed to address any planned or emergency night works beyond 6 pm. This plan should outline measures to minimise light spill and prevent disturbance to nearby wildlife and sensitive receptors. This plan should be submitted to NParks for approval prior to commencement of any night works. ▪ All light fittings should be directed away from the forested areas, angled downwards, pointed inwards, or equipped with shading fixtures to reduce light spill, except lighting for safety and security purposes. ▪ The height of all ambient lighting should not exceed the height of hoarding or noise barriers. ▪ All lights should be switched off when not in use, except in necessary areas with active works or other essential safety purposes. ▪ All ambient light fittings should ideally have a warm colour temperature of not higher than 3,000 K.	-1	-24	Slight negative impact	-
			Residential Community	3	-1	2	2	2	-18	Slight negative impact		0	0	No significant impact	-
Operation Phase															
Light nuisance from operation phase of Project	Light pollution	Light pollution can have adverse impacts on biodiversity, particularly on light-sensitive species such as nocturnal birds and bats Light pollution can also negatively affect nearby (within 150 m radius) residential or hospital buildings, and lead to complaints	Light-sensitive fauna in the Project	4	-2	3	2	2	-56	Minor negative impact	▪ All light fittings should be directed away from the forested areas (if applicable), angled downwards, pointed inwards, or equipped with shading fixtures to reduce light spill, except lighting for safety and security purposes. ▪ All lights should be switched off when not in use, except in necessary areas where required for obstacle avoidance or other essential safety purposes. ▪ All light fittings within the landscape area should ideally have a warm colour temperature of not higher than 3,000 K. Low-glare lighting and lights with reduced or filtered blue, violet and ultra-violet wavelengths are recommended.	-1	-28	Slight negative impact	-
			Residential Community	3	-1	3	2	2	-21	Slight negative impact		0	0	No significant impact	-

7 Waste Management and Pollution

7.1 Applicable Legislation and Standards

The *Environmental Public Health Act 1987 (EPHA 1987)* serves as the overarching legislative framework for regulating waste management and preventing vector proliferation associated with construction activities. A list of relevant local Acts, Regulations, and Guidelines are presented in Table 6-1 below.

Table 7-1 List of Local Acts, Regulations and Guidelines Relevant to Waste Management and Vector Control

Environmental Aspect	Applicable Local Acts, Regulations and Guidelines	Acronyms
Waste Management	Environmental Public Health Act 1987	EPHA 1987
	Environmental Public Health (Toxic Industrial Waste) Regulations	EPH (Toxic Industrial Waste)
	Environmental Public Health (General Waste Collection) Regulations	EPH (General Waste Collection)
Vector Control	Infectious Diseases Act 1976	IDA 1976
	Control of Vectors and Pesticides Act 1998	CVPA 1998
	Environmental Public Health (Employment of Environmental Control Officers) Order	EPH (Employment of Environmental Control Officers)

7.1.1 Waste Management

The *EPHA 1987* 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 their own expense before disposal.

EPH (Toxic Industrial Waste) specifies wastes which are classified as toxic industrial waste (TIW) and regulates their handling, transport and disposal. The Code of Practice on Pollution Control 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) of National Environment Agency (NEA) to engage licensed TIW collectors to collect their wastes for recycling or treatment for safe disposal.

The *EPH (General Waste Collection)* governs 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 waste 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.

7.1.2 Vector Control

Three (3) legislations are enforced for the prevention and control of vectors in Singapore, namely: the *Infectious Diseases Act 1976 (IDA 1976)* which deals with the notification, investigation and treatment of infectious diseases such as Dengue; the *Control of Vectors and Pesticides Act 1998 (CVPA 1998)* which is focussed on the prevention of vectors and where necessary treatments to remove them; and the *EPHA 1987* which deals with environmental sanitation and other public health issues – such as but not limited to *EPHA (Part III – Public Cleansing)*. A key element of legislation applicable to all construction projects is detailed in Section 15 of the *CVPA 1998*, which states that no person shall create or cause or permit to be created any condition favourable to the propagation or harbouring of vectors.

The NEA is the regulatory body responsible for minimizing the incidence of vector-borne diseases in Singapore and it defines disease vectors as organisms that transmit diseases as “any insect, including its egg, larva and pupa, and any rodent, including its young, carrying or causing, or capable of carrying or causing any disease to human beings”. The five main vectors in Singapore are mosquitoes, fleas, cockroaches, rodents and flies. The presence of which is associated with stagnant water or food waste. NEA has the power to direct the owner or occupier of premises to implement vector control work per the requirements of the Act. The vector control work must be carried out by a vector control operator registered with NEA.

NEA also oversees the *EPH (Employment of Environmental Control Officers)* and *Code of Practice for Environmental Control Officers for Construction Sites Published 2021,* which requires construction site occupiers to employ either a part-time or full-time Environmental Control Officer (ECO), depending on the contract sum of the construction works. The *Code of Practice for Environmental Control Officers* also spells out the responsibilities of the ECO and recommended measures in vector control.

7.2 Impact Assessment Matrix with Mitigation Measures – Waste Management and Pollution

Table 7-2 Impact Assessment Matrix with Mitigation Measures for Waste Management and Pollution

Work Activity	Environmental Aspect	Environmental Impacts	Sensitive Receptors	Impact Evaluation without Mitigation Measures							Recommended Mitigation Measures	Impact Evaluation with Mitigation Measures			Remarks
				A1 – Importance A2 – Magnitude		B1 – Permanence B2 – Recoverability B3 – Cumulative Impact			ES – Environmental Score						
				A1	A2	B1	B2	B3	ES	ES Class		A2	ES	ES Class	
Pre-construction / Construction Phase															
Site clearance	Horticultural waste generated from site clearance consists mainly of trees, grass, secondary shrub vegetations, and small woody plants	Vegetation degradation may increase nutrient levels in surface runoff during rainy conditions, potentially impacting the water quality of receiving waterbodies Horticultural waste may be washed into the waterbodies during rainy conditions, resulting in potential water quality deterioration in the receiving waterbodies	Downstream Waterbodies & Natural Stream D/S25	4	-2	2	2	3	-56	Minor negative impact	▪ A Waste Management Plan should be formulated to ensure proper handling, storage, and disposal of waste. ▪ Horticultural waste should be transferred to a designated stockpile area within the site, located at least 10 m away from any waterways, prior to disposal at an approved dumpsite. ▪ Horticultural waste should be removed from the site to an approved dumpsite as soon as reasonably practicable to prevent further degradation. ▪ Lorries carrying waste material should be properly covered to prevent spillage.	-1	-28	Slight negative impact	-
			Freshwater Aquatic Fauna	2	-3	2	2	3	-42	Minor negative impact		-1	-14	Slight negative impact	-
General construction activities	Construction waste generated from various activities	Potential environmental impacts and pollutions on surrounding environment	Fauna in the Study Area	4	-2	2	2	2	-48	Minor negative impact	▪ A Waste Management Plan should be formulated to ensure proper handling, storage, and disposal of waste. ▪ Hazardous waste should be stored with secondary containment in a proper sheltered, kerbed area and located at least 10 m away from any waterways. ▪ Waste storage area should be located at least 10 m away from any waterways and regularly removed and disposed of by a licensed waste collector. ▪ Recommended best practices for management of cement wash-water – After concrete is poured at a construction site, the agitator and chutes of ready-mix concrete trucks as well as the piping of concrete pumps shall, where practicable, be washed out to remove the remaining concrete before it hardens – only if there are the appropriate facilities available to capture the cement wash. – Should the equipment be washed on site, cement wash should not be diverted to retention ponds of ECM plant, but instead be collected in a dedicated facility for disposal. – Disposal of collected cement wash to an appropriate waste processing facility.	-1	-24	Slight negative impact	-

Work Activity	Environmental Aspect	Environmental Impacts	Sensitive Receptors	Impact Evaluation without Mitigation Measures							Recommended Mitigation Measures	Impact Evaluation with Mitigation Measures			Remarks
				A1 – Importance A2 – Magnitude		B1 – Permanence B2 – Recoverability B3 – Cumulative Impact			ES – Environmental Score						
				A1	A2	B1	B2	B3	ES	ES Class		A2	ES	ES Class	
General construction activities	Improper disposal of food waste can attract wildlife and disease-bearing rodents	Potential human health impacts and environmental pollution	Project Management Team and Construction Workers	4	-3	2	2	2	-72	Minor negative impact	▪ Food should only be consumed at the designated rest areas. ▪ Food waste should be disposed of in securely covered, monkey-proof bins, with regular waste removal from the site. ▪ Construction materials should be stored under proper shelter and elevated off the ground. ▪ Regular housekeeping practices to remove potential breeding sites. ▪ Weekly inspections conducted by an external NEA-licensed Pest Control Operator.	-1	-24	Slight negative impact	-
			Residential Community	4	-3	2	2	2	-72	Minor negative impact		-1	-24	Slight negative impact	-
Operation Phase															
Operation phase of Project	General waste and potential vector proliferation arising from residential activities	Potential human health impacts and environmental pollution	Residential Community	4	-3	3	2	2	-84	Moderate negative impact	▪ A Waste Management Plan should be formulated to ensure proper handling, storage, and disposal of waste. ▪ Food waste should be disposed of in securely covered, monkey-proof bins, with regular waste removal from the site. ▪ Provision of sufficient waste bins to prevent improper waste disposal. ▪ Waste should be regularly removed and disposed of by a licensed waste collector. ▪ Routine inspections conducted by an external NEA-licensed Pest Control Operator. ▪ Educational signages for proper waste disposal and prevention of feeding of wildlife should be provided at appropriate locations.	-1	-28	Slight negative impact	-
			Fauna in the Project	4	-3	3	2	2	-84	Moderate negative impact		-1	-28	Slight negative impact	-

8 Environmental Management and Monitoring Plan

This section provides an overview of the monitoring and management guidelines recommended for the development.

8.1 EMMP Objectives

The Environmental Management and Monitoring Plan (EMMP) is a systematic approach designed to minimize environmental impacts and oversee the implementation of mitigation measures. It aims to ensure that the Project proceeds without causing unwanted impacts to the site and its surrounding environment.. Furthermore, the EMMP acts as a crucial mechanism for assessing the efficacy of mitigation efforts in managing potential Project-related environmental effects within acceptable thresholds during the construction period.

8.2 EMMP Roles and Responsibilities

The ongoing effectiveness and proper execution of the EMMP will require the dedicated cooperation of diverse stakeholders, who must collaboratively work to minimise the ecological and environmental impacts of the Project's construction activities as much as practicable, with ongoing monitoring ensuring that this ideal mitigation level will be maintained throughout the entire development period.

8.2.1 Developer

The developer for this Project shall regularly liaise with the Contractor's Project Manager to review the effectiveness of measures implemented and compliances status during the implementation.

Developer's Environmental Team

The following sub-sections list the parties involved and their roles in the EMMP, with the Project Organizational Chart in Figure 8-1.

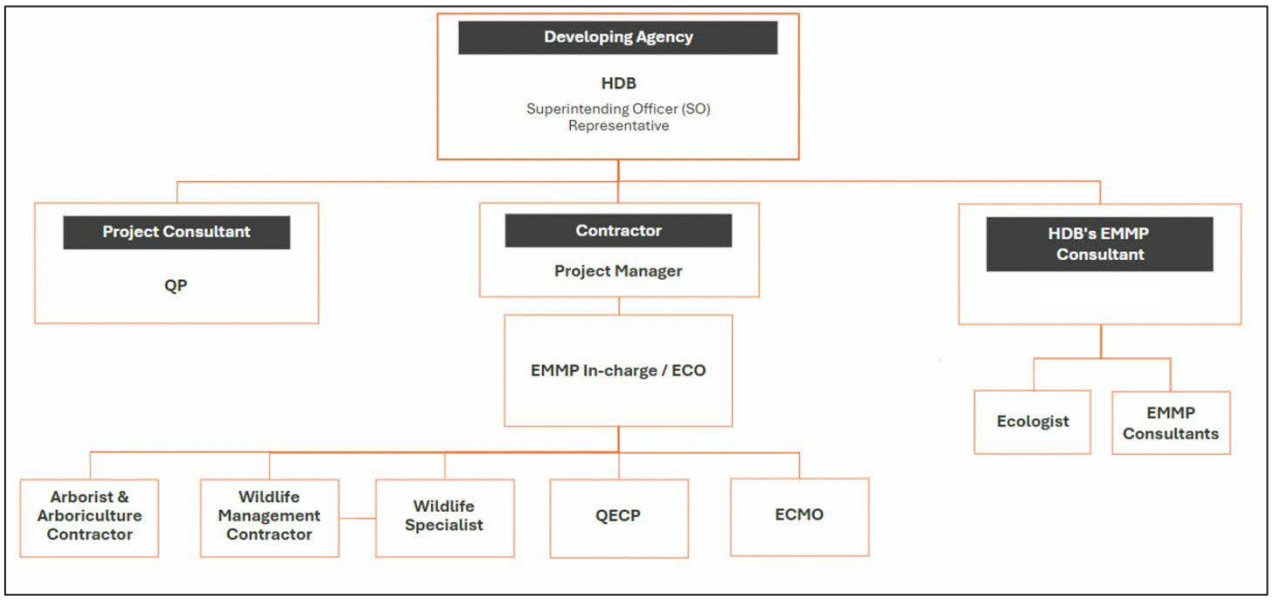


Figure 8-1 Environmental Management Organization Chart

EMMP Consultant

The EMMP Consultant will provide technical knowledge on the mitigation and monitoring measures pertaining to EMMP. The responsibilities of the EMMP Consultant are as follows:

- To monitor the implementation of the EMMP by all parties and provide oversight;
- Provide a solution if any environmental issue and/or non-compliance arises and ensure that rectification is carried out to the satisfaction of Client and Technical Agencies (TAs);
- Ensure that the Project team, subcontractors and site personnel understand and implement the EMMP requirements;
- Provide input for environmental mitigation measures and monitoring requirements prior to any physical works;
- To advise all parties (e.g., Project Manager, Environmental Control Officer, Environmental Checker, Site Engineers, Site Supervisors, Subcontractors etc.) on matters related to environmental management and promote awareness within the site;
- Ensure the preparation and timely submission of EMMP to the Developer, Agency and TAs;
- To ensure the monthly environmental inspection and reporting is carried out and submitted to HDB and NParks; and
- To liaise with Agency or TA on environmental matters.

Ecologist

An Ecologist will be engaged under the EMMP Consultant. The responsibilities of the Ecologist in this Project include but are not limited to the following:

- To prepare site-specific fauna management plan as part of EMMP, utilizing the EMMP framework recommended in the EIA Report and assist Contractor in obtaining authority approval;
- To conduct pre-fell checks and prepare wildlife management protocols as necessary during site clearance stage;
- To provide advice and training to site personnel throughout the construction duration;
- To visit the Project site regularly to carry out inspection related to fauna EMMP requirements;
- To assist the Contractor's Animal Management Specialist to identify, rescue, and manage any wildlife in and around the Project that will affect the development;
- To assist in reporting requirements of EMMP during construction phase; and
- To liaise with NParks on addressing any comments or requirements related to wildlife implementation measures.

8.2.2 Contractor

The Contractor shall provide sufficient manpower and resources to implement the requirements of the EMMP. Appropriate personnel shall be appointed by the Contractor to look after all implementations and reporting. The general responsibilities of the appointed Contractor's Environmental team for this Project are detailed in the following paragraphs.

Contractor's Environmental Team

Environmental Control Officer

The requirements, duties and responsibilities of the Environmental Control Officer (ECO) engaged by the Contractor include:

- Ensure the Contractor's adherence to all legal, environmental requirements;
- Perform the role of ECO stipulated in the Code of Practice for Environmental Control Officers;
- Possess relevant certifications to effectively implement EMMP requirements (e.g. Joint ITE-NEA Certificate in Pest Management for ECO or equivalent);
- Act as the EMMP In-Charge and lead the implementation and reporting requirements of the EMMP during construction phase;
- Responsible for managing all environmental issues arising from the construction work which includes monitoring and ensuring the implementation and management of change of the EMMP, the environmental performance of the Project, investigation of incidents, inspections of site and implementing corrective/ preventive measures;
- Conduct all the necessary EMMP monitoring and fulfil associated reporting requirements;
- Carry out daily compliance checks on all environmental aspects as per EMMP requirements;
- Execute fauna response and rescue protocols when fauna is found on-site;
- Conduct daily toolbox meetings with construction workers including subcontractors;
- Monitor ECM performance and coordinate with the QECP on specific issues;
- Coordinate with the EMMP Consultant team/EMMP team members for advice on specific issues related to EMMP implementation; and
- Submit monthly Site Environmental Control Reports (SECR) and other relevant reports before the end of each month to the EMMP Consultant for the submission of the monthly Environmental Performance Reports (EPRs).

Arboriculture Contractor

The requirements, duties and responsibilities of the Arboriculture Contractor engaged by the Contractor include:

- Arboriculture Contractor to be listed either under Contact List of NParks Term Contractor or Landscape Company Register list under Centre of Urban Greenery and Ecology (CUGE);
- To perform arboriculture and/or horticultural operation works such as pruning, tree removal, turfing, etc.; and
- To work with the Certified Arborist for matters related to flora and arboriculture

Certified Arborist

A Certified Arborist will be engaged under the Contractor for the Project. The responsibilities of the Arborist in this Project include but are not limited to:

- To conduct Monthly Inspections & Monitoring to ensure that NParks' specifications and requirements of Tree Protection Zone (TPZ) are adhered to and adopt ISA TRAQ Level 1 for tree assessment, if necessary:
  - Tree physiological health condition
  - Highlight concerned defects
- If there are any trees to be retained, furnish monthly report on tree condition, TPZ condition, and recommend any mitigating or remedial measure(s) necessary for the trees based on the site inspection:
  - The assessment and recommendation of the tree condition and TPZ conditions shall be presented in table format
  - Current month tree photographs (overall and tree base) are juxtaposed with previous month tree photograph.

- To advise and implement specific measures in the case of tree pruning prior to clearance, tree injury, and construction activities affecting tree roots;
- To identify any flora species of conservation significance prior to site clearance;
- To provide checks on and submit to the S.O. Rep plan of TPZ;
- To assess trees located outside the development boundary, e.g., 10 m buffer from the perimeter hoarding, that may be potentially impacted by the Project, including any works along the boundary, and to provide recommendations to minimise damage to these trees or, where unavoidable, to recommend pruning or removal when necessary to prevent significant harm to their health or structural integrity, for NParks' assessment; and
- To liaise with NParks on addressing any comments or requirements related to arboriculture implementation measures during the pre-construction phase and construction phase; and
- To work with the Contractor's Arboriculture Contractor for matters related to flora and arboriculture.

NParks Certified Animal Management Specialist

The requirements, duties and responsibilities of the Animal Management Specialist engaged by the Contractor include:

- Listed under NParks' Public Registry of Certified Animal Management Specialists;
- Identify, rescue and manage any trapped and/or injured wildlife at the Project;
- Trap and remove any trapped animal spotted within the Construction site at any time during the Construction Stage;
- Translocate beehives (if any) within the Project at any time during the works;
- Safeguard the welfare or safety of wildlife removed from the site; and
- Liaise with NParks on appropriate areas for translocation of wildlife from the Project.

8.3 Environmental Tolerance Limit and Environmental Quality Objectives (EQOs)

The tolerance level and trigger criteria of water quality parameters and noise levels will take reference from the EIA, and the latest Regulatory Agencies' requirements and will be established during the EMMP stage. The impacts on the various environmental receptors will then be classified according to the following levels shown in below.

Table 8-1 Summary of Impact Level Classification on Environmental Receptors

Impact Level	Description
No Impact	Changes are below the level of model reliability or are significantly below recognised tolerance levels, so that no change to the quality or functionality or a receptor will occur.
Slight Impact	Changes can be resolve by the numerical models but are unlikely to be detectable in the fields, for example, a change in living status. Typically, slight impacts are associated with changes that cause stress, but not mortality to stream/aquatic ecosystems. Slight impacts may be recoverable once the stress factor is removed.
Minor Impact	Changes are identified by the predictive tools at a level where change (e.g. mortality) can be expected to be identifiable in the field. Changes are limited in spatial extent and are unlikely to have any secondary consequences.
Moderate Impact	Changes are at a level that can be classified as locally significant and may results in secondary impacts. From a physical perspective, a moderate impact would typically require a change in operating procedure for the continued safe use of an existing facility.

Major Impact	Changes are often related to a complete loss of local habitat with consequent secondary impacts on liked ecosystem processes. From a physical perspective, a major impact would typically be associated with an impact that prevented the use of an existing facility.

8.3.1 Tolerance Limits

The respective Environmental Quality Objectives (EQOs) tolerance limits (indicative) prescribed for each monitoring parameter will be detailed in their respective sections. The general tolerance limits proposed for each parameter are as shown:

- Water Quality at ECM discharge;
  - Total suspended solids (TSS) should not exceed **30 mg/l**; and
  - pH level should be within the range of **6 – 9**.
- Noise level (except transient noise from aircraft) at noise monitoring stations located in the vicinity of forested area, and subject to the outcome of the standalone Noise Management Plan prepared by the Contractor:
  - 7 am – 7 pm: LA_{eq} 5 mins – **75 dBA**; and
  - 7 pm – 7 am: LA_{eq} 5 mins – **70 dBA**.

8.4 Construction Specific EMMP (CEMMP)

Before construction begins, the Contractor shall collaborate with the appointed EMMP Consultant to establish a Contract-specific EMMP (CEMMP) based on the construction work specifics. The CEMMP shall incorporate references to the mitigation and monitoring approaches advised in this EIA. The CEMMP will cover the following elements:

- Project Description;
- CEMMP Objectives and Scope;
- Summary of EIA;
- Proposed Construction Plan and Timeline;
- Applicable Environmental Legislations;
- Environmental Roles and Responsibilities;
- Environmental Monitoring and Reporting;
- Biodiversity Monitoring; and
- Environmental Management and Mitigation Measures.

To meet the environmental objectives of the EMMP, the CEMMP document will comprise the following management and monitoring plans:

- Noise Management and Monitoring Plan;
- Waste Management and Monitoring Plan;
- Flora Management and Monitoring Plan;
- Arboriculture Management and Monitoring Plan;
- Water Quality Management and Monitoring Plan;
- Vector Control Plan;
- Wildlife Management Plan;
- Wildlife Shepherding Plan;

- Earth Control Measures Plan; and
- Light Management Plan (if night work is required).

8.4.1 Mitigation and Monitoring Plan

The table below summarises the actionable items required for each phase of construction and operation. The contractor must collaborate with the appointed EMMP Consultant to ensure that the mitigation measures are implemented, monitored, and documented. The final section of the table pertains to the operation phase, where the appointed EMMP Consultant will work with the appointed Contractor to ensure the effective implementation of these mitigation measures.

Table 8-2 EMMP Table

No.	Work Activity	Description of Work Activity (if applicable)	Environmental Aspect	Management and Monitoring Plan	Responsible Party	Remarks
1.	Advance works	▪ Cable detection ▪ Soil investigation (SI) ▪ Clearing for access road	Biodiversity	▪ Maximum working space of 6 m x 4 m for SI works. ▪ The vegetation clearance is recommended to be done slowly and carefully to prevent animal deaths. ▪ Avoid excessive vegetation removal. ▪ All works are strictly limited to daytime only (8 am to 6 pm) to prevent disturbances to animals in the early morning and late evening. No nightworks should be conducted, unless otherwise approved by NParks and relevant agencies (i.e. LMP). ▪ Removal of all waste from site on a daily basis. ▪ No feeding of any animals.	Contractor	During pre-construction stage or before main contractor on board
				▪ Salvaging of flora species (both conservation species and common species) prior to SI works. ▪ Conduct inspection and pre-fell checks for bird nests prior to any vegetation clearance and tree felling prior to SI works. ▪ Conduct wildlife awareness training for the workers involved.	EMMP Consultant	
			Water Quality	▪ Fence up the work areas to contain the silty water generated from Soil Investigation drilling. ▪ Cover the exposed areas with biodegradable Erosion Control Blankets (ECB). ▪ Generators should be provided with proper drip trays. ▪ Regular maintenance of drip trays and secondary containment facilities to prevent rain from washing out the pollutive substances. ▪ Any spillage should be cleaned up immediately. ▪ Daily collection and disposal of waste generated from the advance works.	Contractor	
			Noise	▪ Use of portable noise barriers or enclosures for noisy equipment and machineries (including SI rig) to minimise the disturbance.	Contractor	
2.	Site Clearance	▪ Machine mobilisation ▪ Clearing for access road ▪ Hoarding works ▪ ECM facilities set up ▪ Temporary drainage ▪ Undergrowth clearance ▪ Tree felling ▪ Storage and site office set up ▪ Noise-barrier set up	Biodiversity	<u>Pre-construction</u> ▪ The salvaging of conservation species (CS) plants can be carried out before any construction work begins. This process will be supported by NParks. For external salvaging conducted by NParks, the plants will be transplanted to the NParks' nursery. Refer to Section 8.4.2 (Plant Salvaging) for further detail. ▪ Biodiversity awareness training should be carried out by the EMMP Consultant for all Project personnel prior to start of construction, with refresher courses conducted on bi-annual basis. ▪ Salvaging of CS riparian plants can be carried out before any construction works starts. ▪ Salvaging of freshwater aquatic fauna, if necessitated by NParks, can be carried out by an aquatic fauna expert. The fishes should then be released in a suitable environment, with the location to be decided following consultation with NParks. Refer to Section 8.4.2 (Protection of Aquatic Fauna) for further detail.	EMMP Consultant/Flora Specialist/Aquatic Fauna Specialist	To consult NParks for plant salvaging
				<u>During Site Clearance</u> ▪ Land clearance direction and sequence of events should be carried out following the recommended wildlife shepherding plan during the EMMP stage. ▪ Before land clearance, hoarding should be installed starting from the most disturbed areas, such as roads, to prevent any roadkill and then progressively move inwards. ▪ The hoarding shall be installed with no gaps between panels and should extend at least 300 mm into the ground to prevent ground-dwelling animals from entering the site. ▪ Access gates should be designed to close tightly with no gaps between panels and positioned as close to the ground as possible.	Contractor	-

No.	Work Activity	Description of Work Activity (if applicable)	Environmental Aspect	Management and Monitoring Plan	Responsible Party	Remarks
				▪ If any wildlife, especially birds, reptiles, or mammals, is spotted at or around the site during construction and cannot be safely guided out, a licensed Wildlife Management Company should be engaged for the safe rescue and relocation of the animal. ▪ All Project personnel shall attend biodiversity awareness training, to be carried out by the EMMP Consultant. ▪ The appointed Contractor shall keep a register of personnel who have undertaken the training. ▪ A bi-annual refresher for the biodiversity awareness training should be done for all Project personnel. ▪ Workers should be briefed on a weekly basis during toolbox meetings and reminded not to stray beyond the Project. ▪ Rubbish bins should be securely enclosed to prevent monkeys from accessing the food waste. ▪ Bins at open areas should be monkey-proof to discourage wildlife from scavenging food waste. ▪ Ensure that garbage, recyclables, and food waste are not left outside. ▪ Feeding monkeys or any other wildlife is strictly prohibited. ▪ The worker assembly area, rest area, worksite entrances, and access routes should be located away from the edge of the forested area where possible. ▪ All site personnel shall attend biodiversity awareness training. Regular refresher sessions during toolbox meetings are recommended to enhance awareness among construction personnel. ▪ Daily inspections should be conducted by the Environmental Checker / Environmental Control Officer / Earth Control Measures Officer on site in areas where Erosion Control Blankets (ECB)s and Earth Control Measure (ECM)s are implemented to check for any trapped animals. Gaps in hoarding are to be checked too and promptly sealed. ▪ Any incidents of animal entrapment should be promptly reported. ▪ Only biodegradable ECBs are to be used within the Project. <u>Protection of Aquatic Habitat(s)</u> ▪ Bund walls and silt fences should be set up at appropriate locations if to prevent flow of pollution of waterbodies outside of the Project. ▪ These waterbodies should also be monitored on a monthly basis during site clearance. Parameters to be monitored should follow the EIA baseline water sampling parameters, as stated in Table 4-3 and Table 4-4. ▪ If water quality parameters exceed the pre-construction baseline levels or appropriate legislation, necessary steps shall be taken to ensure that water quality parameters return to acceptable levels. ▪ Backfilling of streams should start from upstream and proceed downstream, to allow for aquatic fauna to swim downstream. <u>Road Calming Measures</u> ▪ A vehicle speed limit of 15 km/h should be imposed within the Project. ▪ A road hump should be installed at the entrance of the Project and to control vehicle speed. ▪ Adequate wildlife warning signage should be prominently displayed along access roads to prevent wildlife-vehicle collisions. ▪ Daily checks of access roads and roads within the construction site should be conducted to monitor for roadkill. Site personnel should report any roadkill encountered, and mitigation measures should be reassessed to ensure their effectiveness. <u>Tree Protection Zones (TPZs)</u> ▪ In general, TPZ requirements and management measures specified in the Guidelines on Greenery Provision and Tree Conservation for Developments by NParks shall be adhered to, and further advice to be sought from the Certified Arborist. – Tree Protection Zones (TPZs) should be established to safeguard the trees and their root systems where reasonably practicable. – TPZ should be hoarded up (i.e. bright orange polyethylene fencing or other effective tree protection fencing) to demarcate TPZ boundary clearly to restrict entry and prevent construction works from encroaching into the TPZ. ▪ The health of retained trees and trees 10 m along the Project should be checked monthly by a certified arborist, and, if the health of the trees deteriorate, the arborist and appointment Contractor should work together to cease or reverse the deterioration if possible.		

No.	Work Activity	Description of Work Activity (if applicable)	Environmental Aspect	Management and Monitoring Plan	Responsible Party	Remarks
				During Site Clearance ■ Pre-felling fauna inspections should be carried out prior to land clearance to identify active bird nests or other wildlife. ■ Weekly site inspection and reporting of wildlife shepherding progress. ■ If a wild boar is spotted at or around the site at any time during construction, EMMP consultant must notify NParks immediately at nparks_wildlife_management@nparks.gov.sg. A licensed wild boar removal contractor must also be engaged to safely trap and remove the animal. The trapping and removal process may take about 4 – 8 weeks. Once it is confirmed that no wild boars remain within the forest patch, the wildlife shepherding plan outlined in the EMMP may proceed.	EMMP Consultant	-
			Water Quality	■ A QECP should be engaged to formulate and implement an ECM Plan in accordance with the PUB's requirements. ■ ECM infrastructure, including holding ponds and treatment tanks, should be fully commissioned and operational prior to the commencement of site clearance and earthworks. ■ Various layers of silt fences/bund should be provided along the watercourses to prevent silty runoff (depending on the outcome of the ECM Plan). ■ ECM provisions and infrastructure should be inspected weekly and after heavy rainfall events, and maintained as necessary. ■ Recommended best practices for management of cement wash-water – After concrete is poured at a construction site, the agitator and chutes of ready-mix concrete trucks as well as the piping of concrete pumps shall, where practicable, be washed out to remove the remaining concrete before it hardens – only if there are the appropriate facilities available to capture the cement wash. – Should the equipment be washed on site, cement wash should not be diverted to retention ponds of ECM plant, but instead be collected in a dedicated facility for disposal. – Disposal of cement wash to an appropriate waste processing facility. – Where feasibly practicable, to ensure retention pond water quality parameters are within PUB's allowable limits prior to discharge.	Contractor	-
			Waste and Vector	■ A Waste Management Inventory should be prepared to ensure proper handling, storage, and disposal of waste. ■ Horticultural waste/biomass from site clearance should be transferred to a designated stockpile area within the site, located at least 10 m away from any waterways, prior to disposal at an approved dumpsite. ■ Horticultural waste/biomass should be removed from the site to an approved dumpsite as soon as reasonably practicable to prevent further degradation. ■ Lorries carrying waste material should be properly covered to prevent spillage.	Contractor	-
3.	Earthwork	■ Excavation ■ Land grading ■ Soil stabilisation	Biodiversity	■ If any wildlife, especially birds, reptiles, or mammals, is spotted at or around the site during construction and cannot be safely guided out, a licensed Wildlife Management Company should be engaged for the safe rescue and relocation of the animal. ■ All Project personnel shall attend biodiversity awareness training, to be carried out by the EMMP Consultant. ■ The appointed Contractor shall keep a register of personnel who have undertaken the training. ■ A bi-annual refresher for the biodiversity awareness training should be done for all Project personnel. ■ Workers should be briefed on a weekly basis during toolbox meetings and reminded not to stray beyond the Project. ■ Rubbish bins should be securely enclosed to prevent monkeys from accessing the food waste. ■ Bins at open areas should be monkey-proof to discourage wildlife from scavenging food waste. ■ Ensure that garbage, recyclables, and food waste are not left outside. ■ Feeding monkeys or any other wildlife is strictly prohibited. ■ The worker assembly area, rest area, worksite entrances, and access routes should be located away from the edge of the forested area where possible. ■ All site personnel shall attend biodiversity awareness training. Regular refresher sessions during toolbox meetings are recommended to enhance awareness among construction personnel.	Contractor	-

No.	Work Activity	Description of Work Activity (if applicable)	Environmental Aspect	Management and Monitoring Plan	Responsible Party	Remarks
				▪ Daily inspections should be conducted by the Environmental Checker / Environmental Control Officer / Earth Control Measures Officer on site in areas where Erosion Control Blankets (ECB)s and Earth Control Measure (ECM)s are implemented to check for any trapped animals. Gaps in hoarding are to be checked too and promptly sealed. ▪ Any incidents of animal entrapment should be promptly reported. ▪ Only biodegradable ECBs are to be used within the Project.		
			Air Quality	▪ Set up hoarding of at least 2.4 m high to act as physical barrier to prevent dust dispersion. ▪ Regular compaction of exposed surfaces and cover them with biodegradable erosion control blankets (ECBs) or concrete lining to reduce dust emissions. ▪ Equipment and machinery should be regularly maintained to ensure proper upkeep. ▪ Turn off the equipment and machinery when not in use. ▪ Cover soil stockpiles with biodegradable ECBs. ▪ Regular water sprinkling should be carried out on dry days. ▪ Implement closed turfing in areas where the activities are completed. ▪ Ensure vehicles use paved roads to minimise dust generation. ▪ Regular water sprinkling should be carried out on dry days. ▪ Regular sweeping and cleaning of access road to prevent dust buildup. ▪ Lorries carrying loose materials should be properly covered with tarpaulin to prevent dust dispersion and spillage. ▪ Provision of wheel washing facilities to clean the vehicles before entering the public roads.	Contractor	-
4.	General construction works	▪ Bored pilling works ▪ Construction of pile caps ▪ RC works ▪ Crane lifting ▪ Hoisting/installation of precast elements/superstructure ▪ Construction of retaining wall ▪ Drainage and utilities ▪ External works (drain, retaining walls, road base, road kerbs, premix)	Biodiversity	▪ If any wildlife, especially birds, reptiles, or mammals, is spotted at or around the site during construction and cannot be safely guided out, a licensed Wildlife Management Company should be engaged for the safe rescue and relocation of the animal. ▪ All Project personnel shall attend biodiversity awareness training, to be carried out by the EMMP Consultant. ▪ The appointed Contractor shall keep a register of personnel who have undertaken the training. ▪ A bi-annual refresher for the biodiversity awareness training should be done for all Project personnel. ▪ Workers should be briefed on a weekly basis during toolbox meetings and reminded not to stray beyond the Project. ▪ Rubbish bins should be securely enclosed to prevent monkeys from accessing the food waste. ▪ Bins at open areas should be monkey-proof to discourage wildlife from scavenging food waste. ▪ Ensure that garbage, recyclables, and food waste are not left outside. ▪ Feeding monkeys or any other wildlife is strictly prohibited. ▪ The worker assembly area, rest area, worksite entrances, and access routes should be located away from the edge of the forested area where possible. ▪ All site personnel shall attend biodiversity awareness training. Regular refresher sessions during toolbox meetings are recommended to enhance awareness among construction personnel. ▪ Daily inspections should be conducted by the Environmental Checker / Environmental Control Officer / Earth Control Measures Officer on site in areas where Erosion Control Blankets (ECB)s and Earth Control Measure (ECM)s are implemented to check for any trapped animals. Gaps in hoarding are to be checked too and promptly sealed. ▪ Any incidents of animal entrapment should be promptly reported.	Contractor	-

No.	Work Activity	Description of Work Activity (if applicable)	Environmental Aspect	Management and Monitoring Plan	Responsible Party	Remarks
			Water Quality	▪ ECM provisions and infrastructure should be inspected weekly and after heavy rainfall events, and maintained as necessary. ▪ Appropriate housekeeping and handling practices should be implemented to prevent any spillage of cement, wet or uncured concrete, or grout. ▪ Concrete spillage during pile filling should be avoided through careful concrete handling and placement. If necessary, water will be pumped out of the pile to prevent overflow. ▪ Concrete and cement wash shall be collected and disposed of separately. These materials are not to be discharged or channelled into the ECM ponds, where feasibly practicable. ▪ Recommended best practices for management of cement wash-water – After concrete is poured at a construction site, the agitator and chutes of ready-mix concrete trucks as well as the piping of concrete pumps shall, where practicable, be washed out to remove the remaining concrete before it hardens – only if there are appropriate facilities available to capture the cement wash. – Should the equipment be washed on site, cement wash should not be diverted to retention ponds of ECM plant, but instead be collected in a dedicated facility for disposal. – Disposal of collected cement wash to an appropriate waste processing facility. ▪ Contaminated soil shall be disposed offsite at a designated facility for the treatment of hazardous chemicals. ▪ During construction, the Contractor shall implement a Continuous Monitoring System for total suspended solids (TSS) levels in treated discharge water. If TSS levels of 30 mg/L or above are detected, an alert shall trigger the suspension of work in the vicinity of watercourses. ▪ Regular water quality monitoring along any retained streams and final discharge point for all ECMs on a monthly basis. Parameters to be monitored shall follow those in Table 4-1. ▪ Contractor to ensure that pH for the retention pond water quality is within NEA's allowable limits (i.e. 6 <= pH <= 9) prior to discharge. This should be done at least on a weekly basis, where feasible and relevant. Should the pH of the retention pond exceed the pH range, the pond should be pumped out and contents disposed of at an appropriate waste disposal facility, where feasible. ▪ Cover stockpiles with biodegradable ECBs or tarpaulin to prevent runoff at the end of each day or upon onset of heavy rain. ▪ Cover materials, i.e., biodegradable ECBs or tarpaulin, should be stored nearby and readily available for use on the stockpiles. ▪ Exposed bare earth areas should be covered with biodegradable ECBs, concreted, or replanted with vegetation. ▪ An additional 0.5 m bunds or silt fences should be installed around stockpiles to contain runoff and direct it to the ECM treatment system. ▪ Water used to wash truck and vehicle wheels should not be discharged into any receiving waterbody. The silty water in the wheel wash basin should be directed to the ECM plant for treatment. ▪ The silt collected at the bottom of the wheel wash basin should be regularly removed. ▪ Fuel and chemicals should be stored under shelter in kerbed or bunded areas with secondary containment. ▪ The secondary storage volume should ideally be large enough to contain the entire volume of chemicals or fuel stored in the area. Minimally, the containment should accommodate 110% of the largest tank volume. ▪ Sand and/or other spill control kits, including absorbents, should be readily available to manage any spills that may occur. ▪ Fuel and chemical storage should be located at least 10 m away from any watercourses. ▪ Generators should be equipped with drip trays and regularly maintained to ensure proper functioning. Where possible, generators should be kept under shelter. ▪ Drip trays should be regularly cleaned, and rainwater should be avoided from accumulating on the surface. ▪ Provision and maintenance of vegetation cover along the watercourses. ▪ Installation of perimeter drain along the boundaries of Project. ▪ Recommendation of post-construction water quality monitoring for a designated period i.e., three (3) months.	Contractor	-

No.	Work Activity	Description of Work Activity (if applicable)	Environmental Aspect	Management and Monitoring Plan	Responsible Party	Remarks
			Noise	▪ Continuous noise monitoring should be conducted in accordance with NEA requirements. ▪ Noise barriers should be erected along the site boundary adjacent to the forested area (if applicable). ▪ Installation of localised noise barriers around noisy equipment and machinery, such as pilling rig, to reduce loud noise. ▪ Routine checks and maintenance of construction equipment and machinery. ▪ Avoid parallel use of noisy equipment and machinery, where feasible and practical. ▪ Turn off the equipment and machinery when not in use. ▪ Construction works should be limited to daytime hours of 8 am to 6 pm daily, and night works should be avoided whenever possible. Should night works be unavoidable, a Lighting Management Plan (LMP) should be prepared and submitted to NParks for approval.	Contractor	-
			Waste and Vector Proliferation	▪ A Waste Management Inventory should be prepared to ensure proper handling, storage, and disposal of waste. ▪ Hazardous waste should be stored with secondary containment in a proper sheltered, kerbed area and located at least 10 m away from any waterways. ▪ Waste storage area should be located at least 10 m away from any waterways and regularly removed and disposed of by a licensed waste collector.	Contractor	-
5.	Building works	▪ M&E works ▪ Roofing ▪ Wrap building - External walls ▪ External windows ▪ Internal doors and windows ▪ Install ceiling ▪ Masonry wall ▪ Line wall ▪ Painting	Biodiversity	▪ If any wildlife, especially birds, reptiles, or mammals, is spotted at or around the site during construction and cannot be safely guided out, a licensed Wildlife Management Company should be engaged for the safe rescue and relocation of the animal. ▪ All Project personnel shall attend biodiversity awareness training, to be carried out by the EMMP Consultant. ▪ The appointed Contractor shall keep a register of personnel who have undertaken the training. ▪ A bi-annual refresher for the biodiversity awareness training should be done for all Project personnel. ▪ Workers should be briefed on a weekly basis during toolbox meetings and reminded not to stray beyond the Project. ▪ Rubbish bins should be securely enclosed to prevent monkeys from accessing the food waste. ▪ Bins at open areas should be monkey-proof to discourage wildlife from scavenging food waste. ▪ Ensure that garbage, recyclables, and food waste are not left outside. ▪ Feeding monkeys or any other wildlife is strictly prohibited. ▪ The worker assembly area, rest area, worksite entrances, and access routes should be located away from the edge of the forested area where possible. ▪ All site personnel shall attend biodiversity awareness training. Regular refresher sessions during toolbox meetings are recommended to enhance awareness among construction personnel. ▪ Daily inspections should be conducted by the Environmental Checker / Environmental Control Officer / Earth Control Measures Officer on site in areas where Erosion Control Blankets (ECB)s and Earth Control Measure (ECM)s are implemented to check for any trapped animals. Gaps in hoarding are to be checked too and promptly sealed. ▪ Any incidents of animal entrapment should be promptly reported.	Contractor	-
			Illumination	▪ Construction works should be limited to daytime hours of 8 am to 6 pm daily, and night work should be avoided whenever possible. ▪ A Light Management Plan (LMP) should be developed to address any planned or emergency night works beyond 6 pm. This plan should outline measures to minimise light spill and prevent disturbance to nearby wildlife and sensitive receptors. This plan should be submitted to NParks for approval prior to commencement of any night works. ▪ All light fittings should be directed away from the forested areas, angled downwards, pointed inwards, or equipped with shading fixtures to reduce light spill, except lighting for safety and security purposes. ▪ The height of all ambient lighting should not exceed the height of hoarding or noise barriers. ▪ All lights should be switched off when not in use, except in necessary areas with active works or other essential safety purposes. ▪ All ambient light fittings should ideally have a warm colour temperature of not higher than 3,000 K.	Contractor/EMMP Consultant	-

No.	Work Activity	Description of Work Activity (if applicable)	Environmental Aspect	Management and Monitoring Plan	Responsible Party	Remarks
6.	Landscape	▪ Landscaping works	Biodiversity	▪ Provide maintenance for retained trees. ▪ Species planted should be native species. ▪ Only native plants should be used for landscaping along the forest edge to prevent non-native species from outgrowing native vegetation. ▪ Provide ecological connectivity between the Project and adjacent green spaces by planting native, biodiversity-attracting plants as part of the landscape.	Landscape Contractor	-
7.	General operation of Project	▪ Landscape ▪ Lighting ▪ Waste generation	Biodiversity	▪ Maintain ecological connectivity between the Project and adjacent green spaces by planting native, biodiversity-attracting plants as part of the landscape.	Landscape Contractor	-
				▪ Provision of ecologically sensitive pedestrian crossings to minimise environmental impacts and human-wildlife conflict. ▪ Conduct regular biodiversity awareness and educational talks to residents ▪ Implement monkey guarding, if necessary.	NParks, Town Councils and/or relevant organisations	-
			Noise	▪ Sufficient setbacks for developments with air conditioning and mechanical ventilation (ACMV) systems should be established in front of NSRs (if applicable). ▪ Noise attenuators and other Best Available Technology (BAT) and Best Environmental Practice (BEP) measures for noise control should be recommended. ▪ Speed control measures, such as speed limits, speed bumps, and related signages, should be provided to minimise traffic noise.	Contractor	-
			Air quality	▪ Designated drop-off and pick-up zones to minimise idling and reduce congestion. ▪ Green walls or trellises are recommended in pick-up/drop-off areas to intercept particulate matter. ▪ Promotion of sustainable transport modes, such as shuttle bus services and provision of sheltered bicycle parking.		
			Light	▪ All light fittings should be directed away from the forested areas (if applicable), angled downwards, pointed inwards, or equipped with shading fixtures to reduce light spill, except lighting for safety and security purposes. ▪ All lights should be switched off when not in use, except in necessary areas where required for obstacle avoidance or other essential safety purposes. ▪ All light fittings within the landscape area should ideally have a warm colour temperature of not higher than 3,000 K. Low-glare lighting and lights with reduced or filtered blue, violet and ultra-violet wavelengths are recommended		
			Waste and Vector Proliferation	▪ A Waste Management Plan should be formulated to ensure proper handling, storage, and disposal of waste. ▪ Food should only be consumed at the designated areas. ▪ Food waste should be disposed of in securely covered, wildlife-proof bins, with regular waste removal from the site. ▪ Provision of sufficient waste bins to prevent improper waste disposal. ▪ Waste should be regularly removed and disposed of by a licensed waste collector. ▪ Routine inspections conducted by an external NEA-licensed Pest Control Operator. ▪ Educational signages for proper waste disposal and prevention of feeding of wildlife should be provided at appropriate locations.		

8.4.2 Pre-construction Phase

Mitigation Measures for Advance Works

Soil Investigation

The purpose of Soil Investigation (SI) works is to obtain geotechnical information on the subsurface condition, which is crucial for ascertaining subsurface soil composition, groundwater levels, penetration resistance etc. for advanced and in-depth engineering analyses. Indicative SI borehole locations and proposed access routes shall be provided to NParks for their review and approval. The Qualified Personnel (QP) in charge of SI works shall prepare and submit the necessary information and documents detailing the scope of works to NParks, if required. The detailed methodology shall be appended to this EMMP at a later juncture, when available. Nonetheless, the following biodiversity mitigation measures are proposed as shown in Table 8-3 below. Should site clearance and tree felling works be unavoidable and necessary, the following mitigation measures described in Section 8.4.2 (Pre-felling Fauna Inspection) shall be referenced and adhered to.

Table 8-3 Mitigation Measure for Soil Investigation and Advance Works

Mitigation Measure	Description
Biodiversity	▪ Where practicable, borehole locations should remain within the Project, and be at least 5 m from tree structures to protect roots. ▪ Only minimal site clearance, if required; undergrowth clearance and pre-clearance inspections may be conducted to form access routes. ▪ Access paths and routes are to be clearly marked/demarcated with rope and/or tape, including path widths, thereby deterring unauthorized entry into forested areas. ▪ Use mini excavators and small portable drilling rigs where feasible to reduce habitat disturbance. ▪ Soil investigation works and related ancillary works shall only be conducted during daylight hours and only during workdays.
Noise Management	▪ Where practicable and to best effort, SI work sites shall be clearly demarcated with portable hoarding (or next best alternative such as orange netting) and enclosed with acoustic barriers/screens, where practicable (see Figure 8-2 example).
Waste Management	▪ All waste arising from the SI works (be it solid or liquid, construction, drilling or human/food waste), such as slurry, shall be kept in proper containment structures and disposed of properly by licensed waste disposal contractors. ▪ There shall be no discharge of slurry or disposal of waste within or around the SI work areas. ▪ Sandbags and/or silt fencing shall be deployed around the perimeter of the worksite(s) to prevent discharge of waste into surrounding area. ▪ Food and drinks shall be consumed outside of the worksite and in proper designated zone(s).



Figure 8-2 Reference photo for Soil Investigation Worksite Setup

Site Access Works & ECM Setup

Where applicable and feasible, site access works (i.e. site office setup, access roads and perimeter/preliminary hoarding) and ECM setup (whether necessitating site clearance or not) shall adhere to the mitigation measures described above in the following section. The detailed fauna management and mitigation measures are described in the following section below.

Fauna Management Plan

Given the significance of this area as a natural wildlife corridor, it is essential to minimize impacts on local fauna. Developing a Wildlife Response and Rescue Plan can mitigate these impacts and lower the risk of human-wildlife conflicts that could threaten safety. Wildlife management should begin before construction to safely move animals out of the work area, either through passive shepherding or active relocation. Additionally, a Wildlife Rescue and Response Plan should be implemented during construction to assist any animals that become trapped or injured on-site.

The Contractor shall also engage an NParks-certified Animal Management Specialist/Wildlife Management Contractor who can be promptly deployed upon the EMMP Specialist's recommendation to relocate fauna during the Project. This specialist should be an approved third-party contractor authorized by the Director-General of Wildlife Management to perform activities regulated by the Wildlife Act.

Proposed Shepherding/Site Clearance Sequence

For the purposes of this EIA, a preliminary wildlife shepherding place is proposed here as a reference (Figure 8-3). The detailed wildlife shepherding plan, which includes the proposed sequence of works, shall be devised and proposed by the EMMP Consultant.



Figure 8-3 Preliminary Wildlife Shepherding Plan

Fauna Management during Site Clearance

The objective of fauna management during site clearance is to effectively remove wildlife from the worksite before construction activities begin. This approach is crucial for preventing fauna entrapment, injury, and mortality, in particular animals such as snakes that may pose human-wildlife conflicts during the clearance process, with the aim of minimizing interactions between humans and wildlife.

Prior to commencing any work, the area designated for construction should be fully enclosed by hoarding to contain the worksite and protect surrounding habitats. An inspection of the hoarded area will be conducted to assess the presence of wildlife. This inspection should occur before any site clearance activities take place. The Wildlife Specialist shall carry out a thorough survey within the hoarded area specifically aimed at detecting any wildlife that may be trapped.

Once the area has been secured and inspected, site clearance activities should be carried out in a directional manner, moving towards a designated forested wildlife refuge area. This approach aims to encourage any remaining wildlife to vacate the worksite naturally due to the disturbances caused by the clearance activities. Prior to the felling of any trees, additional pre-site clearance fauna inspections must be conducted to ensure that no fauna remain in the vicinity.

Hoarding Installation

The contractor is responsible for completing the installation of hoarding prior to the commencement of site clearance activities. The hoarding must adhere to the following specifications:

- The hoarding shall be a minimum of 2.4 m in height. Both sides of the hoarding should be painted white to enhance visibility for fauna, thereby minimizing the likelihood of accidental contact.

- In areas where internal hoarding is required to partition the site into smaller zones, the hoarding may be reduced to a height of 1.8 m.
- It is crucial that the hoarding panels are installed without any gaps, ensuring they form a continuous barrier. The base of the hoarding must extend at least 300 mm into the ground to deter burrowing animals from accessing the site.
- The mitigation measures described for advance works shall be referenced and adhered to as well. In particular:
  - The Contractor shall make all effort to ensure that the least intrusive path, existing roads, pathways and/or trails will be undertaken during SI and advance works (e.g., perimeter hoarding) – as well as to conduct minimal or no site clearance – thereby ensuring minimal disturbance to surrounding biodiversity.
- The sequence of the hoarding installation will be reviewed by the Ecologist or Wildlife Specialist to ensure that the disturbances caused by the installation do not drive fauna onto adjacent roads. The optimal installation order will be:
  - First, install hoarding adjacent to roadways;
  - Next, address areas that are furthest from identified wildlife refuge areas; and
  - Finally, complete the installation in the remaining sections of the site.
- Once the hoarding installation is complete, the Ecologist or Wildlife Specialist will conduct an inspection to assess the integrity of the hoarding. This inspection will confirm that the hoarding effectively prevents the entry and exit of fauna, ensuring that the site remains secure for the duration of the clearance and construction activities.
- The perimeter hoardings are positioned at the site boundary.

Pre-site Clearance Fauna Inspection

Prior to site clearance, the Wildlife Specialist is responsible for conducting thorough fauna inspections in areas designated for clearance, as well as for any subsequent removal, pruning, or trimming of vegetation and trees. The inspections will aim to fulfil the following objectives:

- The inspection will focus on identifying potentially active animal nests, hollows, burrows, and other nesting structures. It will also aim to detect any animals that may be at risk of being trapped, injured, or killed during site clearance. This includes recognizing animals that could potentially lead to human-wildlife conflicts, such as snakes. Each inspection will remain valid for a period of seven (7) days.
- The Wildlife Specialist will report and document all fauna observations made during inspections. Recommendations for mitigating measures will also be included based on these observations.
- In the event of wildlife encounters, the Wildlife Specialist will coordinate actions in accordance with the designated Wildlife Response Plan.

If fauna is found on vegetation slated for clearance, the affected vegetation will be marked with coloured tags or tape. Wildlife will be allowed to vacate the area on their own prior to any clearance activities. In cases where eggs, chicks, or young animals are present in nests, these will also be allowed to fledge or leave the nests naturally before site clearance. The Wildlife Specialist will conduct follow-up checks to confirm that all faunas have departed prior to any vegetation removal. If it is impractical or unsafe for certain fauna to leave on their own (e.g., a venomous snake that cannot be safely captured), relocation efforts will be considered and executed by certified wildlife management contractors. This will be done in consultation with NParks and in alignment with the Wildlife Response Plan that is to be proposed by the EMMP Consultant.

Should the Wildlife Specialist determine that there is a risk of injury or death to fauna – even in the absence of visible signs during the inspection (e.g., a bird nest but no observable activity) – the Wildlife Specialist will be present on-site during the removal of the affected vegetation. This presence will ensure the implementation of

the Wildlife Response Plan as needed. To aid in inspections of nests, hollows, and structures, elevating equipment will be deployed where necessary.

The Wildlife Specialist is required to submit an inspection report within 24 hours of conducting the inspection. This report will include the following information:

- Date of the inspection;
- Tree tag number (or location coordinates if untagged);
- Observations made during the inspection;
- Recommended mitigation measures; and
- Photographic evidence of the findings.

Site Inspection

To ensure effective wildlife management and environmental protection during the construction phase, a structured site inspection regime will be implemented, comprising bi-weekly inspections by the EMMP Consultant and daily inspections by the Contractor.

The EMMP Consultant will conduct site inspections every two weeks to document findings related to the following key items:

- Degradation of adjacent sensitive habitats;
- Implementation of proper ECM measures;
- Food and waste management;
- Gaps in hoarding;
- Potential fauna entrapments; and
- Presence of injured/trapped/dead animals.

Daily inspections will be performed by the Contractor and Contractor's ECO on-site. These inspections will focus on the following critical items:

- Proper ECM measures;
- Food management practices; and
- Potential fauna entrapments.

Pre-felling Fauna Inspection

The main objective of the pre-felling fauna inspection is to prevent and mitigate fauna mortality during the clearing of the forest habitat. The key considerations for clearing of the forested land are in compliance with the National Parks Board (NParks) Technical *Note on Wildlife Shepherding and Pre-felling Fauna Inspection* (NParks, 2024c):

- Clearance shall be phased from the most disturbed area (usually the side nearest to roads or existing developments) towards the **least disturbed area** (where applicable and practicable);
- Clearance shall also take place from **high to low ground** (where applicable and practicable);
- An **unobstructed escape route** shall be designed to channel wildlife out of the development site; and
- Clearance of the development site can be broken up into **zones** (where applicable and practicable), where each zone is isolated from the next either by natural barriers that prevents animal movement or permanent hoarding structures.

The proposed site clearance and tree-felling will take into consideration the existing Project topography, and obstacles (e.g. terrain) that might impede wildlife movement. The site clearance and tree-felling shall follow that of the final wildlife shepherding plan proposed by the EMMP Consultant. Notwithstanding, the hoarding plan (to be updated when Contractor has been onboarded) will highlight the hoarding layout, whilst Biodiversity Awareness Trainings will be carried out before any clearance can commence. To ensure workers are reminded on the contents discussed during the Biodiversity Awareness Training, regular refreshers, such as during toolbox briefings will be conducted. The sequence of site clearance and tree-felling is divided into the following stages:

- Step 1: Biodiversity Awareness Trainings;
- Step 2: Installation of Hoardings;
- Step 3: Installation of ECMs;
- Step 4: Undergrowth Clearance; and
- Step 5: Tree Felling.

In summary, site clearance and tree-felling follow these steps:

- Biodiversity Awareness Training shall be conducted for all construction personnel.
- Put up perimeter hoardings, perimeter drains, ECMs, and silt fences around the site. This shall be set up to prevent wildlife from entering the road and Project boundary. A work area of 5 m width is allocated for establishing the perimeter hoarding.
- Pre-felling inspections are conducted to identify any nests, burrows, and wildlife. If active nests are detected, further monitoring will be needed with a provision of a vegetative buffer. For animals that cannot be guided out safely, relocation may be considered. Abandoned nests or burrows with no discernible activities shall be removed ASAP to prevent animals from returning.
- Pre-felling inspections shall be conducted within seven (7) days prior to clearing.
- Clearing of the undergrowth vegetation (if applicable).
- Minimum three (3) days of buffer between clearance of undergrowth and the eventual clearance of trees (≥ 1 m girth).
- Clearance of trees (≥ 1 m girth). Close up of sections without any vegetation with temporary barriers.
- Upon completion of all site clearance, the perimeter hoarding shall be set up covering the full perimeter of the Project.

Protection of Aquatic Fauna

This measure focuses on the native aquatic fauna found in streams and other water bodies. Based on the fauna survey conducted during the baseline study, various earth streams and water bodies provide habitat for breeding and feeding for resident aquatic and riparian communities.

The dewatering and backfilling of the existing stream may impact sedentary aquatic fauna, such as tadpoles. Additionally, the destruction of riparian vegetation on both sides of the earth streams could significantly affect aquatic-dependent biodiversity. To address these concerns, Aurecon proposes the following mitigation measures to protect these riparian and aquatic communities.

Before site clearance, silt fences will be installed at the top of the stream bank to prevent silty runoff into the existing earth stream. Erosion control blankets will be placed along the banks and on any exposed soil. These blankets should be made of biodegradable organic materials without plastic threads. Additionally, a buffer zone consisting of approximately 2 to 3 m of vegetation will be retained on both sides of the streams to maintain pre-existing natural erosion control (Figure 8-4). These measures will remain in place until the aquatic animals have been successfully relocated.

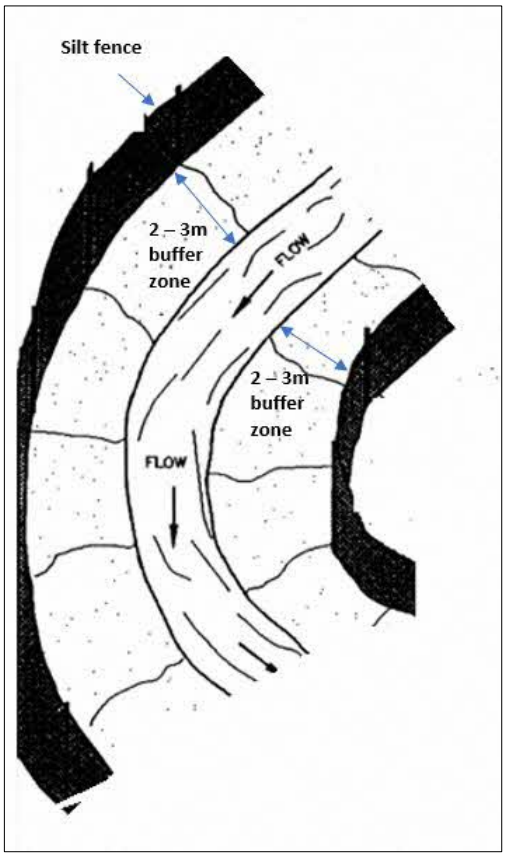


Figure 8-4 Two to three meters buffer zone along both sides of stream

Backfilling at Existing Outlet Point

Backfilling of streams and waterbodies are to be conducted slowly and methodically to facilitate the movement of any aquatic animals. For the aquatic animals to move safely, backfilling should begin upstream of the existing earth stream and following the alignment of the existing earth stream. Backfilling should be limited to a maximum soil load of 50 cm x 50 cm x 50 cm or 1/8 of a cubic meter, and an interval of 10 minutes apart between each fill.

Clear pathway for Aquatic Communities

There should be a clear pathway along streams for fishes, amphibians and reptiles to swim/move downstream during diversion and backfilling. Live or dead shrubs, trees, or debris obstructing flows should be removed along the pathway.

Relocation of Native Aquatic/Riparian Communities

For any native species that are unable to self-relocate—such as sedentary animals found in drying pools of water or during the backfilling of streams—these animals will be captured and relocated downstream. The suitability of the downstream stream for relocation depends on its conditions. If the stream is silty and contains high levels of suspended sediment, it may not be appropriate for relocation of aquatic fauna. In such cases, NParks will be consulted to relocate these aquatic species to other suitable waterbodies.

Flora and Arboriculture Management Plan

Plant Salvaging

This section outlines the plans for plant salvaging and tree protection activities. To ensure the protection of these retained trees within the PRA (especially trees along the boundary of the development area), designated Tree Protection Zones (TPZs) will be established, where applicable practicable, by the ISA-certified Arborist

during the tree verification survey. The assessment will follow the guidelines provided by NParks on greenery provision and tree conservation for developments. The Flora Management Plan includes both plant salvaging and tree protection measures.

Plant Salvaging by NParks

Upon consultation with NParks and prior to the commencement of any clearance or shepherding works, the ISA-certified Arborist/Flora Specialist will mark out the general location of suitable plant specimens based on the list of CS flora species (Table 3-9) to be salvaged within the Project. Where applicable and practicable, the Arborist/Flora Specialist will take photos of and tag native trees, shrubs, ferns, and palm saplings with local conservation status of VU, EN, and CR.

Where practicable, the tagged plants should be in healthy and vigorous condition, free from dead wood, bruises, or other root or branch injuries. They should also be free from insect and/or disease infestation. Figure 8-5 below shows an example of a tagged plant. After the completion of plant selection and tagging (where practicable), NParks will be invited to salvage the plants at the forest.



Figure 8-5 Example of Tagged Plant with Visible Tag

Tree Verification Survey

If necessitated by authorities, the arborist should carry out a pre-construction tree assessment for trees adjacent to the Project that may be impacted by the construction works, before the commencement of any clearance or shepherding. The area to be assessed will cover a minimum of the any retained trees within the Project and 10 m buffer, where applicable and practicable. The arborist should utilize the Site Layout Plan and Topography Plan to carry out a Baseline Tree Impact Assessment to capture tree information such as: Site and tree photos; species; height; girth; crown spread; tree health; form; structure; site observations; tree protection zone; and assessment on whether the tree will be impacted by the Project's construction works.

Based on the Baseline Tree Impact Assessment, the arborist shall then carry out the following for trees impacted by the development and construction:

1. Work closely with the Project Team in maximising tree conservation and protection efforts while satisfying architectural design / construction intent;
2. Provide advice on the feasibility of the proposed design / construction strategies to the Project Team, which may reduce / mitigate the impact on conserved trees; and
3. Study the substructure and construction drawings to provide recommendations from conflicts arising between the proposed structure / associated works and the tree

Once this has been done, a detailed Impact Assessment Report will be prepared based on *NParks' 2023 Guidelines on Greenery Provision and Tree Conservation for Development – Guidelines for Arborist Report*. This Report will serve as a record of pre-development tree condition, and the arborist will have to refer to this report as a benchmark when performing monthly monitoring for the trees.

Tree Protection and Management Plan

The Arborist shall propose tree protection, management, maintenance or care plans for identified trees to adhere to NParks' Guidelines on Greenery Provision and Tree Conservation for Developments (i.e., tree care, pruning and TPZs). Specifically, the Arborist shall ensure that the Contractor's TPZ setup complies with the requirements on Tree Protection Zone, Tree Protection Fencing / Hoarding & Tree Protection Specification as stated in Chapter 2: Conservation of Trees/Plants of the Guidelines (NParks, 2025).

- This includes the formulation of tree maintenance or care plans that involve subsequent remediation upon identification of issues (i.e., diseased trees, disease outbreaks etc.)
- The implementation of remediation measures such as herbicides or pesticides, while permitted, should be kept to a minimum. The affected plants can also be quarantined and removed from the site if necessary.

The Tree Protection Zone (TPZ) will be established to ensure the retained trees within the Proposed Retained Area (PRA) and trees surrounding the Project are provided with sufficient space such that the tree crown and roots are not affected by construction activities (i.e., soil compaction, mechanical damage, setting up of hoarding). It aims to minimise compaction of soil, which results in poor functioning of roots, and changes in soil levels that can cut off or suffocate roots. The TPZ size varies depending on the tree size. In general, all development works should consider the space of the TPZ in the planning of the Project as no permanent or temporary use of the space (i.e. for storage, scaffolding) within the TPZ should occur to ensure the trees within the TPZ remain healthy, where practicable and applicable. The TPZ recommended measures are highlighted in the recommended TPZ size is listed in Table 8-4 below.

Table 8-4 Recommended Tree Protection Zone Radius

Girth	Recommended TPZ radius (Measured as distance from centre of a tree)
<0.5 m	1 m
0.5 m – 1 m	2 m
1 m – 1.5 m	3 m
1.5 m – 2 m	4 m
>2 m	5 m

In order to successfully prevent tree damage, construction activities have to be diverted away from the trees. A good practice to prevent tree damage and ensure tree survival is to place a fence around the TPZ. Bright orange polyethylene fencing or other effective tree protection fencing should be provided along the limits of the protection zone around the tree identified to be retained. This is to demark the TPZ within which activities are restricted before construction begins and kept intact until completion. There must be no excavation, raising or lowering of soil level, compaction or any form of construction activities, including temporary works within the hoarded area. Dumping of debris, excavated materials and/or storage of construction materials and equipment are not allowed within the TPZ. Protection hoarding is required, unless otherwise stated, and should be installed prior to site works. An example of a TPZ set up is illustrated in Figure 8-6.



Figure 8-6 Example of Tree Protection Zone (Extracted from NParks Guidelines on Greenery Provision and Tree Conservation for Developments)

After the site/forest has been cleared, the retained trees are exposed to edge effects and experience sun scorch, potential to be weakened by wind shear, and invasion by competing invasive plants. These factors increase the retained trees' susceptibility to tree failure. The first mitigation measure is tree pruning, which includes structural pruning and crown reduction to achieve an optimal crown condition. This will enable the tree to be more resilient to the stronger wind force and reduces the transit time for the trees to adapt to the new microclimate. This will be done after consultation and permission from NParks.

8.4.3 Construction Phase

This section outlines the primary impact management strategies and the recommended monitoring procedures for the development's pre-construction and construction phases. The following subsections provide concise descriptions of the crucial EMMP measures. Post-construction monitoring will primarily aim to return the site to a state resembling its pre-construction condition and will exclude any monitoring of impacts arising from operations.

Construction Phase Monitoring

Monitoring during the construction phase involves frequent inspections to detect any significant environmental impacts and enable swift corrective actions if environmental standards are breached. The EMMP Consultant will utilise both instrumental measurements and visual checks to verify that environmental management and mitigation strategies are properly applied on site.

If construction activities are required to take place after 6 pm, the Contractor shall develop a Light Management Plan detailing the specifications and placement of artificial lighting. This plan aims to minimise light spillage towards the PRA and nearby residential neighbourhoods.

To ensure EMMP measures are properly implemented and effective, the EMMP Consultant shall perform inspections on a monthly basis. The EMMP Consultant is also responsible for inspecting the site's permanent hoarding perimeter to ensure there are no breaches or defects permitting ground wildlife entry into cleared areas undergoing significant construction. Recommendations will be made if any mitigation or management efforts are identified to be lacking. In scenarios where trees are to be retained within or beside the site, an Arborist will be appointed to conduct monthly health checks and monitoring of these trees.

Monthly Arboriculture and Flora Monitoring

Where applicable and necessary, the Flora Specialist or Arborist shall perform monthly site inspections along the edge between the construction site and forest to verify that the mitigation measures outlined in the CEMMP are properly implemented and effectively minimise impacts on retained trees both within the site and in the adjacent forested areas. These measures include:

- Conduct monthly inspections of the TPZs (if any) surrounding retained trees to ensure their integrity; and
- Perform monthly checks along the forest edge (interfacing the development boundary and PRA) to make sure it remains undisturbed and free from any negative effects caused by construction activities, where applicable and if relevant.

Monthly Fauna Monitoring

Daily monitoring shall be carried out by the Contractor's ECO to ensure that fauna is not trapped in ECM blankets or excavation pits. The designated ecologist shall carry out monthly site visits to verify that the mitigation actions outlined in the CEMMP have been executed and are successfully minimising impacts on local fauna species. These measures include:

- Conduct monthly inspections of the site hoarding to confirm there are no openings or gaps;
- Perform monthly checks to verify that ECM blankets are fully biodegradable and properly installed;
- Carry out monthly assessments of retained stream D/S25 to identify any visible signs of vegetation loss, erosion, or sediment buildup;
- Review all wildlife-related incidents that occur during the month; and
- Conduct monthly monitoring of fauna mitigation measures.
  - If fauna monitoring surveys are necessitated by NParks, the EMMP Consultant shall work with NParks to propose suitable monitoring transect(s).

Physical Environmental Monitoring

It is the Contractor's duty during the construction phase to consistently conduct environmental monitoring as specified. The relevant survey parameters, timing, and locations are listed in Table 8-5.

Table 8-5 Environmental Parameters during Construction Phase

Environmental Aspect	Parameter and Duration	Frequency	Location	Standard/Criteria
Airborne Noise	Continuous (24 h) monitoring of noise levels: ■ Leq 5 min ■ Leq 1 h ■ Leq 12 h	■ Continuous monitoring	■ Along the boundary of the PRA	■ Environmental Protection and Management (Control of Noise at Construction Sites) 2008

Environmental Aspect	Parameter and Duration	Frequency	Location	Standard/Criteria
Water Quality	*In-situ* and *ex-situ* monitoring according to EIA	▪ Monthly (once a month only)	▪ A minimum of one monitoring point located immediately upstream and downstream of every stream intersecting the Project	▪ NEA EPMA (Trade Effluent) Regulations (Controlled Watercourse)
	Implementation of continuous TSS monitoring including a Silty Imagery Detection System (SIDS)	▪ Continuous	▪ Every ECM discharge point	▪ NEA EPMA (Trade Effluent) Regulations (Controlled Watercourse)

8.4.4 Operational Phase (Post-construction)

Close-off EMMP Audit

A Close-Off Environmental Audit Report will be prepared and submitted upon completion of each stage of the construction works, to report on the satisfactory completion of the different aspects of the EMMP implementation across the whole construction phases. The Close-Off Audit report serves to document the post-construction phase environmental conditions which shall include the results of water quality, sediment quality, noise, air and ecological habitat surveys, as compared to the baseline conditions. The report will include the following:

- The environmental impacts that occurred during the construction phase
- Compliance with the relevant regulatory and EMMP requirements during the construction phase
- The results of the control monitoring throughout construction and audit stages
- The results of habitat monitoring throughout construction and audit stages

8.5 EMMP Reporting

8.5.1 Monthly Site Environmental Control Report

Before commencing work, the Contractor's ECO is responsible for developing the Site Environmental Control Programme. Throughout the construction phase, the ECO shall submit monthly Site Environmental Control Reports (SECR) to the Project Manager, which will include an evaluation of the environmental measures implemented and an analysis of their effectiveness.

Regular site inspections by the Contractor's ECO are essential to confirm that environmental and pollution control protocols recommended by the CEMMP are effectively and promptly enforced. The ECO's observations and any remedial actions undertaken shall be documented and incorporated into the SECR. Data documented in the SECR will subsequently feed into the Environmental Performance Report as per the next section's instructions.

8.5.2 Monthly Environmental Performance Report (EPR)

A Monthly Environmental Performance Report (EPR) shall be prepared by the EMMP Consultant and submitted to the Project management team and relevant technical agencies. The report will contain the following information:

- Overview of on-site Project activities completed during the month;
- Current progress of CEMMP implementation;
- Monitoring records encompassing:
  - Flora and fauna assessment reports
  - ECM discharge monitoring results
  - Water quality evaluation reports
  - Noise monitoring data
- Environmental targets addressing compliance status, potential non-compliance issues, and related mitigation strategies;
- Documentation of environmental non-compliance events, including warnings, fines, and stop-work orders;
- Records of wildlife observations, incidents of injury, and mortality;
- Logs of conducted environmental inspections;
- Reports detailing environmental incidents;
- Documentation of site environmental control measures;
- Records of environmental training activities;
- Minutes of meetings focused on environmental matters; and
- Grievance records related to environmental concerns.

8.5.3 Non-Compliance and Remedial Action

Should the Contractor not adhere to the EMMP requirements, the recommended course of action is as follows:

- The Developer is to serve a notice of non-compliance on the Contractor, clearly specifying the type and severity of the breach;
- The Contractor is required to provide the Developer with a written explanation of the corrective actions to be implemented to resolve the non-compliance, along with the expected results;
- The Contractor is required to address the non-compliance within a period set by the Developer, provide documented evidence of the remedial work performed, and obtain the Developer's consent for closing the non-compliance report; and
- Where the Contractor fails to rectify the non-compliance by the deadline or if the non-compliance leads to environmental damage, the Developer may enforce actions like penalty imposition, directive remedial measures, or work stoppage under the contractual provisions.

9 Conclusion

9.1 Impact Assessment Summary

This section presents a synthesis of findings derived from the environmental impact evaluation process. A summary of the impact assessment scores for both pre- and post-mitigation measures (Table 9-1) across the Project phases – specifically during pre-construction and construction activities, as well as throughout the operational phase. Additionally, the key mitigation strategies that are recommended be adopted to address identified environmental impacts are shown in Table 9-2.

Table 9-1 Summary of Impact Assessment

Environmental Aspect	Pre-Mitigation Measures		Post-Mitigation Measures	
	ES	ES Class	ES	ES Class
Pre-construction / Construction Phase				
Biodiversity	-180 to -12	Major Negative to Slight Negative Impact	-135 to 0	Major Negative to No Significant Impact
Surface Water Quality	-56 to -28	Minor Negative to Slight Negative Impact	-28 to 0	Slight Negative to No Significant Impact
Surface Hydrology	-108	Moderate Negative Impact	-72	Minor Negative Impact
Airborne Noise	-63	Minor Negative Impact	-42	Minor Negative Impact
Illumination	-48 to -18	Minor Negative to Slight Negative Impact	-24 to 0	Slight Negative to No Significant Impact
Waste Management and Pollution	-72 to -42	Minor Negative Impact	-28 to -14	Slight Negative Impact
Operation Phase				
Biodiversity	-90 to -54	Moderate Negative to Minor Negative Impact	-45 to -18	Minor Negative to Slight Negative Impact
Surface Water Quality	-28	Slight Negative Impact	0	No Significant Impact
Surface Hydrology	-84	Moderate Negative Impact	-56	Minor Negative Impact
Airborne Noise	-72 to 0	Minor Negative to No Significant Impact	-24 to 0	Slight Negative to No Significant Impact
Illumination	-56 to -21	Minor Negative to Slight Negative Impact	-28 to 0	Slight Negative to No Significant Impact
Waste Management and Pollution	-84	Moderate Negative Impact	-28	Slight Negative Impact

Table 9-2 Summary of Recommended Mitigation Measures

Environmental Aspect	Recommended Key Mitigation Measures
Pre-construction Phase	
Biodiversity	■ Proposed Retained Area (PRA) – Implement PRA to retain ecological connectivity and provide refugia for biodiversity – Figure 3-57 shows the extent of the PRA which has increased from the previous version (see register of material changes in the main EIA Report for before and after of PRA size) ■ Where practicable, borehole locations should remain within Project and be at least 5 m from tree structures to protect roots. – Only minimal site clearance, if required; undergrowth clearance and pre-clearance inspections may be conducted to form access routes.

Environmental Aspect	Recommended Key Mitigation Measures
	– Access paths and routes are to be clearly marked/demarcated with rope and/or tape, including path widths, thereby deterring unauthorized entry into forested areas. – Use mini excavators and small portable drilling rigs where feasible to reduce habitat disturbance. – Soil investigation works and related ancillary works shall only be conducted during daylight hours and only during workdays. ■ Salvaging of conservation significance (CS) plant species and freshwater aquatic fauna before any construction works start. ■ Biodiversity awareness training should be carried out for all Project personnel prior to start of construction, with refresher courses conducted on bi-annual basis. ■ Waterbodies should be monitored on a monthly basis during site clearance, and backfilling of streams should start from upstream and proceed downstream. ■ Vehicle speed limit of 15 km/h should be imposed within the Project, with the installation of a road hump at the entrance of the Project and wildlife warning signages.
Surface Water Quality	■ Work areas to be fenced up to contain silty water from Soil Investigation drilling, and exposed areas to be covered with biodegradable Erosion Control Blankets (ECB). ■ Generators should be provided with proper drip trays with regular maintenance and secondary containment to prevent rain from washing out pollutive substances.
Noise Management	■ Soil investigation work sites shall be clearly demarcated with portable hoarding (or next best alternative) and enclosed with acoustic barriers/screens, where practicable
Waste Management	■ All waste arising from the SI works (be it solid or liquid, construction, drilling or human/food waste), such as slurry, shall be kept in proper containment structures and disposed of properly by licensed waste disposal contractors. ■ There shall be no discharge of slurry or disposal of waste within or around the soil investigation work areas. ■ Sandbags and/or silt fencing shall be deployed around the perimeter of the worksite(s) to prevent discharge of waste into surrounding area.
Construction Phase	
Biodiversity	■ Proposed Retained Area (PRA) – Implement PRA to retain ecological connectivity and provide refugia for biodiversity ■ Establish Tree Protection Zones (TPZs) for any retained trees. – Regular monitoring of health of retained trees. ■ Conduct biodiversity awareness training for all site personnel. ■ Install hoarding from the most disturbed areas, such as roads, to prevent any roadkill. ■ Install hoarding with no gaps between panels and should extend at least 300 mm into the ground. ■ Install access gates with no gaps between panels and positioned as close to the ground as possible. ■ Directional clearance following the wildlife shepherding plan. – Conduct pre-felling fauna inspections to identify active bird nests or other wildlife. ■ Engage a licensed Wildlife Management Contractor for the safe rescue and relocation of any wildlife that cannot be safely guided out at or around the site during construction. – The Wildlife Management Contractor and NParks shall be engaged in advance to mitigate human-wildlife conflict beyond and prior to wildlife shepherding – Conduct biodiversity awareness & educational talks, and monkey guarding, if necessary ■ Provide road calming measures to prevent any roadkill.

Environmental Aspect	Recommended Key Mitigation Measures
	▪ Ensure use of wildlife-friendly biodegradable erosion control blankets (ECBs) with no plastic mesh netting. ▪ Conduct daily checks of access roads, biodegradable ECBs, ECM ponds, and pits for any roadkill or entrapped wildlife. ▪ Provision of securely enclosed, monkey-proof food waste bins.
Surface Water Quality	▪ Engage a QECP to formulate and implement an ECM Plan in accordance with the PUB's requirements. ▪ ECM infrastructure, including holding ponds and treatment tanks, should be fully commissioned and operational prior to the site clearance and earthworks. ▪ Install silt fences along the watercourses to prevent silty runoff. ▪ Inspect ECM provisions and infrastructure regularly and maintained as necessary. ▪ Compact, cover, concrete, or turf the exposed surfaces to prevent silty runoff. ▪ Cover soil stockpiles with biodegradable ECBs or tarpaulin. ▪ Appropriate management and handling practices of concrete spillage and cement wash. These materials shall be collected and disposed of separately, where feasibly practicable. ▪ Store fuel and chemicals under shelter in kerbed or bunded areas with secondary containments, and at least 10 m away from any watercourses. ▪ Equip the generators with secondary containments i.e., drip trays. ▪ Implement proper housekeeping and handling practices to prevent any spillage. ▪ Provision of sand and/or other spill control kits to manage any spills that may occur. ▪ Implementation of a Continuous Monitoring System for total suspended solids (TSS) levels in treated discharge water. ▪ Regular water quality monitoring on a monthly basis. ▪ Provision and maintenance of vegetation cover along the watercourses, and installation of perimeter drain along the boundaries of Project.
Surface Hydrology	▪ Engage a QECP to formulate and implement an ECM Plan in accordance with the PUB's requirements. ▪ Where possible and feasible, diversion or realignment of the waterways during the design and planning stages to retain the overall hydrological flow of the area upstream and downstream.
Airborne Noise	▪ Conduct continuous noise monitoring in accordance with NEA requirements. ▪ Install noise barriers along the Project adjacent to the PRA. ▪ Install localised noise enclosures around noisy equipment and machinery. ▪ Avoid parallel use of noisy equipment and machinery. ▪ Turn off the equipment and machinery when not in use. ▪ Construction works should be limited to daytime hours of 8 am to 6 pm daily, and night works should be avoided whenever possible. Should night works be unavoidable, a Lighting Management Plan (LMP) should be prepared and submitted to NParks for approval.
Air Quality	▪ Set up hoarding of at least 2.4 m high to prevent dust dispersion. ▪ Compact, cover, concrete, or turf the exposed surfaces to reduce dust emissions. ▪ Cover soil stockpiles with biodegradable ECBs. ▪ Carry out regular water sprinkling on unpaved roads during dry days. ▪ Turn off the equipment and machinery when not in use. ▪ Ensure lorries carrying loose materials to be covered to prevent spillage. ▪ Provision of wheel washing facilities to clean the vehicles.

Environmental Aspect	Recommended Key Mitigation Measures
Illumination	▪ Construction works should be limited to daytime hours of 8 am to 6 pm daily, and night works should be avoided whenever possible. Should night works be unavoidable, a Lighting Management Plan (LMP) should be prepared and submitted to NParks for approval. ▪ Direct all light fittings away from the forested areas, angled downwards, pointed inwards, or equipped with shading fixtures, except lighting for safety and security purposes. ▪ The height of all ambient light fittings should not exceed the height of hoarding or noise barriers. ▪ All lights should be switched off when not in use, except in necessary areas with active works or other essential safety purposes. ▪ Ambient Light fittings should ideally have a warm colour temperature of not higher than 3,000 K.
Construction Waste and Vector Proliferation	▪ Consume food only at the designated rest areas. ▪ Dispose food waste in securely covered, monkey-proof bins. ▪ Locate all waste storage areas at least 10 m away from any waterways. ▪ Regular disposal of all wastes by respective licensed waste collectors. ▪ Waste biomass should be removed from the site to an approved dumpsite as soon as reasonably practicable to prevent further degradation. ▪ Regular housekeeping practices to remove potential breeding sites. ▪ Conduct weekly inspections by an external NEA-licensed Pest Control Operator. ▪ Recommended best practices for management of cement wash-water – After concrete is poured at a construction site, the agitator and chutes of ready-mix concrete trucks as well as the piping of concrete pumps shall, where practicable, be washed out to remove the remaining concrete before it hardens – only if there are the appropriate facilities available to capture the cement wash. – Should the equipment be washed on site, cement wash should not be diverted to retention ponds of ECM plant, but instead be collected in a dedicated facility for disposal. – Disposal of collected cement wash to an appropriate waste processing facility.
Operation Phase	
Biodiversity	▪ Provide and maintain ecological connectivity between the Project and surrounding green spaces by planting and maintaining native, biodiversity-attracting plants as part of the landscape. ▪ Provision of ecologically sensitive pedestrian crossings that ensure minimal environmental impacts and also mitigate human-wildlife conflict. ▪ The NParks-certified Wildlife/Animal Management Contractor shall be engaged in advance, together with NParks, to plan and implement management plans to mitigate human-wildlife conflict, such as: – Human-wildlife conflict awareness and educational talks, as well as monkey guarding, if necessary.
Surface Water Quality	▪ Provision and maintenance of vegetation cover along the watercourses. ▪ Install perimeter drain along the boundaries of Project.
Surface Hydrology	▪ Provision of adequate green or porous areas to minimise surface runoff, enhance stormwater infiltration, and maximise groundwater recharge. ▪ Where possible and feasible, facilities such as rain gardens, green roofs, and detention ponds, can be considered to further slow runoff.
Airborne Noise	▪ Planting of native trees and shrubs to act as natural noise barriers to dampen traffic noise. ▪ Provision of road calming measures, such as speed limits, speed bumps, and related signages, to minimise traffic noise.

Environmental Aspect	Recommended Key Mitigation Measures
Air Quality	■ Landscaped vegetative buffers along internal roads and development boundary. ■ Designated drop-off and pick-up zones to minimise idling and reduce congestion. ■ Green walls or trellises are recommended in pick-up/drop-off areas to intercept particulate matter. ■ No-idling policy for all vehicles and visitor cars. ■ Promotion of sustainable transport modes, such as shuttle bus services, provision of sheltered bicycle parking, and incentives for use of public transport.
Illumination	■ Light fittings for landscaping should fittings should be directed away from the forested areas (if applicable), angled downwards, pointed inwards, or equipped with shading fixtures to reduce light spill (except lighting for safety and security purposes), ideally have a warm colour temperature of not higher than 3,000 K. ■ All lights should be switched off when not in use, except lighting for essential safety purposes in necessary areas.
Waste Management and Vector Proliferation	■ Food should only be consumed at designated areas. ■ Provision of sufficient waste bins (monkey-proof bins) to prevent improper waste disposal. ■ Regular disposal of waste by a licensed waste collector. ■ Conduct routine inspections by an external NEA-licensed Pest Control Operator. ■ Provide educational signages for proper waste disposal and prevention of feeding of wildlife at appropriate locations.

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Appendices

Report for EIA at Sunset Way - P528800



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Bringing ideas to life

Appendix A – Topography



JOB NO	JOB DESCRIPTION	SURVEYED BY
24183	TOPO SURVEY	Kumar 25-12-2025

LSVY 2943

NOTE

1) **Boundaries shown hereon are provisional and subject to final survey.**
2) **Vertical Control were based on VCP 80191 RL= 21.247 at ULU PANDAN ROAD / PANDAN VALLEY.**
3) **Horizontal Control were based on ISN Survey Marker :–**
   - **I) SM13708 N33710.325 E20715.181**
   - **II) SM11323 N33644.056 E21744.761**
   - **III) SM13480 N34122.106 E20733.569**
   - **IV) SM18098 N34300.059 E20841.635**
4) **Reduced Levels are based on Singapore Height Datum = 0.000m.**
5) **The tree names are identified to the best of our knowledge and should be verified by a tree specialist.**
6) Road Reserve line derived from INLIS PO: W49726178_1 dated 25-07-2025

ABBREVIATIONS/LEGEND

- AIR VALVE
- BOLLARD
- BUS STOP POST
- CABLE JOINT INDICATOR
- CB CABLE BOX
- COLUMN (ROUND)
- COLUMN (SQUARE)
- CONTROL STATION
- DB DUST BIN ROUND
- DRAINAGE MANHOLE
- DIP DROP INLET CHAMBER
- EARTH PIT
- ELECTRICAL BOX
- ELECTRICAL POLE
- FIRE HYDRANT
- FLAG STAFF
- FB FLOWERBED
- GAS INDICATOR
- GAS VALVE
- GARDEN LIGHT
- INSPECTION CHAMBER (ROUND)
- INSPECTION CHAMBER (SQUARE)
- IRON GRATING
- JAY WALKING RESTRICTION SIGN
- KILOMETER POST
- LAMP POST
- 12 NN LAMP POST (WITHOUT NUMBER)
- LETTER BOX
- BUS STOP SHELTER
- CABLE CONTROLLED PEDESTRIAN ROAD CROSSING
- CP CYCLING PATH
- ENTRANCE & EXIT OF UNDERPASS
- FP FOOTPATH
- FENCE
- GANTRY
- G GAS PIPELINE
- GATE
- GATE BARRIER
- GUARDRAIL
- HOARDING
- RAILING
- SLOPE SYMBOL
- TOP SLOPE SYMBOL BOTTOM SLOPE SYMBOL
- PCN PARK CONNECTOR
- VENT PIPE
- WATER PIPE
- LIGHTING BOX
- REFLECTIVE MIRROR
- OGB OVER GROUND BOX
- PEDESTRIAN CROSSING LIGHT
- PEDESTRIAN CROSSING SIGN
- PILLAR (ROUND)
- PILLAR (SQUARE)
- PUBLIC TELEPHONE BOOTH
- REFLECTIVE BOLLARD
- ROAD SIGN
- SIGN BOARD (SMALL)
- SIGN BOARD (BIG)
- SUMP
- SURVEILLANCE CAMERA
- TELEPHONE POLE
- TRAFFIC LIGHT
- TRAFFIC SIGN
- UNKNOWN MANHOLE
- UP LIGHT
- WM WATER METER
- WATER VALVE (SMALL)
- PUB PUB MANHOLE
- SEW SEWER MANHOLE
- STOOL/CHAIR/PARK BENCH
- TAS TELECOMMUNICATION MANHOLE
- HEDGES
- PALM TREE
- SAPLING
- SHRUBS
- TREE
- SWAMP
- CPL CAR PARKING LOT
- MCL MOTORCYCLE PARKING LOT
- HPL HANDICAPPED PARKING LOT
- COVERED DRAIN
- DRAIN CULVERT
- GRATING OVER DRAIN
- OPEN DRAIN/ CONC OPEN DRAIN
- SLAB OVER DRAIN
- SITE BOUNDARY
- LOT BOUNDARY
- ROAD RESERVE LINE
- DRAIN RESERVE LINE
- DRA OUTDOOR REFRESHMENT AREA
- POB PEDESTRIAN OVERHEAD BRIDGE
- TACTILE TILES
- PATH RAMP
- HUMP
- WALL (GENERAL)
- RETAINING WALL
- RUBBLE WALL
- PARAPET WALL

SITE

CLEMENTI ROAD
MUKIM NO. 04 & 05

N

SURVEYOR

LEW REGISTERED SURVEYOR
71 BUKIT BATOK CRESCENT
#11-02 PRESTIGE CENTRE
SINGAPORE 658071
TEL : 68997971, FAX : 68997972

CADASTRAL MAPS 1700 1759,1760	PREPARED BY
SCALE 1 : 500 PLAN SIZE : A1	27-02-2026 FENNIE
27-02-2026 (Digitally Signed) LEW TEK FART REGISTERED SURVEYOR	CHECKED BY 27-02-2026 CHIANG SHANG MENG

SURVEY PLAN NO

2943-LEW-TP-CL-24183-11

MATCH LINE

MATCH LINE

MATCH LINE

MK05-01391V

MK05-09398T

N 34400
E 20700

N 34150
E 20700

1699 1700
1759 1760

JOB NO	JOB DESCRIPTION	SURVEYED BY
24183	TOPO SURVEY	Kumar 25-12-2025
LSVY 2943		

NOTE

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6) Road Reserve line derived from INLIS PO: W49726178_1 dated 25-07-2025

ABBREVIATIONS/LEGEND

- AIR VALVE
- BOLLARD
- BUS STOP POST
- CABLE JOINT INDICATOR
- CB CABLE BOX
- COLUMN (ROUND)
- COLUMN (SQUARE)
- CONTROL STATION
- DB DUST BIN ROUND
- DRAINAGE MANHOLE
- DRAINAGE INLET CHAMBER
- EARTH PIT
- ELECTRICAL BOX
- ELECTRICAL POLE
- FIRE HYDRANT
- FLAG STAFF
- FB FLOWERBED
- GAS INDICATOR
- GAS VALVE
- GARDEN LIGHT
- INSPECTION CHAMBER (ROUND)
- INSPECTION CHAMBER (SQUARE)
- IRON GRATING
- JAY WALKING RESTRICTION SIGN
- KILOMETER POST
- LAMP POST
- LP NN LAMP POST (WITHOUT NUMBER)
- LETTER BOX
- BUS STOP SHELTER
- CABLE CONTROLLED PEDESTRIAN ROAD CROSSING
- CP CYCLING PATH
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- FP FOOTPATH
- FENCE
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27-02-2026 (Digitally Signed) LEW TEK FART REGISTERED SURVEYOR	CHECKED BY 27-02-2026 CHIANG SHANG MENG

SURVEY PLAN NO

2943-LEW-TP-CL-24183-12



JOB NO	JOB DESCRIPTION	SURVEYED BY
24183	TOPO SURVEY	Kumar 25-12-2025

LSVY 2943

NOTE

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- AIR VALVE
- BOLLARD
- BUS STOP POST
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- COLUMN (SQUARE)
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- DRAINAGE MANHOLE
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- ELECTRICAL POLE
- FIRE HYDRANT
- FLAG STAFF
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- GAS VALVE
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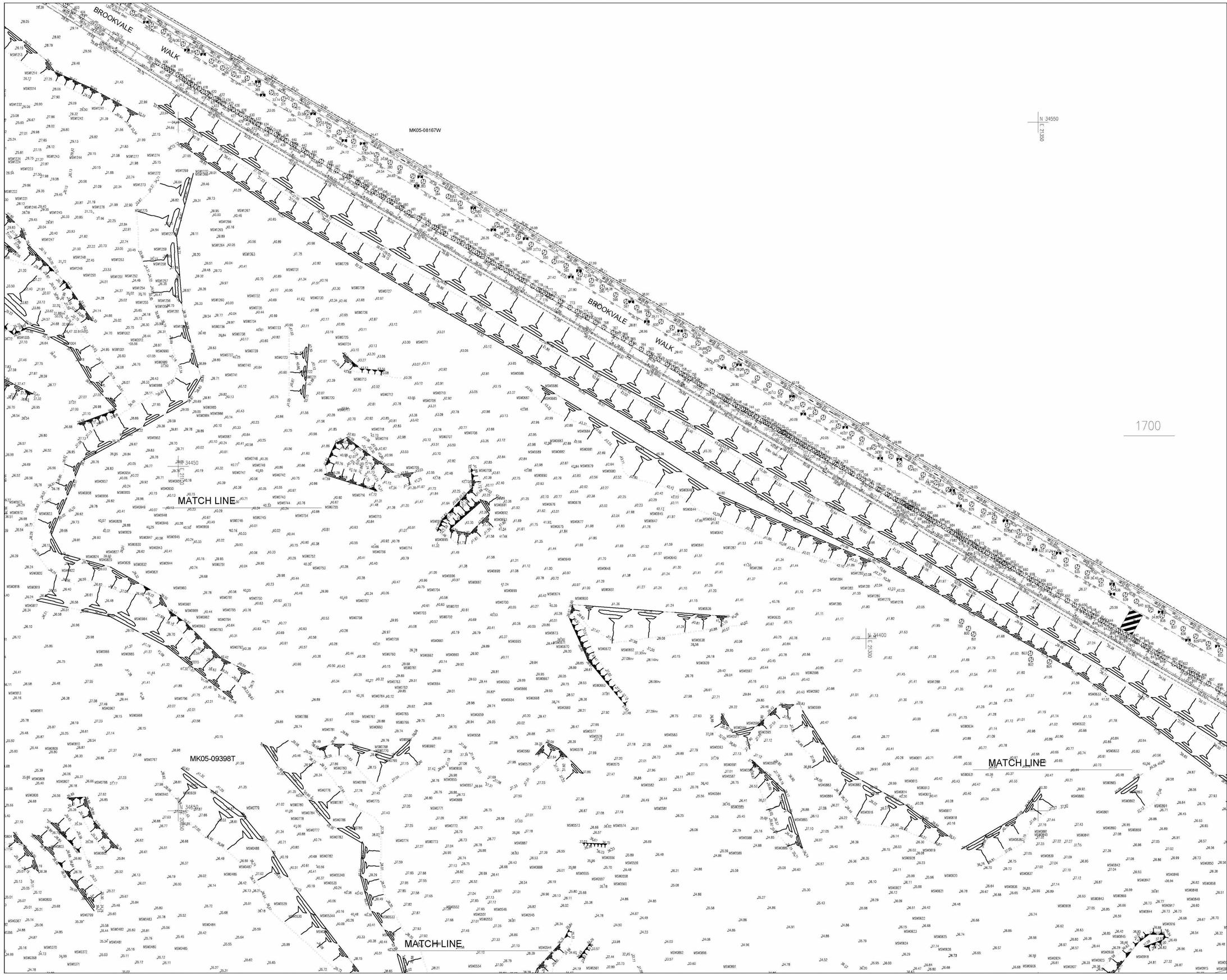
SURVEY PLAN NO

2943-LEW-TP-CL-24183-13



JOB NO	JOB DESCRIPTION	SURVEYED BY
24183	TOPO SURVEY	Kumar 25-12-2025

LSVY 2943

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- INSPECTION CHAMBER (ROUND)
- INSPECTION CHAMBER (SQUARE)
- IRON GRATING
- JAY WALKING RESTRICTION SIGN
- KILOMETER POST
- LAMP POST
- LP(NN) LAMP POST (WITHOUT NUMBER)
- LETTER BOX
- BUS STOP SHELTER
- CABLE CONTROLLED PEDESTRIAN ROAD CROSSING
- CP CYCLING PATH
- ENTRANCE & EXIT OF UNDERPASS
- FP FOOTPATH
- FENCE
- GANTRY
- G GAS PIPELINE
- GATE
- GATE BARRIER
- GUARDRAIL
- HOARDING
- RAILING
- SLOPE SYMBOL
- TOP SLOPE SYMBOL BOTTOM SLOPE SYMBOL
- P2CN PARK CONNECTOR
- V VENT PIPE
- W WATER PIPE
- LIGHTING BOX
- REFLECTIVE MIRROR
- OGB OVER GROUND BOX
- CPCL PEDESTRIAN CROSSING LIGHT
- PEDESTRIAN CROSSING SIGN
- PILLAR (ROUND)
- PILLAR (SQUARE)
- PUBLIC TELEPHONE BOOTH
- REFLECTIVE BOLLARD
- ROAD SIGN
- SIGN BOARD (SMALL)
- SIGN BOARD (BIG)
- SUMP
- SURVEILLANCE CAMERA
- TELEPHONE POLE
- TRAFFIC LIGHT
- TRAFFIC SIGN
- UNKNOWN MANHOLE
- UP LIGHT
- WM WATER METER
- WATER VALVE (SMALL)
- PUB PUB MANHOLE
- SEWER MANHOLE
- STOOL/CHAIR/PARK BENCH
- TELECOMMUNICATION MANHOLE

HEDGES
- PALM TREE
- SAPLING
- SHRUBS
- TREE
- SWAMP
- CPL CAR PARKING LOT
- MCL MOTORCYCLE PARKING LOT
- HPL HANDICAPPED PARKING LOT
- COVERED DRAIN
- DRAIN CULVERT
- GRATING OVER DRAIN
- OPEN DRAIN/ CONC OPEN DRAIN
- SLAB OVER DRAIN
- SITE BOUNDARY
- LOT BOUNDARY
- ROAD RESERVE LINE
- DRAIN RESERVE LINE
- DRA OUTDOOR REFRESHMENT AREA
- P08 PEDESTRIAN OVERHEAD BRIDGE
- TACTILE TILES
- PATH RAMP
- HUMP
- WALL (GENERAL)
- RETAINING WALL
- RUBBLE WALL
- PARAPET WALL

SITE

CLEMENTI ROAD
MUKIM NO. 04 & 05

N

SURVEYOR

LEW REGISTERED SURVEYOR
71 BUKIT BATOK CRESCENT
#11-02 PRESTIGE CENTRE
SINGAPORE 658071
TEL : 68997971, FAX : 68997972

CADASTRAL MAPS 1700 1759,1760	PREPARED BY 27-02-2026 FENNIE
SCALE 1 : 500 PLAN SIZE : A1	
27-02-2026 (Digitally Signed) LEW TEK FART REGISTERED SURVEYOR	CHECKED BY 27-02-2026 CHIANG SHANG MENG

SURVEY PLAN NO

2943-LEW-TP-CL-24183-14



JOB NO	JOB DESCRIPTION	SURVEYED BY
24183	TOPO SURVEY	Kumar 25-12-2025

LSVY 2943

NOTE

1) **Boundaries shown hereon are provisional and subject to final survey.**
2) **Vertical Control were based on VCP 80191 RL= 21.247 at ULU PANDAN ROAD / PANDAN VALLEY.**
3) **Horizontal Control were based on ISN Survey Marker :–**
   - **I) SM13708 N33710.325 E20715.181**
   - **II) SM11323 N33644.056 E21744.761**
   - **III) SM13480 N34122.106 E20733.569**
   - **IV) SM18098 N34300.059 E20841.635**
4) **Reduced Levels are based on Singapore Height Datum = 0.000m.**
5) **The tree names are identified to the best of our knowledge and should be verified by a tree specialist.**
6) Road Reserve line derived from INLIS PO: W49726178_1 dated 25-07-2025

ABBREVIATIONS/LEGEND

- AIR VALVE
- BOLLARD
- BUS STOP POST
- CABLE JOINT INDICATOR
- CB CABLE BOX
- COLUMN (ROUND)
- COLUMN (SQUARE)
- CONTROL STATION
- DB DUST BIN ROUND
- DRAINAGE MANHOLE
- DRAIN DROP INLET CHAMBER
- EARTH PIT
- ELECTRICAL BOX
- ELECTRICAL POLE
- FIRE HYDRANT
- FLAG STAFF
- FB FLOWERBED
- GAS INDICATOR
- GAS VALVE
- GARDEN LIGHT
- INSPECTION CHAMBER (ROUND)
- INSPECTION CHAMBER (SQUARE)
- IRON GRATING
- JAY WALKING RESTRICTION SIGN
- KILOMETER POST
- LAMP POST
- LAMP POST (WITHOUT NUMBER)
- LETTER BOX
- BUS STOP SHELTER
- CABLE CONTROLLED PEDESTRIAN ROAD CROSSING
- CP CYCLING PATH
- ENTRANCE & EXIT OF UNDERPASS
- FP FOOTPATH
- FENCE
- GANTRY
- G GAS PIPELINE
- GATE
- GATE BARRIER
- GUARDRAIL
- HOARDING
- RAILING
- SLOPE SYMBOL
- TOP SLOPE SYMBOL
- BOTTOM SLOPE SYMBOL
- PCN PARK CONNECTOR
- V VENT PIPE
- W WATER PIPE
- LB LIGHTING BOX
- REFLECTIVE MIRROR
- OGB OVER GROUND BOX
- cPCL PEDESTRIAN CROSSING LIGHT
- PEDESTRIAN CROSSING SIGN
- PILLAR (ROUND)
- PILLAR (SQUARE)
- PUBLIC TELEPHONE BOOTH
- REFLECTIVE BOLLARD
- ROAD SIGN
- SIGN BOARD (SMALL)
- SIGN BOARD (BIG)
- SUMP
- SURVEILLANCE CAMERA
- TELEPHONE POLE
- TRAFFIC LIGHT
- TRAFFIC SIGN
- UNKNOWN MANHOLE
- UP LIGHT
- WM WATER METER
- WATER VALVE (SMALL)
- PUB MANHOLE
- SEWER MANHOLE
- STOOL/CHAIR/PARK BENCH
- TC TELECOMMUNICATION MANHOLE
- HEDGES
- PALM TREE
- SAPLING
- SHRUBS
- TREE
- SWAMP
- CPL CAR PARKING LOT
- MCL MOTORCYCLE PARKING LOT
- HPL HANDICAPPED PARKING LOT
- COVERED DRAIN
- DRAIN CULVERT
- GRATING OVER DRAIN
- OPEN DRAIN/ CONC OPEN DRAIN
- SLAB OVER DRAIN
- SITE BOUNDARY
- LOT BOUNDARY
- ROAD RESERVE LINE
- DRAIN RESERVE LINE
- DRA OUTDOOR REFRESHMENT AREA
- POB PEDESTRIAN OVERHEAD BRIDGE
- TACTILE TILES
- PATH RAMP
- HUMP
- WALL (GENERAL)
- RETAINING WALL
- RUBBLE WALL
- PARAPET WALL

SITE

CLEMENTI ROAD
MUKIM NO. 04 & 05

N

SURVEYOR

LEW REGISTERED SURVEYOR
71 BUKIT BATOK CRESCENT
#11–02 PRESTIGE CENTRE
SINGAPORE 658071
TEL : 68997971, FAX : 68997972

CADASTRAL MAPS 1700 1759,1760	PREPARED BY 27-02-2026 FENNIE
SCALE 1 : 500 PLAN SIZE : A1	
27-02-2026 (Digitally Signed) LEW TEK FART REGISTERED SURVEYOR	CHECKED BY 27-02-2026 CHIANG SHANG MENG

SURVEY PLAN NO

2943-LEW-TP-CL-24183-15



JOB NO	JOB DESCRIPTION	SURVEYED BY
24183	TOPO SURVEY	Kumar 25-12-2025

LSVY 2943

NOTE

1) **Boundaries shown hereon are provisional and subject to final survey.**
2) **Vertical Control were based on VCP 80191 RL= 21.247 at ULU PANDAN ROAD / PANDAN VALLEY.**
3) **Horizontal Control were based on ISN Survey Marker :-**
   - **I) SM13708 N33710.325 E20715.181**
   - **II) SM11323 N33644.056 E21744.761**
   - **III) SM13480 N34122.106 E20733.569**
   - **IV) SM18098 N34300.059 E20841.635**
4) **Reduced Levels are based on Singapore Height Datum = 0.000m.**
5) **The tree names are identified to the best of our knowledge and should be verified by a tree specialist.**
6) Road Reserve line derived from INLIS PO: W49726178_1 dated 25-07-2025

ABBREVIATIONS/LEGEND

- AIR VALVE
- BOLLARD
- BUS STOP POST
- CABLE JOINT INDICATOR
- CB CABLE BOX
- COLUMN (ROUND)
- COLUMN (SQUARE)
- CONTROL STATION
- DB DUST BIN ROUND
- DRAINAGE MANHOLE
- DRAIN INLET CHAMBER
- EARTH PIT
- ELECTRICAL BOX
- ELECTRICAL POLE
- FIRE HYDRANT
- FLAG STAFF
- FB FLOWERBED
- GAS INDICATOR
- GAS VALVE
- GARDEN LIGHT
- INSPECTION CHAMBER (ROUND)
- INSPECTION CHAMBER (SQUARE)
- IRON GRATING
- JAY WALKING RESTRICTION SIGN
- KILOMETER POST
- LAMP POST
- LAMP POST (WITHOUT NUMBER)
- LETTER BOX
- BUS STOP SHELTER
- CABLE CONTROLLED PEDESTRIAN ROAD CROSSING
- CP CYCLING PATH
- ENTRANCE & EXIT OF UNDERPASS
- FP FOOTPATH
- FENCE
- GANTRY
- G GAS PIPELINE
- GATE
- GATE BARRIER
- GUARDRAIL
- HOARDING
- RAILING
- SLOPE SYMBOL
- TOP SLOPE SYMBOL / BOTTOM SLOPE SYMBOL
- PCN PARK CONNECTOR
- V VENT PIPE
- W WATER PIPE
- LIGHTING BOX
- REFLECTIVE MIRROR
- OG OVER GROUND BOX
- CPCL PEDESTRIAN CROSSING LIGHT
- PEDESTRIAN CROSSING SIGN
- PILLAR (ROUND)
- PILLAR (SQUARE)
- PUBLIC TELEPHONE BOOTH
- REFLECTIVE BOLLARD
- ROAD SIGN
- SIGN BOARD (SMALL)
- SIGN BOARD (BIG)
- SUMP
- SURVEILLANCE CAMERA
- TELEPHONE POLE
- TRAFFIC LIGHT
- TRAFFIC SIGN
- U UNKNOWN MANHOLE
- UP LIGHT
- WM WATER METER
- WATER VALVE (SMALL)
- PUB PUB MANHOLE
- SEW SEWER MANHOLE
- STOOL/CHAIR/PARK BENCH
- TAS TELECOMMUNICATION MANHOLE
- HEDGES
- PALM TREE
- SAPLING
- SHRUBS
- TREE
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- CPL CAR PARKING LOT
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- SLAB OVER DRAIN
- SITE BOUNDARY
- LOT BOUNDARY
- ROAD RESERVE LINE
- DRAIN RESERVE LINE
- DRA OUTDOOR REFRESHMENT AREA
- POB PEDESTRIAN OVERHEAD BRIDGE
- TACTILE TILES
- PATH RAMP
- HUMP
- WALL (GENERAL)
- RETAINING WALL
- RUBBLE WALL
- PARAPET WALL

SITE

CLEMENTI ROAD
MUKIM NO. 04 & 05

N

SURVEYOR

LEW REGISTERED SURVEYOR
71 BUKIT BATOK CRESCENT
#11-02 PRESTIGE CENTRE
SINGAPORE 658071
TEL : 68997971, FAX : 68997972

CADASTRAL MAPS 1700 1759,1760	PREPARED BY
SCALE 1 : 500 PLAN SIZE : A1	27-02-2026 FENNIE
27-02-2026 (Digitally Signed) LEW TEK FART REGISTERED SURVEYOR	CHECKED BY 27-02-2026 CHIANG SHANG MENG

SURVEY PLAN NO

2943-LEW-TP-CL-24183-16

JOB NO	JOB DESCRIPTION	SURVEYED BY
24183	TOPO SURVEY	Kumar 25-12-2025

LSVY 2943

NOTE

1) **Boundaries shown hereon are provisional and subject to final survey.**
2) **Vertical Control were based on VCP 80191 RL= 21.247 at ULU PANDAN ROAD / PANDAN VALLEY.**
3) **Horizontal Control were based on ISN Survey Marker :-**
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   - **ii) SM11323 N33644.056 E21744.761**
   - **iii) SM13480 N34122.106 E20733.569**
   - **iv) SM18098 N34300.059 E20841.635**
4) **Reduced Levels are based on Singapore Height Datum = 0.000m.**
5) **The tree names are identified to the best of our knowledge and should be verified by a tree specialist.**
6) Road Reserve line derived from INLIS PO: W49726178_1 dated 25-07-2025

ABBREVIATIONS/LEGEND

AIR VALVE; BOLLARD; BUS STOP POST; CABLE JOINT INDICATOR; CB CABLE BOX; COLUMN (ROUND); COLUMN (SQUARE); CONTROL STATION; DUST BIN ROUND; DRAINAGE MANHOLE; DIMC DROP INLET CHAMBER; EARTH PIT; ELECTRICAL BOX; ELECTRICAL POLE; FIRE HYDRANT; FLAG STAFF; FB FLOWERBED; GAS INDICATOR; GAS VALVE; GARDEN LIGHT; INSPECTION CHAMBER (ROUND); INSPECTION CHAMBER (SQUARE); IRON GRATING; JAY WALKING RESTRICTION SIGN; KILOMETER POST; LAMP POST; KM LAMP POST (WITHOUT NUMBER); LETTER BOX; BUS STOP SHELTER; CABLE CONTROLLED PEDESTRIAN ROAD CROSSING; CP CYCLING PATH; ENTRANCE & EXIT OF UNDERPASS; FP FOOTPATH; FENCE; GANTRY; G GAS PIPELINE; GATE; GATE BARRIER; GUARDRAIL; HOARDING; RAILING; SLOPE SYMBOL; TOP SLOPE SYMBOL; BOTTOM SLOPE SYMBOL; PCN PARK CONNECTOR; V VENT PIPE; W WATER PIPE; LIGHTING BOX; REFLECTIVE MIRROR; OVER GROUND BOX; PEDESTRIAN CROSSING LIGHT; PEDESTRIAN CROSSING SIGN; PILLAR (ROUND); PILLAR (SQUARE); PUBLIC TELEPHONE BOOTH; REFLECTIVE BOLLARD; ROAD SIGN; SIGN BOARD (SMALL); SIGN BOARD (BIG); SUMP; SURVEILLANCE CAMERA; TELEPHONE POLE; TRAFFIC LIGHT; TRAFFIC SIGN; UM UNKNOWN MANHOLE; UP LIGHT; WATER METER; WATER VALVE (SMALL); PUB PUB MANHOLE; SEWER MANHOLE; STOOL/CHAIR/PARK BENCH; TELECOMMUNICATION MANHOLE; HEDGES; PALM TREE; SAPLING; SHRUBS; TREE; SWAMP; CPL CAR PARKING LOT; MCL MOTORCYCLE PARKING LOT; HPL HANDICAPPED PARKING LOT; COVERED DRAIN; DRAIN CULVERT; GRATING OVER DRAIN; OPEN DRAIN/ CONC OPEN DRAIN; SLAB OVER DRAIN; SITE BOUNDARY; LOT BOUNDARY; ROAD RESERVE LINE; DRAIN RESERVE LINE; DRA OUTDOOR REFRESHMENT AREA; POB PEDESTRIAN OVERHEAD BRIDGE; TACTILE TILES; PATH RAMP; HUMP; WALL (GENERAL); RETAINING WALL; RUBBLE WALL; PARAPET WALL

SITE

CLEMENTI ROAD
MUKIM NO. 04 & 05

N

SURVEYOR

LEW REGISTERED SURVEYOR
71 BUKIT BATOK CRESCENT
#11-02 PRESTIGE CENTRE
SINGAPORE 658071
TEL : 68997971, FAX : 68997972

CADASTRAL MAPS 1700 1759,1760	PREPARED BY
SCALE 1 : 500	27-02-2026
PLAN SIZE : A1	FENNIE
27-02-2026	CHECKED BY
(Digitally Signed) LEW TEK FART REGISTERED SURVEYOR	27-02-2026 CHIANG SHANG MENG

SURVEY PLAN NO

2943-LEW-TP-CL-24183-17

TAGGED TREES DETAILS BY ARBORIST

Tag ID	Girth	Height	Tree Name
TUW0447	2.5	20.0	Ficus microcarpa
TUW0448	4.5	22.0	Durio zibethinus
TUW0449	1.5	15.0	Ficus variegata
TUW0450	1.1	14.0	Hevea brasiliensis
TUW0451	1.5	11.0	cf. Bambusa vulgaris
TUW0452	1.3	15.0	Hevea brasiliensis
TUW0453	1.1	15.0	Hevea brasiliensis
TUW0454	1.6	16.0	Hevea brasiliensis
TUW0455	1.1	14.0	Ficus variegata
TUW0456	4	13.0	cf. Bambusa vulgaris
TUW0457	1.5	13.0	Spathodea campanulata
TUW0458	1.2	17.0	Hevea brasiliensis
TUW0459	1.2	10.0	Hevea brasiliensis
TUW0460	1.5	16.0	Hevea brasiliensis
TUW0461	1.3	15.0	Ficus variegata
TUW0462	1.8	14.0	Syzygium grande
TUW0463	1.5	16.0	Hevea brasiliensis
TUW0464	1	10.0	Syzygium cerasiforme
TUW0465	1.3	5.0	Syzygium cerasiforme
TUW0466	2	15.0	Alstonia angustiloba
TUW0467	2.6	17.0	Alstonia angustiloba
TUW0468	1	14.0	Hevea brasiliensis
TUW0469	1	17.0	Syzygium cerasiforme
TUW0470	1	17.0	Hevea brasiliensis
TUW0471	1.1	16.0	Hevea brasiliensis
TUW0472	1	14.0	Cyrtophyllum fragrans
TUW0473	1.2	14.0	Hevea brasiliensis
TUW0474	1.2	12.0	Syzygium grande
TUW0475	1.2	16.0	Hevea brasiliensis
TUW0476	1.4	12.0	Elaeis guineensis
TUW0477	1.5	18.0	Hevea brasiliensis
TUW0478	1.7	15.0	Hevea brasiliensis
TUW0479	4	8.0	UnID Timber Bamboo
TUW0480	1.4	14.0	Hevea brasiliensis
TUW0481	1.3	13.0	Hevea brasiliensis
TUW0482	1.2	12.0	Hevea brasiliensis
TUW0483	1.3	NA	Hevea brasiliensis
TUW0484	5	8.0	UnID Timber Bamboo
TUW0485	3	10.0	UnID Timber Bamboo
TUW0486	1.1	15.0	Hevea brasiliensis
TUW0487	1.3	15.0	Hevea brasiliensis
TUW0488	5	10.0	UnID Timber Bamboo
TUW0489	1.2	10.0	Hevea brasiliensis
TUW0490	1.1	16.0	Hevea brasiliensis
TUW0491	4	10.0	UnID Timber Bamboo
TUW0492	1	14.0	Hevea brasiliensis
TUW0493	1.1	10.0	Hevea brasiliensis
TUW0494	1.5	12.0	Hevea brasiliensis
MSW0001	1.3	14.0	Ficus variegata
MSW0002	1.3	16.0	Ixonanthes reticulata
MSW0003	1.3	20.0	Hevea brasiliensis
MSW0004	1.2	15.0	Hevea brasiliensis
MSW0005	1.4	16.0	Ficus variegata
MSW0006	1.1	12.0	Ficus variegata
MSW0007	1.3	18.0	Ficus variegata
MSW0008	1.1	16.0	Ficus variegata
MSW0009	1	20.0	Ficus variegata
MSW0010	1	14.0	Hevea brasiliensis
MSW0011	1.3	18.0	Hevea brasiliensis
MSW0012	1.3	16.0	Hevea brasiliensis
MSW0013	2	10.0	UnID Timber Bamboo
MSW0014	1.6	14.0	Nephelium lappaceum
MSW0015	1.5	20.0	Dimocarpus fichi
MSW0016	1.3	14.0	Baccaurea motleyana
MSW0017	1.5	16.0	Nephelium lappaceum
MSW0018	1.2	20.0	Hevea brasiliensis
MSW0019	2.1	16.0	Nephelium lappaceum
MSW0020	1.1	22.0	Adenanthera pavonina
MSW0021	1.2	16.0	Nephelium lappaceum
MSW0022	1.5	16.0	Nephelium lappaceum
MSW0023	2.3	16.0	Durio zibethinus
MSW0024	1.5	25.0	Falcataria falcata
MSW0025	1.5	28.0	Falcataria falcata
MSW0026	1.5	10.0	Cinnamomum iners
MSW0027	1.1	16.0	Hevea brasiliensis
MSW0028	2	23.0	Durio zibethinus
MSW0029	1.5	23.0	Ficus variegata
MSW0030	1.4	20.0	Ficus variegata
MSW0031	1.4	20.0	Ficus variegata
MSW0032	1.4	14.0	Elaeis guineensis
MSW0033	1.3	18.0	Ficus variegata
MSW0034	1.5	23.0	Ficus variegata
MSW0035	1.2	16.0	Syzygium polyanthum
MSW0036	1.3	14.0	Ficus variegata
MSW0037	1.7	20.0	Dimocarpus fichi
MSW0038	2	20.0	Dimocarpus fichi
MSW0039	1.7	20.0	Dimocarpus fichi
MSW0040	1.8	20.0	Baccaurea motleyana
MSW0041	1.3	20.0	Baccaurea motleyana
MSW0042	1.3	30.0	Falcataria falcata
MSW0043	1.1	30.0	Falcataria falcata
MSW0044	1.3	30.0	Falcataria falcata
MSW0045	1.2	25.0	Falcataria falcata
MSW0046	1	17.0	Hevea brasiliensis
MSW0047	1.5	30.0	Falcataria falcata
MSW0048	1	14.0	Hevea brasiliensis
MSW0049	1.5	18.0	Syzygium cerasiforme
MSW0050	1.5	18.0	Hevea brasiliensis
MSW0051	1.1	14.0	Macaranga conifera
MSW0052	1.3	18.0	Hevea brasiliensis
MSW0053	1.1	18.0	Hevea brasiliensis
MSW0054	1.4	12.0	Elaeis guineensis
MSW0055	1.4	18.0	Syzygium cerasiforme
MSW0057	1.4	16.0	Hevea brasiliensis
MSW0058	1.1	18.0	Hevea brasiliensis
MSW0059	1.2	16.0	Hevea brasiliensis
MSW0060	1.4	16.0	Hevea brasiliensis
MSW0061	1.2	16.0	Syzygium cerasiforme
MSW0062	1.3	16.0	Hevea brasiliensis
MSW0063	2.2	20.0	Alstonia angustiloba
MSW0064	1.1	15.0	Cyrtophyllum fragrans
MSW0065	1.1	20.0	Elaeis guineensis
MSW0066	2.7	24.0	Durio zibethinus
MSW0067	2.2	20.0	Baccaurea motleyana
MSW0068	1.1	15.0	Dimocarpus fichi
MSW0069	1.2	16.0	Dimocarpus fichi
MSW0070	1.2	14.0	Dimocarpus fichi
MSW0071	1.3	10.0	Averrhoa carambola
MSW0072	1.1	19.0	Hevea brasiliensis
MSW0073	1	14.0	Dimocarpus fichi
MSW0074	1.3	17.0	Dimocarpus fichi
MSW0075	1.3	16.0	Hevea brasiliensis
MSW0076	1.2	16.0	Hevea brasiliensis
MSW0077	1.4	16.0	Hevea brasiliensis
MSW0078	1.3	14.0	Hevea brasiliensis
MSW0079	4.5	28.0	Alstonia angustiloba
MSW0080	1.4	17.0	Syzygium cerasiforme
MSW0081	1.5	16.0	Hevea brasiliensis

TAGGED TREES DETAILS BY ARBORIST

Tag ID	Girth	Height	Tree Name
MSW0082	1.6	20.0	Hevea brasiliensis
MSW0083	1.6	16.0	Dimocarpus fichi
MSW0084	1.4	28.0	Falcataria falcata
MSW0085	4	17.0	Ficus microcarpa
MSW0086	1.4	18.0	Hevea brasiliensis
MSW0087	1	18.0	Hevea brasiliensis
MSW0088	1.2	17.0	Hevea brasiliensis
MSW0089	1	14.0	Hevea brasiliensis
MSW0090	1.3	16.0	Hevea brasiliensis
MSW0091	1.4	17.0	Hevea brasiliensis
MSW0092	1.6	16.0	Hevea brasiliensis
MSW0093	1.4	11.0	Elaeis guineensis
MSW0094	1.2	16.0	Hevea brasiliensis
MSW0095	1.5	14.0	Hevea brasiliensis
MSW0096	1.4	18.0	Hevea brasiliensis
MSW0097	1.5	8.0	Elaeis guineensis
MSW0098	1.5	16.0	Hevea brasiliensis
MSW0099	1.2	12.0	Elaeis guineensis
MSW0100	1	20.0	Hevea brasiliensis
MSW0101	1.2	11.0	Elaeis guineensis
MSW0102	2.4	20.0	Ficus variegata
MSW0103	2.2	12.0	Cyrtophyllum fragrans
MSW0104	1	14.0	Syzygium cerasiforme
MSW0105	1.3	14.0	Hevea brasiliensis
MSW0106	1.2	15.0	Cyrtophyllum fragrans
MSW0107	1.7	15.0	Cyrtophyllum fragrans
MSW0108	1.1	14.0	Cyrtophyllum fragrans
MSW0109	2.2	15.0	Cyrtophyllum fragrans
MSW0110	2.3	16.0	Cyrtophyllum fragrans
MSW0111	1.2	16.0	Hevea brasiliensis
MSW0112	1.1	16.0	Hevea brasiliensis
MSW0113	1	16.0	Hevea brasiliensis
MSW0114	1.1	16.0	Hevea brasiliensis
MSW0115	1.1	15.0	Hevea brasiliensis
MSW0116	1	19.0	Hevea brasiliensis
MSW0117	2.3	17.0	Hevea brasiliensis
MSW0118	1.1	16.0	Hevea brasiliensis
MSW0119	1.3	15.0	Hevea brasiliensis
MSW0120	1.5	16.0	Hevea brasiliensis
MSW0121	1.1	15.0	Hevea brasiliensis
MSW0122	1.7	10.0	Elaeis guineensis
MSW0123	2.5	11.0	cf. Bambusa vulgaris
MSW0124	3	12.0	cf. Bambusa vulgaris
MSW0125	1.3	12.0	Hevea brasiliensis
MSW0126	1.2	14.0	Hevea brasiliensis
MSW0127	3.8	17.0	Cyrtophyllum fragrans
MSW0128	1.1	15.0	Cyrtophyllum fragrans
MSW0129	3.4	20.0	Cyrtophyllum fragrans
MSW0130	1.9	20.0	Cyrtophyllum fragrans
MSW0131	2.2	20.0	Cyrtophyllum fragrans
MSW0132	3	12.0	cf. Bambusa vulgaris
MSW0133	1.1	18.0	Hevea brasiliensis
MSW0134	2.5	11.0	cf. Bambusa vulgaris
MSW0135	1.6	14.0	Cyrtophyllum fragrans
MSW0136	1.2	16.0	Cyrtophyllum fragrans
MSW0137	1.4	16.0	Cyrtophyllum fragrans
MSW0138	1.3	17.0	Cyrtophyllum fragrans
MSW0139	3	16.0	Alstonia angustiloba
MSW0140	1.3	18.0	Syzygium cerasiforme
MSW0141	1.6	17.0	Cyrtophyllum fragrans
MSW0142	1.2	13.0	Cyrtophyllum fragrans
MSW0143	1.2	16.0	Rhodamnia cinerea
MSW0144	1.8	16.0	Cyrtophyllum fragrans
MSW0145	1.4	14.0	Alstonia angustiloba
MSW0146	1.2	14.0	Syzygium grande
MSW0147	1.3	14.0	Cyrtophyllum fragrans
MSW0148	2.3	18.0	Cyrtophyllum fragrans
MSW0149	2	15.0	Cyrtophyllum fragrans
MSW0150	2.4	20.0	Cyrtophyllum fragrans
MSW0151	1.9	17.0	Cyrtophyllum fragrans
MSW0152	2.5	18.0	Cyrtophyllum fragrans
MSW0153	2.3	15.0	Cyrtophyllum fragrans
MSW0154	1.8	15.0	Hevea brasiliensis
MSW0155	1.3	16.0	Alstonia angustiloba
MSW0156	1.4	10.0	Cyrtophyllum fragrans
MSW0157	1	15.0	Alstonia angustiloba
MSW0158	1.6	16.0	Syzygium cerasiforme
MSW0159	2.6	22.0	Cyrtophyllum fragrans
MSW0160	2.6	19.0	Cyrtophyllum fragrans
MSW0161	1.5	16.0	Cyrtophyllum fragrans
MSW0162	1.7	20.0	Cyrtophyllum fragrans
MSW0163	2.5	20.0	Syzygium grande
MSW0165	1	12.0	Hevea brasiliensis
MSW0166	1	13.0	Hevea brasiliensis
MSW0167	1.9	12.0	Elaeis guineensis
MSW0168	1.5	20.0	Hevea brasiliensis
MSW0169	2.2	11.0	Elaeis guineensis
MSW0170	1.9	10.0	Elaeis guineensis
MSW0171	1.5	10.0	Elaeis guineensis
MSW0172	1.7	18.0	Hevea brasiliensis
MSW0173	1	12.0	Hevea brasiliensis
MSW0174	1.4	17.0	Hevea brasiliensis
MSW0175	1.3	17.0	Hevea brasiliensis
MSW0176	1	16.0	Hevea brasiliensis
MSW0177	1	15.0	Hevea brasiliensis
MSW0178	1	14.0	Hevea brasiliensis
MSW0179	1.2	14.0	Hevea brasiliensis
MSW0180	1	15.0	Syzygium grande
MSW0181	1.1	12.0	Hevea brasiliensis
MSW0182	1.4	14.0	Ficus variegata
MSW0183	1	16.0	Hevea brasiliensis
MSW0184	1.4	19.0	Cyrtophyllum fragrans
MSW0185	1.3	15.0	Cyrtophyllum fragrans
MSW0186	1.2	18.0	Alstonia angustiloba
MSW0187	1.4	17.0	Cyrtophyllum fragrans
MSW0188	1.1	16.0	Alstonia angustiloba
MSW0189	2	16.0	Cyrtophyllum fragrans
MSW0190	1.4	16.0	Hevea brasiliensis
MSW0191	1.5	18.0	Cyrtophyllum fragrans
MSW0192	1	18.0	Cyrtophyllum fragrans
MSW0193	1	11.0	Elaeis guineensis
MSW0194	1.5	20.0	Cyrtophyllum fragrans
MSW0195	1.1	16.0	Cyrtophyllum fragrans
MSW0196	1.4	18.0	Cyrtophyllum fragrans
MSW0197	1.3	18.0	Syzygium grande
MSW0198	1.7	20.0	Cyrtophyllum fragrans
MSW0199	1.6	18.0	Cyrtophyllum fragrans
MSW0200	1.3	16.0	Hevea brasiliensis
MSW0201	1.7	20.0	Cyrtophyllum fragrans
MSW0202	1.2	23.0	Syzygium cerasiforme
MSW0203	1.3	20.0	Syzygium cerasiforme
MSW0204	1.4	23.0	Cyrtophyllum fragrans
MSW0205	1	4.0	Syzygium cerasiforme
MSW0206	1.2	16.0	Syzygium cerasiforme
MSW0207	1.3	16.0	Hevea brasiliensis
MSW0208	1.4	14.0	Hevea brasiliensis
MSW0209	1.4	18.0	Hevea brasiliensis
MSW0210	1.4	15.0	Cyrtophyllum fragrans

TAGGED TREES DETAILS BY ARBORIST

Tag ID	Girth	Height	Tree Name
MSW0211	1.2	14.0	Cyrtophyllum fragrans
MSW0212	1.1	17.0	Ixonanthes reticulata
MSW0213	1	20.0	Ixonanthes reticulata
MSW0214	1.6	20.0	Syzygium cerasiforme
MSW0215	1	18.0	Cyrtophyllum fragrans
MSW0216	1.2	20.0	Syzygium grande
MSW0217	2	22.0	Alstonia angustiloba
MSW0218	1	22.0	Hevea brasiliensis
MSW0219	1.6	24.0	Vitex pinnata
MSW0220	1.6	20.0	Vitex pinnata
MSW0221	1.1	20.0	Hevea brasiliensis
MSW0222	1.2	15.0	Hevea brasiliensis
MSW0223	1.5	17.0	Hevea brasiliensis
MSW0224	1.2	12.0	Elaeis guineensis
MSW0225	2	10.0	Gnoosperma horridum
MSW0226	1	15.0	Hevea brasiliensis
MSW0227	1.1	17.0	Hevea brasiliensis
MSW0228	1.6	17.0	Hevea brasiliensis
MSW0229	1.3	15.0	Hevea brasiliensis
MSW0230	1.5	8.0	Elaeis guineensis
MSW0231	1.1	18.0	Vitex pinnata
MSW0232	2	22.0	Hevea brasiliensis
MSW0233	1.6	18.0	Syzygium cerasiforme
MSW0234	1.5	18.0	Ixonanthes reticulata
MSW0235	1.5	18.0	Ixonanthes reticulata
MSW0236	1.2	18.0	Ixonanthes reticulata
MSW0237	1.1	18.0	Ixonanthes reticulata
MSW0238	2.1	24.0	Ixonanthes reticulata
MSW0239	1.6	20.0	Ixonanthes reticulata
MSW0240	1.6	20.0	Ixonanthes reticulata
MSW0241	1.3	20.0	Ixonanthes reticulata
MSW0242	4	25.0	Alstonia angustiloba
MSW0243	1.4	22.0	Ixonanthes reticulata
MSW0244	2.1	24.0	Ixonanthes reticulata
MSW0245	1.5	20.0	Ixonanthes reticulata
MSW0246	2.1	25.0	Ixonanthes reticulata
MSW0247	1.5	15.0	Syzygium cerasiforme
MSW0248	1.8	22.0	Alstonia angustiloba
MSW0249	1.1	12.0	Cyrtophyllum fragrans
MSW0250	1.2	16.0	Cyrtophyllum fragrans
MSW0251	1	16.0	Alstonia angustiloba
MSW0252	2.8	25.0	Ixonanthes reticulata
MSW0253	1.7	18.0	Alstonia angustiloba
MSW0254	1.4	18.0	Hevea brasiliensis
MSW0255	1	16.0	Vitex pinnata
MSW0256	1.1	15.0	Vitex pinnata
MSW0257	1.2	18.0	Hevea brasiliensis
MSW0258	1.3	16.0	Hevea brasiliensis
MSW0259	1.3	20.0	Durio zibethinus
MSW0260	1.1	12.0	Elaeis guineensis
MSW0261	1.2	18.0	Syzygium cerasiforme
MSW0262	1.4	18.0	Syzygium cerasiforme
MSW0263	1.5	16.0	Hevea brasiliensis
MSW0264	1.1	16.0	Hevea brasiliensis
MSW0265	1.3	16.0	Dimocarpus fichi
MSW0266	1.3	14.0	Hevea brasiliensis
MSW0267	1.6	15.0	Hevea brasiliensis
MSW0268	1.5	16.0	Hevea brasiliensis
MSW0269	1.3	18.0	Hevea brasiliensis
MSW0270	1.1	14.0	Hevea brasiliensis
MSW0271	1	15.0	Hevea brasiliensis
MSW0272	1.2	16.0	Hevea brasiliensis
MSW0273	1.5	20.0	Durio zibethinus
MSW0274	1.2	18.0	Hevea brasiliensis
MSW0275	1.4	20.0	Hevea brasiliensis
MSW0276	1.6	20.0	Ficus variegata
MSW0277	1.2	13.0	Elaeis guineensis
MSW0278	1.2	13.0	Elaeis guineensis
MSW0279	1.2	13.0	Elaeis guineensis
MSW0280	1.4	15.0	Vitex pinnata
MSW0281	1	15.0	Macaranga conifera
MSW0282	1.7	16.0	Cyrtophyllum fragrans
MSW0283	2.1	20.0	Cyrtophyllum fragrans
MSW0284	1.3	16.0	Hevea brasiliensis
MSW0285	1.1	13.0	Artocarpus integer var. integer
MSW0286	1.3	13.0	Elaeis guineensis
MSW0287	1	13.0	Ficus variegata
MSW0288	1.2	17.0	Elaeis guineensis
MSW0289	1.3	12.0	Hevea brasiliensis
MSW0290	1.3	13.0	Elaeis guineensis
MSW0291	3.4	18.0	Syzygium grande
MSW0292	4.3	25.0	Syzygium grande
MSW0293	1.2	12.0	Syzygium cerasiforme
MSW0294	4.2	20.0	Cyrtophyllum fragrans
MSW0295	3.2	20.0	Syzygium grande
MSW0296	2	20.0	Cyrtophyllum fragrans
MSW0297	1.4	14.0	Hevea brasiliensis
MSW0298	1.1	16.0	Cyrtophyllum fragrans
MSW0299	2.3	20.0	Cyrtophyllum fragrans
MSW0300	1.7	22.0	Cyrtophyllum fragrans
MSW0301	1	13.0	Cyrtophyllum fragrans
MSW0302	1.1	14.0	Adinandra dumosa
MSW0303	1.2	14.0	Rhodamnia cinerea
MSW0304	1.4	15.0	Vitex pinnata
MSW0305	2.2	20.0	Cyrtophyllum fragrans
MSW0306	1	14.0	Artocarpus integer var. integer
MSW0307	1.4	13.0	Vitex pinnata
MSW0308	1.3	20.0	Syzygium cerasiforme
MSW0309	1	14.0	Elaeis guineensis
MSW0310	1.2	15.0	Elaeis guineensis
MSW0311	1.3	16.0	Durio zibethinus
MSW0312	1.3	13.0	Elaeis guineensis
MSW0313	1.8	25.0	Falcataria falcata
MSW0314	1.4	22.0	Falcataria falcata
MSW0315	2.1	27.0	Falcataria falcata
MSW0316	2.2	30.0	Falcataria falcata
MSW0317	1.5	22.0	Falcataria falcata
MSW0318	1	18.0	Vitex pinnata
MSW0319	1	17.0	Vitex pinnata
MSW0320	1.1	16.0	Vitex pinnata
MSW0321	1.3	21.0	Hevea brasiliensis
MSW0322	1.1	20.0	Vitex pinnata
MSW0323	2.7	18.0	Cyrtophyllum fragrans
MSW0324	1.2	17.0	Vitex pinnata
MSW0325	1.3	20.0	Hevea brasiliensis
MSW0326	1	16.0	Arthrophyllum jackianum
MSW0327	1.3	18.0	Syzygium polyanthum
MSW0328	1.1	17.0	Hevea brasiliensis
MSW0329	1.4	18.0	Cyrtophyllum fragrans
MSW0330	1.3	22.0	Vitex pinnata
MSW0331	1.3	18.0	Vitex pinnata
MSW0332	1.3	22.0	Syzygium grande
MSW0333	1.2	20.0	Vitex pinnata
MSW0334	1	16.0	Vitex pinnata
MSW0335	1	12.0	Vitex pinnata
MSW0336	2.6	20.0	Ixonanthes reticulata
MSW0337	1.3	20.0	Vitex pinnata
MSW0338	1.3	20.0	Hevea brasiliensis

TAGGED TREES DETAILS BY ARBORIST

Tag ID	Girth	Height	Tree Name
MSW0339	1.2	15.0	Elaeis guineensis
MSW0340	1.7	21.0	Cyrtophyllum fragrans
MSW0341	1.3	18.0	Vitex pinnata
MSW0342	2.2	16.0	Cyrtophyllum fragrans
MSW0343	1.4	14.0	Cyrtophyllum fragrans
MSW0344	1.4	10.0	Cyrtophyllum fragrans
MSW0345	1.2	15.0	Cyrtophyllum fragrans
MSW0346	1.6	18.0	Syzygium grande
MSW0347	1	18.0	Syzygium grande
MSW0348	1.2	15.0	Macaranga conifera
MSW0349	1.6	12.0	Vitex pinnata
MSW0350	1.2	12.0	Morella esculenta
MSW0351	1.2	14.0	Syzygium cerasiforme
MSW0352	1.2	13.0	Cyrtophyllum fragrans
MSW0353	1.2	12.0	Syzygium grande
MSW0354	1	16.0	Hevea brasiliensis
MSW0355	1.1	13.0	Rhodamnia cinerea
MSW0356	1	16.0	Hevea brasiliensis
MSW0357	1.3	14.0	Vitex pinnata
MSW0358	1.1	15.0	Vitex pinnata
MSW0359	1.7	15.0	Vitex pinnata
MSW0360	1.3	16.0	Artocarpus integer var. integer
MSW0361	1.2	15.0	Elaeis guineensis
MSW0362	2	25.0	Ixonanthes reticulata
MSW0363	1.1	17.0	Ixonanthes reticulata
MSW0364	1.3	18.0	Syzygium polyanthum
MSW0365	1.1	10.0	Elaeis guineensis
MSW0366	1.2	14.0	Elaeis guineensis
MSW0367	1.5	18.0	Syzygium grande
MSW0368	1	18.0	Elaeis guineensis
MSW0369	1.8	17.0	Hevea brasiliensis
MSW0370	1	14.0	Syzygium grande
MSW0371	1.1	16.0	Hevea brasiliensis
MSW0372	1.6	17.0	Syzygium grande
MSW0373	2.2	15.0	Senna siamea
MSW0374	2.3	22.0	Cyrtophyllum fragrans
MSW0375	1.2	18.0	Cyrtophyllum fragrans
MSW0376	1.2	18.0	Hevea brasiliensis
MSW0377	5.1	18.0	Syzygium grande
MSW0378	1	8.0	Vitex pinnata
MSW0379	1.3	15.0	Vitex pinnata
MSW0380	1.4	18.0	Vitex pinnata
MSW0381	1.6	17.0	Vitex pinnata
MSW0382	1	14.0	Vitex pinnata
MSW0383	1.3	15.0	Hevea brasiliensis
MSW0384	1.5	10.0	Vitex pinnata
MSW0385	1	7.0	Vitex pinnata
MSW0386	1.4	9.0	Elaeis guineensis
MSW0387	1.1	14.0	Vitex pinnata
MSW0388	1.6	18.0	Vitex pinnata
MSW0389	1.8	18.0	Hevea brasiliensis
MSW0390	1.4	15.0	Vitex pinnata
MSW0391	1.4	19.0	Hevea brasiliensis
MSW0392	1.3	18.0	Hevea brasiliensis
MS

TAGGED TREES DETAILS BY ARBORIST

Tag ID	Girth	Height	Tree Name
NSM0845	1.8	14.0	Eclectica guineensis
NSM0846	1.2	15.0	Ecclectica electo
NSM0847	1.8	12.0	Ecclectica electo
NSM0848	2.3	25.0	Ecclectica electo
NSM0849	2.5	20.0	Ecclectica electo
NSM0850	1.9	20.0	Ecclectica electo
NSM0851	1.8	17.0	Ecclectica electo
NSM0852	1.1	14.0	Eclectica guineensis
NSM0853	1.5	13.0	Eclectica guineensis
NSM0854	1.1	13.0	Eclectica guineensis
NSM0855	2.5	27.0	Eclectica guineensis
NSM0856	2	26.0	Eclectica guineensis
NSM0857	1.2	13.0	Eclectica guineensis
NSM0858	1.2	10.0	Eclectica guineensis
NSM0859	1.1	15.0	Eclectica guineensis
NSM0860	1.2	20.0	Eclectica guineensis
NSM0861	1.1	13.0	Eclectica guineensis
NSM0862	1.2	20.0	Eclectica guineensis
NSM0863	1.2	13.0	Eclectica guineensis
NSM0864	1.1	14.0	Eclectica guineensis
NSM0865	1.1	14.0	Eclectica guineensis
NSM0866	1.2	17.0	Eclectica guineensis
NSM0867	1.3	17.0	Eclectica guineensis
NSM0868	1	13.0	Eclectica guineensis
NSM0869	2.3	30.0	Eclectica guineensis
NSM0870	3	6.0	cf. Bambusa vulgaris
NSM0871	1.2	17.0	Eclectica guineensis
NSM0872	1.2	14.0	Eclectica guineensis
NSM0873	1.1	14.0	Eclectica guineensis
NSM0874	1.2	20.0	Dura zeylanica
NSM0875	1.2	8.0	Eclectica guineensis
NSM0876	4	25.0	Syzygium grande
NSM0877	1.2	14.0	Eclectica guineensis
NSM0878	1.1	14.0	Eclectica guineensis
NSM0879	4	25.0	Syzygium grande
NSM0880	2.2	20.0	Chrysophyllum fragrans
NSM0881	1.1	17.0	Eclectica guineensis
NSM0882	1.2	14.0	Eclectica guineensis
NSM0883	1.2	20.0	Eclectica guineensis
NSM0884	1.2	14.0	Eclectica guineensis
NSM0885	1.2	14.0	Eclectica guineensis
NSM0886	1.2	14.0	Eclectica guineensis
NSM0887	1.2	14.0	Eclectica guineensis
NSM0888	1.2	14.0	Eclectica guineensis
NSM0889	1.2	14.0	Eclectica guineensis
NSM0890	1.2	14.0	Eclectica guineensis
NSM0891	1.2	14.0	Eclectica guineensis
NSM0892	1.2	14.0	Eclectica guineensis
NSM0893	1.2	14.0	Eclectica guineensis
NSM0894	1.2	14.0	Eclectica guineensis
NSM0895	1.2	14.0	Eclectica guineensis
NSM0896	1.2	14.0	Eclectica guineensis
NSM0897	1.2	14.0	Eclectica guineensis
NSM0898	1.2	14.0	Eclectica guineensis
NSM0899	1.2	14.0	Eclectica guineensis
NSM0900	1.2	14.0	Eclectica guineensis
NSM0901	1.2	14.0	Eclectica guineensis
NSM0902	1.2	14.0	Eclectica guineensis
NSM0903	1.2	14.0	Eclectica guineensis
NSM0904	1.2	14.0	Eclectica guineensis
NSM0905	1.2	14.0	Eclectica guineensis
NSM0906	1.2	14.0	Eclectica guineensis
NSM0907	1.2	14.0	Eclectica guineensis
NSM0908	1.2	14.0	Eclectica guineensis
NSM0909	1.2	14.0	Eclectica guineensis
NSM0910	1.2	14.0	Eclectica guineensis
NSM0911	1.2	14.0	Eclectica guineensis
NSM0912	1.2	14.0	Eclectica guineensis
NSM0913	1.2	14.0	Eclectica guineensis
NSM0914	1.2	14.0	Eclectica guineensis
NSM0915	1.2	14.0	Eclectica guineensis
NSM0916	1.2	14.0	Eclectica guineensis
NSM0917	1.2	14.0	Eclectica guineensis
NSM0918	1.2	14.0	Eclectica guineensis
NSM0919	1.2	14.0	Eclectica guineensis
NSM0920	1.2	14.0	Eclectica guineensis
NSM0921	1.2	14.0	Eclectica guineensis
NSM0922	1.2	14.0	Eclectica guineensis
NSM0923	1.2	14.0	Eclectica guineensis
NSM0924	1.2	14.0	Eclectica guineensis
NSM0925	1.2	14.0	Eclectica guineensis
NSM0926	1.2	14.0	Eclectica guineensis
NSM0927	1.2	14.0	Eclectica guineensis
NSM0928	1.2	14.0	Eclectica guineensis
NSM0929	1.2	14.0	Eclectica guineensis
NSM0930	1.2	14.0	Eclectica guineensis
NSM0931	1.2	14.0	Eclectica guineensis
NSM0932	1.2	14.0	Eclectica guineensis
NSM0933	1.2	14.0	Eclectica guineensis
NSM0934	1.2	14.0	Eclectica guineensis
NSM0935	1.2	14.0	Eclectica guineensis
NSM0936	1.2	14.0	Eclectica guineensis
NSM0937	1.2	14.0	Eclectica guineensis
NSM0938	1.2	14.0	Eclectica guineensis
NSM0939	1.2	14.0	Eclectica guineensis
NSM0940	1.2	14.0	Eclectica guineensis
NSM0941	1.2	14.0	Eclectica guineensis
NSM0942	1.2	14.0	Eclectica guineensis
NSM0943	1.2	14.0	Eclectica guineensis
NSM0944	1.2	14.0	Eclectica guineensis
NSM0945	1.2	14.0	Eclectica guineensis
NSM0946	1.2	14.0	Eclectica guineensis
NSM0947	1.2	14.0	Eclectica guineensis
NSM0948	1.2	14.0	Eclectica guineensis
NSM0949	1.2	14.0	Eclectica guineensis
NSM0950	1.2	14.0	Eclectica guineensis
NSM0951	1.2	14.0	Eclectica guineensis
NSM0952	1.2	14.0	Eclectica guineensis
NSM0953	1.2	14.0	Eclectica guineensis
NSM0954	1.2	14.0	Eclectica guineensis
NSM0955	1.2	14.0	Eclectica guineensis
NSM0956	1.2	14.0	Eclectica guineensis
NSM0957	1.2	14.0	Eclectica guineensis
NSM0958	1.2	14.0	Eclectica guineensis
NSM0959	1.2	14.0	Eclectica guineensis
NSM0960	1.2	14.0	Eclectica guineensis
NSM0961	1.2	14.0	Eclectica guineensis
NSM0962	1.2	14.0	Eclectica guineensis
NSM0963	1.2	14.0	Eclectica guineensis
NSM0964	1.2	14.0	Eclectica guineensis
NSM0965	1.2	14.0	Eclectica guineensis
NSM0966	1.2	14.0	Eclectica guineensis
NSM0967	1.2	14.0	Eclectica guineensis
NSM0968	1.2	14.0	Eclectica guineensis
NSM0969	1.2	14.0	Eclectica guineensis
NSM0970	1.2	14.0	Eclectica guineensis
NSM0971	1.2	14.0	Eclectica guineensis
NSM0972	1.2	14.0	Eclectica guineensis
NSM0973	1.2	14.0	Eclectica guineensis
NSM0974	1.2	14.0	Eclectica guineensis
NSM0975	1.2	14.0	Eclectica guineensis
NSM0976	1.2	14.0	Eclectica guineensis
NSM0977	1.2	14.0	Eclectica guineensis
NSM0978	1.2	14.0	Eclectica guineensis
NSM0979	1.2	14.0	Eclectica guineensis
NSM0980	1.2	14.0	Eclectica guineensis
NSM0981	1.2	14.0	Eclectica guineensis
NSM0982	1.2	14.0	Eclectica guineensis
NSM0983	1.2	14.0	Eclectica guineensis
NSM0984	1.2	14.0	Eclectica guineensis
NSM0985	1.2	14.0	Eclectica guineensis
NSM0986	1.2	14.0	Eclectica guineensis
NSM0987	1.2	14.0	Eclectica guineensis
NSM0988	1.2	14.0	Eclectica guineensis
NSM0989	1.2	14.0	Eclectica guineensis
NSM0990	1.2	14.0	Eclectica guineensis
NSM0991	1.2	14.0	Eclectica guineensis
NSM0992	1.2	14.0	Eclectica guineensis

TAGGED TREES DETAILS BY ARBORIST

Tag ID	Girth	Height	Tree Name
NSM0993	1.2	15.0	Heavea brasiliensis
NSM0994	1.4	12.0	Eclectica guineensis
NSM0995	2	24.0	Terminalia catappa
NSM0996	1.1	17.0	Heavea brasiliensis
NSM0997	1.1	16.0	Heavea brasiliensis
NSM0998	1.2	17.0	Eclectica guineensis
NSM0999	3.5	24.0	Eclectica guineensis
NSM1000	1.9	30.0	Eclectica guineensis
NSM1001	1.4	15.0	Heavea brasiliensis
NSM1002	1.4	14.0	Heavea brasiliensis
NSM1003	1.2	14.0	Heavea brasiliensis
NSM1004	1.4	14.0	Heavea brasiliensis
NSM1005	1.4	10.0	Heavea brasiliensis
NSM1006	1.3	15.0	Heavea brasiliensis
NSM1007	1.1	13.0	Heavea brasiliensis
NSM1008	1.2	13.0	Heavea brasiliensis
NSM1009	1.2	14.0	Heavea brasiliensis
NSM1010	1.5	16.0	Heavea brasiliensis
NSM1011	1.8	14.0	Heavea brasiliensis
NSM1012	1.2	15.0	Heavea brasiliensis
NSM1013	1.2	13.0	Heavea brasiliensis
NSM1014	1.2	15.0	Heavea brasiliensis
NSM1015	1	14.0	Heavea brasiliensis
NSM1016	1	12.0	Heavea brasiliensis
NSM1017	1.9	15.0	Heavea brasiliensis
NSM1018	1.7	17.0	Heavea brasiliensis
NSM1019	1.8	15.0	Heavea brasiliensis
NSM1020	1	16.0	Heavea brasiliensis
NSM1021	1	24.0	Heavea brasiliensis
NSM1022	1.7	16.0	Heavea brasiliensis
NSM1023	1.1	20.0	Heavea brasiliensis
NSM1024	1.2	14.0	Heavea brasiliensis
NSM1025	1.2	14.0	Heavea brasiliensis
NSM1026	1.1	14.0	Heavea brasiliensis
NSM1027	1.3	17.0	Heavea brasiliensis
NSM1028	1.3	14.0	Heavea brasiliensis
NSM1029	1	12.0	Heavea brasiliensis
NSM1030	1.2	14.0	Heavea brasiliensis
NSM1031	1.3	17.0	Heavea brasiliensis
NSM1032	1.2	14.0	Heavea brasiliensis
NSM1033	1.2	14.0	Heavea brasiliensis
NSM1034	1.4	14.0	Heavea brasiliensis
NSM1035	1.2	14.0	Heavea brasiliensis
NSM1036	1.2	14.0	Heavea brasiliensis
NSM1037	1.2	14.0	Heavea brasiliensis
NSM1038	1.2	14.0	Heavea brasiliensis
NSM1039	1.2	14.0	Heavea brasiliensis
NSM1040	1.4	14.0	Heavea brasiliensis
NSM1041	1	17.0	Ilaea elliptica
NSM1042	2.7	20.0	Heavea brasiliensis
NSM1043	1.2	15.0	Heavea brasiliensis
NSM1044	1.1	14.0	Heavea brasiliensis
NSM1045	1.8	8.0	Ilaea guineensis
NSM1046	1.1	17.0	Ilaea elliptica
NSM1047	1.6	14.0	Eclectica electo
NSM1048	2.5	10.0	Eclectica electo
NSM1049	1.8	17.0	Eclectica electo
NSM1050	2.2	15.0	Eclectica electo
NSM1051	2.2	12.0	Ilaea guineensis
NSM1052	1.1	12.0	Eclectica electo
NSM1053	2.5	15.0	Eclectica electo
NSM1054	1.1	12.0	Ilaea guineensis
NSM1055	2	12.0	Ilaea guineensis
NSM1056	1.6	12.0	Ilaea guineensis
NSM1057	1.1	16.0	Heavea brasiliensis
NSM1058	2.2	15.0	Ilaea guineensis
NSM1059	2.7	16.0	Syzygium grande
NSM1060	1	16.0	Heavea brasiliensis
NSM1061	2.7	20.0	Mangifera indica
NSM1062	1.2	12.0	Ilaea guineensis
NSM1063	1.7	16.0	Chrysophyllum fragrans
NSM1064	1.2	14.0	Heavea brasiliensis
NSM1065	1.2	14.0	Heavea brasiliensis
NSM1066	1.2	14.0	Heavea brasiliensis
NSM1067	1.1	16.0	Heavea brasiliensis
NSM1068	1.2	14.0	Heavea brasiliensis
NSM1069	1.2	14.0	Heavea brasiliensis
NSM1070	1.1	13.0	Heavea brasiliensis
NSM1071	1.5	14.0	Heavea brasiliensis
NSM1072	1.1	16.0	Heavea brasiliensis
NSM1073	1.2	14.0	Heavea brasiliensis
NSM1074	1	16.0	Heavea brasiliensis
NSM1075	1.2	15.0	Heavea brasiliensis
NSM1076	4	25.0	Syzygium grande
NSM1077	1.1	17.0	Chrysophyllum fragrans
NSM1078	1.1	16.0	Heavea brasiliensis
NSM1079	4	25.0	Syzygium grande
NSM1080	2.2	20.0	Chrysophyllum fragrans
NSM1081	2.9	25.0	Chrysophyllum fragrans
NSM1082	1.7	16.0	Chrysophyllum fragrans
NSM1083	1.2	15.0	Chrysophyllum fragrans
NSM1084	2.4	16.0	Chrysophyllum fragrans
NSM1085	2.4	14.0	Heavea brasiliensis
NSM1086	2	8.0	Ilaea guineensis
NSM1087	2.1	15.0	Eclectica electo
NSM1088	1.2	12.0	Spondiodea compositifolia
NSM1089	1.2	16.0	Heavea brasiliensis
NSM1090	1.2	16.0	Heavea brasiliensis
NSM1091	1.5	16.0	Thvia pinnata
NSM1092	1.2	16.0	Heavea brasiliensis
NSM1093	1.1	12.0	Ilaea guineensis
NSM1094	1.4	15.0	Heavea brasiliensis
NSM1095	1	13.0	Ilaea guineensis
NSM1096	1.5	13.0	Ilaea guineensis
NSM1097	1.2	15.0	Heavea brasiliensis
NSM1098	1.2	14.0	Ilaea guineensis
NSM1099	1.2	14.0	Heavea brasiliensis
NSM1100	1.9	14.0	Ilaea guineensis
NSM1101	1.6	14.0	Heavea brasiliensis
NSM1102	1.4	12.0	Thvia pinnata
NSM1103	1	14.0	Hephesilum oppocoumi
NSM1104	1.2	7.0	Ilaea guineensis
NSM1105	2	16.0	Hephesilum oppocoumi
NSM1106	1.2	14.0	Heavea brasiliensis
NSM1107	1.7	10.0	Ilaea guineensis
NSM1108	1.6	9.0	Ilaea guineensis
NSM1109	1.8	8.0	Ilaea guineensis
NSM1110	2.1	20.0	Dura zeylanica
NSM1111	1.1	13.0	Syzygium cerasiforme
NSM1112	2.2	12.0	Syzygium grande
NSM1113	1.2	14.0	Heavea brasiliensis
NSM1114	2.1	17.0	Antiaris toxicaria
NSM1115	2.5	18.0	Syzygium grande
NSM1116	1	15.0	Heavea brasiliensis
NSM1117	1.8	12.0	Syzygium grande
NSM1118	1.4	16.0	Heavea brasiliensis
NSM1119	1.1	16.0	Heavea brasiliensis
NSM1120	1.1	16.0	Heavea brasiliensis
NSM1121	1.8	16.0	Heavea brasiliensis

TAGGED TREES DETAILS BY ARBORIST

Tag ID	Girth	Height	Tree Name
NSM1122	1.2	14.0	Heavea brasiliensis
NSM1123	1.2	14.0	Ilaea guineensis
NSM1124	1.1	17.0	Heavea brasiliensis
NSM1125	1.3	12.0	Heavea brasiliensis
NSM1126	1.4	10.0	Heavea brasiliensis
NSM1127	1.5	10.0	Spondiodea compositifolia
NSM1128	1.8	12.0	Eclectica electo
NSM1129	1.2	12.0	Eclectica electo
NSM1130	1.2	13.0	Adenanthera pavonina
NSM1131	1.2	13.0	Eclectica electo
NSM1132	2.6	17.0	Spondiodea compositifolia
NSM1133	1.4	10.0	Hephesilum oppocoumi
NSM1134	1.4	10.0	Hephesilum oppocoumi
NSM1135	1.2	14.0	Heavea brasiliensis
NSM1136	1.2	15.0	Heavea brasiliensis
NSM1137	1.2	13.0	Heavea brasiliensis
NSM1138	1.7	12.0	Heavea brasiliensis
NSM1139	1.2	16.0	Heavea brasiliensis
NSM1140	1.2	16.0	Heavea brasiliensis
NSM1141	1.5	16.0	Heavea brasiliensis
NSM1142	1.2	17.0	Heavea brasiliensis
NSM1143	2.2	20.0	Spondiodea compositifolia
NSM1144	1.2	15.0	Eclectica electo
NSM1145	1.2	15.0	Heavea brasiliensis
NSM1146	1.7	12.0	Heavea brasiliensis
NSM1147	1.5	10.0	Dacryodes rostrata
NSM1148	1.4	9.0	Heavea brasiliensis
NSM1149	1.1	8.0	Heavea brasiliensis
NSM1150	1.3	15.0	Heavea brasiliensis
NSM1151	1.2	15.0	Heavea brasiliensis
NSM1152	1.2	15.0	Heavea brasiliensis
NSM1153	1.1	12.0	Heavea brasiliensis
NSM1154	1.4	15.0	Heavea brasiliensis
NSM1155	1.2	14.0	Heavea brasiliensis
NSM1156	1.2	14.0	Heavea brasiliensis
NSM1157	1.2	14.0	Heavea brasiliensis
NSM1158	1.2	14.0	Heavea brasiliensis
NSM1159	1.2	14.0	Heavea brasiliensis
NSM1160	1.3	15.0	Heavea brasiliensis
NSM1161	1.4	13.0	Heavea brasiliensis
NSM1162	1.3	15.0	Heavea brasiliensis
NSM1163	1.2	14.0	Heavea brasiliensis
NSM1164	1.2	14.0	Heavea brasiliensis
NSM1165	1.2	16.0	Heavea brasiliensis
NSM1166	1.2	14.0	Heavea brasiliensis
NSM1167	1.2	14.0	Heavea brasiliensis
NSM1168	2.1	15.0	Heavea brasiliensis
NSM1169	1.1	8.0	Ilaea guineensis
NSM1170	1.6	15.0	Heavea brasiliensis
NSM1171	1.7	10.0	Ilaea guineensis
NSM1172	2.5	14.0	Heavea brasiliensis
NSM1173	1.2	15.0	Heavea brasiliensis
NSM1174	1.8	15.0	Heavea brasiliensis
NSM1175	1.4	12.0	Heavea brasiliensis
NSM1176	4	10.0	Syzygium grande
NSM1177	1.3	16.0	Heavea brasiliensis
NSM1178	4	15.0	Syzygium grande
NSM1179	4	15.0	Syzygium grande
NSM1180	1.8	12.0	Heavea brasiliensis
NSM1181	6	10.0	cf. Bambusa vulgaris
NSM1182	1	12.0	Ilaea guineensis
NSM1183	1.5	16.0	Heavea brasiliensis
NSM1184	7	12.0	cf. Bambusa vulgaris
NSM1185	1.4	12.0	Heavea brasiliensis
NSM1186	1.4	12.0	Terminalia catappa
NSM1187	1.2	12.0	Heavea brasiliensis
NSM1188	1.7	12.0	Ficus vogeliana
NSM1189	1.8	15.0	Heavea brasiliensis
NSM1190	1.4	5.0	cf. Bambusa vulgaris
NSM1191	1.4	12.0	Heavea brasiliensis
NSM1192	2	8.0	cf. Bambusa vulgaris
NSM1193	2	8.0	cf. Bambusa vulgaris
NSM1194	1.4	11.0	Ficus vogeliana
NSM1195	1.1	13.0	Spondiodea cytherea
NSM1196	1.7	10.0	Dacryodes rostrata
NSM1197	1.2	13.0	Heavea brasiliensis
NSM1198	1.4	12.0	Heavea brasiliensis
NSM1199	1.8	12.0	Heavea brasiliensis
NSM1200	1.5	17.0	Ficus vogeliana
NSM1201	1.3	10.0	Heavea brasiliensis
NSM1202	1.5	12.0	Heavea brasiliensis
NSM1203	1.9	15.0	Heavea brasiliensis
NSM1204	1.7	13.0	Heavea brasiliensis
NSM1205	1.7	12.0	Heavea brasiliensis
NSM1206	1.1	14.0	Heavea brasiliensis
NSM1207	1.4	9.0	Heavea brasiliensis
NSM1208	1.1	8.0	Heavea brasiliensis
NSM1209	2.1	18.0	Spondiodea compositifolia
NSM1210	2	18.0	Heavea brasiliensis
NSM1211	2.4	14.0	Heavea brasiliensis
NSM1212	2.6	16.0	Heavea brasiliensis
NSM1213	2.6	18.0	Heavea brasiliensis
NSM1214	4.3	15.0	Ficus vogeliana
NSM1215	8	10.0	Spondiodea cytherea
NSM1216	1.4	10.0	Heavea brasiliensis
NSM1217	1.5	10.0	Heavea brasiliensis
NSM1218	1.3	15.0	Heavea brasiliensis
NSM1219	1.5	18.0	Spondiodea compositifolia
NSM1220	1.6	18.0	Heavea brasiliensis
NSM1221	1.1	12.0	Spondiodea compositifolia
NSM1222	2.4	20.0	Ficus vogeliana
NSM1223	1.2	8.0	Heavea brasiliensis
NSM1224	1.5	15.0	Heavea brasiliensis
NSM1225	1.3	8.0	Heavea brasiliensis
NSM1226	1.3	10.0	Spondiodea compositifolia
NSM1227	1.4	14.0	Spondiodea compositifolia
NSM1228	2.4	9.0	Ilaea guineensis
NSM1229	2.4	15.0	Spondiodea compositifolia
NSM1230	1.8	15.0	Spondiodea compositifolia
NSM1231	1.7	20.0	Ficus vogeliana
NSM1232	1.7	14.0	Ficus vogeliana
NSM1233	1.5	15.0	Heavea brasiliensis
NSM1234	1.4	18.0	Heavea brasiliensis
NSM1235	1.4	12.0	Heavea brasiliensis
NSM1236	1.4	9.0	Heavea brasiliensis
NSM1237	1.2	10.0	Ficus vogeliana
NSM1238	1.8	12.0	Heavea brasiliensis
NSM1239	1.2	12.0	Ilaea guineensis
NSM1240	2	8.0	cf. Bambusa vulgaris
NSM1241	1.2	15.0	Ficus vogeliana
NSM1242	2	8.0	cf. Bambusa vulgaris
NSM1243	4.8	30.0	Ficus vogeliana
NSM1244	1.1	12.0	Spondiodea compositifolia
NSM1245	1.5	17.0	Spondiodea compositifolia
NSM1246	1.1	12.0	Spondiodea compositifolia
NSM1247	2.2	20.0	Spondiodea compositifolia
NSM1248	1.2	12.0	Spondiodea compositifolia

TAGGED TREES DETAILS BY ARBORIST

Tag ID	Girth	Height	Tree Name
NSM1249	1.2	15.0	Heavea brasiliensis
NSM1250	1.1	14.0	Eclectica electo
NSM1251	3.5	20.0	Eclectica electo
NSM1252	1.1	14.0	Ilaea guineensis
NSM1253	1.1	13.0	Ilaea guineensis
NSM1254	1.1	17.0	Ficus vogeliana
NSM1255	1.2	14.0	Ilaea guineensis
NSM1256	1.2	14.0	Ilaea guineensis
NSM1257	1.5	14.0	Ilaea guineensis
NSM1258	2.5	16.0	Ficus vogeliana
NSM1259	1.1	13.0	Ficus vogeliana
NSM1260	3.3	13.0	Ficus bemjhonna
NSM1261	2.8	13.0	Ficus bemjhonna
NSM1262	2	13.0	Ficus microcarpa
NSM1263	1.1	10.0	Phoenicophorium tumphii
NSM1264	1.5	20.0	Syzygium polyanthum
NSM1265	1.6	10.0	Syzygium polyanthum
NSM1266	1.6	10.0	Xanthostemon chrysanthus
NSM1267	1.2	10.0	Phoenicophorium tumphii
NSM1268	1.1	10.0	Phoenicophorium tumphii
NSM1269	1.1	10.0	Syzygium grande
NSM1270	1.2	14.0	Syzygium polyanthum
NSM1271	1.4	14.0	Syzygium polyanthum
NSM1272	1.2	13.0	Chrysophyllum fragrans
NSM1273	1.2	13.0	Chrysophyllum fragrans
NSM1274	1.1	18.0	Ficus vogeliana
NSM1275	1.2	13.0	Syzygium grande
NSM1276	1.2	15.0	Eclectica electo
NSM1277	1.4	10.0	Spondiodea compositifolia
NSM1278	1.2	15.0	Eclectica electo
NSM1279	1.4	10.0	Eclectica electo
NSM1280	1.2	20.0	Eclectica electo
NSM1281	1.5	18.0	Eclectica electo
NSM1282	1.2	20.0	Eclectica electo
NSM1283	1.4	18.0	Eclectica electo
NSM1284	1.2	20.0	Eclectica electo
NSM1285	1.8	25.0	Eclectica electo
NSM1286	1.2	18.0	Eclectica electo
NSM1287	1.9	22.0	Eclectica electo
NSM1288	1.2	14.0	Eclectica electo
NSM1289	2.4	20.0	Eclectica electo
NSM1290	1	10.0	Ficus vogeliana
NSM1291	2.3	25.0	Eclectica electo
NSM1292	1.1	12.0	Spondiodea compositifolia
NSM1293	1.2	12.0	Spondiodea compositifolia
NSM1294	1.2	14.0	Spondiodea compositifolia
NSM1295	1	14.0	Spondiodea compositifolia
NSM1296	2.3	25.0	Eclectica electo
NSM1297	2.6	20.0	Eclectica electo
NSM1298	1.8	20.0	Eclectica electo
NSM1299	1.8	11.0	Eclectica guineensis
NSM1300	2	11.0	Eclectica guineensis
NSM1301	1	13.0	Eclectica guineensis
NSM1302	1.1	13.0	Syzygium polyanthum
NSM1303	1.1	13.0	Syzygium polyanthum
NSM1304	1	13.0	Syzygium polyanthum
NSM1305	1	13.0	Syzygium polyanthum
NSM1306	1	13.0	Syzygium polyanthum
NSM1307	1.2	13.0	Syzygium polyanthum
NSM1308	1.1	13.0	Syzygium polyanthum
NSM1309	1	12.0	Syzygium polyanthum
NSM1310	1	13.0	Syzygium polyanthum
NSM1311	1	13.0	Syzygium polyanthum
NSM1312	1.1	5.0	Leucaena leucocephala
NSM1313	1	13.0	Syzygium polyanthum
NSM1314	1.2	15.0	Syzygium polyanthum
NSM1315	1.5	13.0	Syzygium polyanthum
NSM1316	2	13.0	Syzygium polyanthum
NSM1317	1	12.0	Syzygium polyanthum
NSM1318	1	13.0	Syzygium polyanthum
NSM1319	1.1	13.0	Syzygium polyanthum
NSM1320	1.2	14.0	Leucaena leucocephala
NSM1321	1.1	18.0	Leucaena leucocephala
NSM1322	1.2	13.0	Leucaena leucocephala
NSM1323	1.5	15.0	Leucaena leucocephala
NSM1324	1.5	5.0	Ficus vogeliana
NSM1325	2	6.0	Ilaea guineensis
NSM1326	1.2	13.0	Syzygium polyanthum
NSM1327	1.2	10.0	Chrysophyllum fragrans
NSM1328	1.1	14.0	Syzygium polyanthum
NSM1329	1.2	14.0	Syzygium polyanthum
NSM1330	1.2	18.0	Eclectica electo
NSM1331	1.1	13.0	Syzygium polyanthum
NSM1332	1.2	17.0	Syzygium polyanthum
NSM1333	1.2	13.0	Syzygium polyanthum
NSM1334	1.2	14.0	Syzygium polyanthum
NSM1335	1.2	13.0	Syzygium polyanthum
NSM1336	1.2	13.0	Syzygium polyanthum
NSM1337	1.2	13.0	Chrysophyllum fragrans
NSM1338	1.2	13.0	Syzygium polyanthum
NSM1339	1.1	10.0	Syzygium polyanthum
NSM1340	1.4	14.0	Syzygium polyanthum
NSM1341	1.4	12.0	Eclectica electo
NSM1342	1	11.0	Eclectica electo
NSM1343	1.2	13.0	Eclectica guineensis
NSM1344	1.2	13.0	Eclectica guineensis
NSM1345	1.3	14.0	Eclectica guineensis
NSM1346	1.2	13.0	Eclectica guineensis
NSM1347	1.1	12.0	Terminalia catappa
NSM1348	1	14.0	Syzygium polyanthum
NSM1349	1.2	14.0	Eclectica electo
NSM1350	1.

JOB NO	JOB DESCRIPTION	SURVEYED BY
24183	TOPO SURVEY	Kumar 25-12-2025

NO.	GIRTH	HEIGHT	TREE_NAME
1	1.3m	13.0m	Java Plum (Syzygium cumini (L.))
2	1.1m	10.0m	Temenau (Cyrtophyllum fragrans (Roxb.))
3	0.8m	8.0m	Temenau (Cyrtophyllum fragrans (Roxb.))
4	0.8m	11.0m	Temenau (Cyrtophyllum fragrans (Roxb.))
5	0.8m	11.0m	Temenau (Cyrtophyllum fragrans (Roxb.))
6	1.0m	13.0m	Chengal Pasir (Hopea odorata Roxb.)
7	1.0m	11.0m	Chengal Pasir (Hopea odorata Roxb.)
8	0.7m	11.0m	Chengal Pasir (Hopea odorata Roxb.)
9	0.7m	11.0m	Chengal Pasir (Hopea odorata Roxb.)
10	0.7m	11.0m	Chengal Pasir (Hopea odorata Roxb.)
11	0.7m	11.0m	Chengal Pasir (Hopea odorata Roxb.)
12	0.7m	11.0m	Chengal Pasir (Hopea odorata Roxb.)
13	0.7m	11.0m	Chengal Pasir (Hopea odorata Roxb.)
14	0.5m	8.0m	Chengal Pasir (Hopea odorata Roxb.)
15	0.7m	11.0m	Chengal Pasir (Hopea odorata Roxb.)
16	0.7m	11.0m	Chengal Pasir (Hopea odorata Roxb.)
17	0.9m	6.0m	Mango Tree (Mangifera indica L.)
18	0.8m	9.0m	Chengal Pasir (Hopea odorata Roxb.)
19	0.8m	8.0m	Mangosteen (Garcinia mangostana L. var.)
20	1.8m	15.0m	Indian Almond (Terminalia catappa L.)
21	–	–	Chengal Pasir (Hopea odorata Roxb.)
22	–	–	Chengal Pasir (Hopea odorata Roxb.)
23	1.4m	5.0m	Mango Tree (Mangifera indica L.)
24	0.4m	3.0m	Mangosteen (Garcinia mangostana L. var.)
25	0.6m	5.0m	Chengal Pasir (Hopea odorata Roxb.)
26	1.1m	13.0m	Chengal Pasir (Hopea odorata Roxb.)
27	1.4m	13.0m	Chengal Pasir (Hopea odorata Roxb.)
28	0.6m	10.0m	Chengal Pasir (Hopea odorata Roxb.)
29	1.0m	11.0m	Dammar Pine (Agathis borneensis)
30	1.1m	13.0m	Chengal Pasir (Hopea odorata Roxb.)
31	0.7m	11.0m	Chengal Pasir (Hopea odorata Roxb.)
32	1.1m	13.0m	Chengal Pasir (Hopea odorata Roxb.)
33	0.4m	8.0m	Brazilian Ironwood (Libidibia ferrea (Mart. ex Tul.) L. P.)
34	0.4m	8.0m	Brazilian Ironwood (Libidibia ferrea (Mart. ex Tul.) L. P.)
35	0.9m	7.0m	Brazilian Ironwood (Libidibia ferrea (Mart. ex Tul.) L. P.)
36	0.7m	7.0m	Brazilian Ironwood (Libidibia ferrea (Mart. ex Tul.) L. P.)
37	0.8m	12.0m	Brazilian Ironwood (Libidibia ferrea (Mart. ex Tul.) L. P.)
38	0.5m	7.0m	Brazilian Ironwood (Libidibia ferrea (Mart. ex Tul.) L. P.)
39	0.5m	7.0m	Brazilian Ironwood (Libidibia ferrea (Mart. ex Tul.) L. P.)
40	0.5m	5.0m	Brazilian Ironwood (Libidibia ferrea (Mart. ex Tul.) L. P.)
41	0.4m	3.0m	Mangosteen (Garcinia mangostana L. var.)
42	0.4m	3.0m	Mangosteen (Garcinia mangostana L. var.)
43	0.4m	3.0m	Mangosteen (Garcinia mangostana L. var.)
44	2.1m	8.0m	Mango Tree (Mangifera indica L.)
45	0.7m	8.0m	Kayu Arang (Diospyros diepenhorstii Miq.)
46	0.3m	3.0m	Frangipani (Plumeria rubra)
47	0.2m	3.0m	Frangipani (Plumeria cultivars)
48	0.2m	3.0m	Frangipani (Plumeria cultivars)
49	0.2m	3.0m	Frangipani (Plumeria cultivars)
50	0.8m	10.0m	Chengal Pasir (Hopea odorata Roxb.)
51	0.7m	5.0m	Mangosteen (Garcinia mangostana L. var.)
52	0.6m	7.0m	Chengal Pasir (Hopea odorata Roxb.)
53	0.7m	8.0m	Kayu Arang (Diospyros diepenhorstii Miq.)
54	1.0m	11.0m	Chengal Pasir (Hopea odorata Roxb.)
55	0.7m	8.0m	Kayu Arang (Diospyros diepenhorstii Miq.)
56	0.2m	3.0m	Mangosteen (Garcinia mangostana L. var.)
57	0.4m	3.0m	Mangosteen (Garcinia mangostana L. var.)
58	0.2m	8.0m	Mango Tree (Mangifera indica L.)
59	0.2m	3.0m	Sapling
60	0.3m	3.0m	Mangosteen (Garcinia mangostana L. var.)
61	0.3m	3.0m	Mangosteen (Garcinia mangostana L. var.)
62	0.3m	3.0m	Mangosteen (Garcinia mangostana L. var.)
63	0.2m	3.0m	Frangipani (Plumeria cultivars)
64	0.2m	3.0m	Frangipani (Plumeria cultivars)
65	0.2m	3.0m	Frangipani (Plumeria cultivars)
66	0.2m	3.0m	Frangipani (Plumeria cultivars)
67	0.8m	10.0m	Kayu Arang (Diospyros diepenhorstii Miq.)
68	0.7m	6.0m	Mangosteen (Garcinia mangostana L. var.)
69	0.4m	4.0m	Mangosteen (Garcinia mangostana L. var.)
70	0.2m	4.0m	Sapling
71	0.3m	5.0m	Sapling
72	0.3m	5.0m	Sapling
73	0.7m	5.0m	Coconut Palm (Cocos nucifera L.)
74	0.7m	5.0m	Coconut Palm (Cocos nucifera L.)
75	0.7m	5.0m	Coconut Palm (Cocos nucifera L.)
76	0.1m	3.0m	Delaveya toxocarpa
77	0.1m	3.0m	Delaveya toxocarpa
78	0.1m	3.0m	Delaveya toxocarpa
79	0.1m	3.0m	Delaveya toxocarpa
80	0.3m	5.0m	Peacock Flower (Caesalpinia pulcherrima (L.) Sw.)
81	0.3m	5.0m	Peacock Flower (Caesalpinia pulcherrima (L.) Sw.)
82	0.8m	7.0m	Coconut Palm (Cocos nucifera L.)
83	1.1m	12.0m	Trumpet Tree (Tabebuia rosea (Bertol.) DC.)
84	0.2m	12.0m	Rubber Tree (Ficus elastica Roxb. ex Hornem.)
85	1.3m	10.0m	Rubber Tree (Ficus elastica Roxb. ex Hornem.)
86	0.1m	3.0m	Sapling
87	0.1m	3.0m	Sapling
88	0.1m	3.0m	Sapling
89	0.4m	5.0m	Sea Hibiscus (Hibiscus tiliaceus L.)
90	0.4m	5.0m	Sea Hibiscus (Hibiscus tiliaceus L.)
91	0.4m	5.0m	Sea Hibiscus (Hibiscus tiliaceus L.)
92	1.5m	13.0m	Delaveya toxocarpa
93	0.8m	6.0m	Kayu Manis (Cinnamomum verum)
94	0.6m	8.0m	Jackfruit (Artocarpus heterophyllus Lam.)
95	0.7m	8.0m	Trumpet Tree (Tabebuia rosea (Bertol.) DC.)
96	1.6m	15.0m	Rubber Tree (Ficus elastica Roxb. ex Hornem.)
97	1.2m	14.0m	Rubber Tree (Ficus elastica Roxb. ex Hornem.)
98	1.6m	12.0m	Sea Apple (Syzygium grande (Wight) Walp.)
99	1.4m	9.0m	Delaveya toxocarpa
100	2.0m	6.0m	Oil Palm (Elaeis guineensis)
101	0.4m	10.0m	Delaveya toxocarpa
102	1.3m	12.0m	Common Pulai (Alstonia angustiloba Miq.)
103	0.3m	3.0m	Mango Tree (Mangifera indica L.)
104	0.8m	8.0m	Fishtail Palm (Caryota mitis Lour.)
105	0.2m	1.0m	Coconut Palm (Cocos nucifera L.)
106	0.3m	1.0m	Coconut Palm (Cocos nucifera L.)
107	0.2m	1.0m	Red Frangipani (Plumeria rubra)
108	0.1m	2.0m	Red Frangipani (Plumeria rubra)
109	1.0m	8.0m	Fishtail Palm (Caryota mitis Lour.)
110	1.0m	8.0m	Fishtail Palm (Caryota mitis Lour.)
111	2.3m	12.0m	Oil Palm (Elaeis guineensis)
112	0.3m	2.0m	Coconut Palm (Cocos nucifera L.)
113	1.0m	9.0m	Red Frangipani (Plumeria rubra)
114	0.2m	3.0m	Jackfruit (Artocarpus heterophyllus Lam.)
115	0.1m	2.0m	Delaveya toxocarpa
116	0.7m	4.0m	Coconut Palm (Cocos nucifera L.)
117	0.1m	3.0m	Neem Tree (Azadirachta indica A. Juss.)
118	0.7m	7.0m	Neem Tree (Azadirachta indica A. Juss.)
119	0.4m	5.0m	Mango Tree (Mangifera indica L.)
120	0.4m	5.0m	Mango Tree (Mangifera indica L.)
121	0.7m	6.0m	Coconut Palm (Cocos nucifera L.)
122	7.7m	4.0m	Mango Tree (Mangifera indica L.)
123	0.3m	2.0m	Coconut Palm (Cocos nucifera L.)
124	0.3m	2.0m	Coconut Palm (Cocos nucifera L.)
125	0.3m	2.0m	Coconut Palm (Cocos nucifera L.)
126	0.6m	6.0m	Coconut Palm (Cocos nucifera L.)
127	1.0m	6.0m	Coconut Palm (Cocos nucifera L.)
128	0.5m	1.0m	Silver Bismarck Palm (Bismarckia nobilis 'Silver')
129	0.3m	1.0m	Silver Bismarck Palm (Bismarckia nobilis 'Silver')
130	0.8m	4.0m	Coconut Palm (Cocos nucifera L.)
131	1.5m	5.0m	Wild Areca Palm (Areca triandra)
132	0.8m	5.0m	Wild Areca Palm (Areca triandra)
133	0.2m	3.0m	Cheese Fruit (Morinda citrifolia L.)
134	0.7m	6.0m	Cuban Royal Palm (Roystonea regia (Kunth) O.F.Cook)
135	1.2m	10.0m	Cuban Royal Palm (Roystonea regia (Kunth) O.F.Cook)
136	1.2m	10.0m	Cuban Royal Palm (Roystonea regia (Kunth) O.F.Cook)
137	0.4m	3.0m	Butterfly Palm (Chrysalidocarpus lutescens H.Wendl.)
138	0.3m	3.0m	Butterfly Palm (Chrysalidocarpus lutescens H.Wendl.)
139	0.3m	2.0m	Coconut Palm (Cocos nucifera L.)
140	0.6m	3.0m	Malabar Gooseberry (Melastoma malabathricum L.)
141	0.7m	8.0m	Kelat sil (Syzygium myrtifolium (Roxb.) Walp.)
142	0.9m	7.0m	Kelat sil (Syzygium myrtifolium (Roxb.) Walp.)
143	0.7m	7.0m	Kelat sil (Syzygium myrtifolium (Roxb.) Walp.)
144	0.7m	7.0m	Kelat sil (Syzygium myrtifolium (Roxb.) Walp.)
145	0.3m	6.0m	Kelat sil (Syzygium myrtifolium (Roxb.) Walp.)
146	0.3m	6.0m	Kelat sil (Syzygium myrtifolium (Roxb.) Walp.)
147	0.7m	6.0m	Kelat sil (Syzygium myrtifolium (Roxb.) Walp.)
148	1.0m	8.0m	Kelat sil (Syzygium myrtifolium (Roxb.) Walp.)
149	1.0m	9.0m	Kelat sil (Syzygium myrtifolium (Roxb.) Walp.)
150	1.0m	8.0m	Kelat sil (Syzygium myrtifolium (Roxb.) Walp.)
151	1.0m	8.0m	Kelat sil (Syzygium myrtifolium (Roxb.) Walp.)
152	1.0m	8.0m	Kelat sil (Syzygium myrtifolium (Roxb.) Walp.)
153	0.4m	7.0m	Kelat sil (Syzygium myrtifolium (Roxb.) Walp.)
154	0.4m	7.0m	Durian (Durio zibethinus L.)
155	0.9m	12.0m	Jackfruit (Artocarpus heterophyllus Lam.)
156	0.7m	8.0m	Kelat sil (Syzygium myrtifolium (Roxb.) Walp.)
157	0.7m	8.0m	Kelat sil (Syzygium myrtifolium (Roxb.) Walp.)
158	0.7m	8.0m	Kelat sil (Syzygium myrtifolium (Roxb.) Walp.)
159	0.7m	8.0m	Kelat sil (Syzygium myrtifolium (Roxb.) Walp.)
160	0.7m	8.0m	Kelat sil (Syzygium myrtifolium (Roxb.) Walp.)
161	0.4m	6.0m	Kelat sil (Syzygium myrtifolium (Roxb.) Walp.)
162	0.4m	6.0m	Kelat sil (Syzygium myrtifolium (Roxb.) Walp.)
163	0.4m	6.0m	Kelat sil (Syzygium myrtifolium (Roxb.) Walp.)
164	0.4m	6.0m	Kelat sil (Syzygium myrtifolium (Roxb.) Walp.)
165	0.3m	2.0m	Sapling
166	0.3m	2.0m	Sapling
167	1.1m	8.0m	Butterfly Tree (Bauhinia)
168	0.5m	8.0m	Chengal Pasir (Hopea odorata Roxb.)
169	1.4m	8.0m	Chengal Pasir (Hopea odorata Roxb.)
170	1.1m	6.0m	Chengal Pasir (Hopea odorata Roxb.)
171	1.3m	16.0m	Chengal Pasir (Hopea odorata Roxb.)
172	0.8m	10.0m	Chengal Pasir (Hopea odorata Roxb.)
173	0.3m	3.0m	Sapling
174	0.8m	6.0m	Kayu Manis Hutan (Cinnamomum iners Reinw. ex Blume)
175	0.2m	3.0m	Sapling
176	0.3m	5.0m	Sapling
177	0.3m	5.0m	Sapling
178	0.3m	5.0m	Sapling

NO.	GIRTH	HEIGHT	TREE_NAME
179	0.3m	5.0m	Sapling
180	0.3m	5.0m	Sapling
181	0.3m	5.0m	Sapling
182	0.3m	5.0m	Sapling
183	0.3m	5.0m	Sapling
184	0.3m	5.0m	Sapling
185	0.3m	5.0m	Sapling
186	0.3m	5.0m	Sapling
187	0.3m	5.0m	Sapling
188	1.2m	15.0m	Chengal Pasir (Hopea odorata Roxb.)
189	1.0m	10.0m	Island Lychee (Pometia pinnata J.R.Forst. & G.Forst.)
190	1.0m	10.0m	Island Lychee (Pometia pinnata J.R.Forst. & G.Forst.)
191	0.5m	7.0m	Kelat sil (Syzygium myrtifolium (Roxb.) Walp.)
192	0.7m	5.0m	Kelat sil (Syzygium myrtifolium (Roxb.) Walp.)
193	0.3m	6.0m	Kelat sil (Syzygium myrtifolium (Roxb.) Walp.)
194	0.3m	6.0m	Kelat sil (Syzygium myrtifolium (Roxb.) Walp.)
195	0.5m	5.0m	Kelat sil (Syzygium myrtifolium (Roxb.) Walp.)
196	0.1m	3.0m	Kelat sil (Syzygium myrtifolium (Roxb.) Walp.)
197	0.3m	6.0m	Kelat sil (Syzygium myrtifolium (Roxb.) Walp.)
198	0.3m	6.0m	Kelat sil (Syzygium myrtifolium (Roxb.) Walp.)
199	0.3m	6.0m	Kelat sil (Syzygium myrtifolium (Roxb.) Walp.)
200	0.3m	6.0m	Kelat sil (Syzygium myrtifolium (Roxb.) Walp.)
201	0.3m	6.0m	Kelat sil (Syzygium myrtifolium (Roxb.) Walp.)
202	0.3m	6.0m	Kelat sil (Syzygium myrtifolium (Roxb.) Walp.)
203	0.3m	6.0m	Kelat sil (Syzygium myrtifolium (Roxb.) Walp.)
204	0.4m	5.0m	African Sandalwood Tree (Osyris lanceolata)
205	0.4m	5.0m	African Sandalwood Tree (Osyris lanceolata)
206	0.4m	5.0m	African Sandalwood Tree (Osyris lanceolata)
207	0.4m	5.0m	African Sandalwood Tree (Osyris lanceolata)
208	0.4m	5.0m	African Sandalwood Tree (Osyris lanceolata)
209	0.4m	5.0m	African Sandalwood Tree (Osyris lanceolata)
210	0.4m	5.0m	African Sandalwood Tree (Osyris lanceolata)
211	0.4m	50m	African Sandalwood Tree (Osyris lanceolata)
212	0.4m	5.0m	African Sandalwood Tree (Osyris lanceolata)
213	0.4m	5.0m	African Sandalwood Tree (Osyris lanceolata)
214	0.4m	5.0m	African Sandalwood Tree (Osyris lanceolata)
215	0.4m	5.0m	African Sandalwood Tree (Osyris lanceolata)
216	0.4m	5.0m	African Sandalwood Tree (Osyris lanceolata)
217	0.4m	5.0m	African Sandalwood Tree (Osyris lanceolata)
218	3.1m	18.0m	Sea Apple (Syzygium grande (Wight) Walp.)
219	3.2m	18.0m	Sea Apple (Syzygium grande (Wight) Walp.)
220	3.0m	6.0m	Yellow Cane Palm (Chrysalidocarpus lutescens H.Wendl.)
221	0.4m	6.0m	Sapling
222	0.4m	6.0m	Sapling
223	0.4m	6.0m	Sapling
224	0.4m	6.0m	Sapling
225	0.5m	6.0m	Kayu Manis Hutan (Cinnamomum iners Reinw. ex Blume)
226	0.4m	6.0m	Rambutan (Nephelium lappaceum L. var. lappaceum)
227	0.3m	6.0m	Fishtail Palm (Caryota mitis Lour.)
228	0.3m	6.0m	Sapling
229	0.3m	6.0m	Sapling
230	0.6m	6.0m	Sapling
231	0.3m	6.0m	Sapling
232	0.3m	6.0m	Sapling
233	0.3m	6.0m	Sapling
234	0.3m	6.0m	Sapling
235	0.3m	6.0m	Sapling
236	0.3m	6.0m	Sapling
237	0.3m	6.0m	Sapling
238	0.3m	6.0m	Sapling
239	0.3m	6.0m	Sapling
240	0.3m	6.0m	Sapling
241	0.3m	6.0m	Sapling
242	0.3m	6.0m	Sapling
243	2.0m	12.0m	Mango Tree (Mangifera indica L.)
244	1.8m	6.0m	Wild Oil Palm (Elaeis guineensis)
245	0.3m	7.5m	Rambutan (Nephelium lappaceum L. var. lappaceum)
246	0.3m	7.5m	Rambutan (Nephelium lappaceum L. var. lappaceum)
247	0.3m	5.0m	Rambutan (Nephelium lappaceum L. var. lappaceum)
248	0.9m	7.0m	Derum Seluchor (Crotaxylum cochinchinense (Lour.) Blum)
249	0.6m	6.0m	Derum Seluchor (Crotaxylum cochinchinense (Lour.) Blum)
250	0.7m	7.0m	Derum Seluchor (Crotaxylum cochinchinense (Lour.) Blum)
251	0.6m	6.0m	Durian (Durio zibethinus L.)
252	0.6m	6.0m	Durian (Durio zibethinus L.)
253	0.6m	6.0m	Chengal Pasir (Hopea odorata Roxb.)
254	1.0m	12.0m	Chengal Pasir (Hopea odorata Roxb.)
255	0.5m	7.0m	Chengal Pasir (Hopea odorata Roxb.)
256	1.1m	12.0m	Yellow Flame (Peltophorum pterocarpum (DC.) Backer ex K.Heyne)
257	1.0m	7.0m	Yellow Flame (Peltophorum pterocarpum (DC.) Backer ex K.Heyne)
258	0.6m	8.0m	Chengal Pasir (Hopea odorata Roxb.)
259	0.4m	6.0m	Yellow Cane Palm (Chrysalidocarpus lutescens H.Wendl.)
260	2.5m	8.0m	Wild Oil Palm (Elaeis guineensis)
261	1.5m	11.0m	Rain Tree (Samanea saman (Jacq.) Merr.)
262	1.8m	7.0m	Wild Oil Palm (Elaeis guineensis)
263	0.3m	5.0m	Kayu Manis Hutan (Cinnamomum iners Reinw. ex Blume)
264	0.6m	8.0m	Kayu Manis Hutan (Cinnamomum iners Reinw. ex Blume)
265	0.3m	5.0m	Kayu Manis Hutan (Cinnamomum iners Reinw. ex Blume)
266	0.7m	6.0m	Rubber Tree (Ficus elastica Roxb. ex Hornem.)
267	2.0m	6.0m	Wild Oil Palm (Elaeis guineensis)
268	2.0m	6.0m	Wild Oil Palm (Elaeis guineensis)
269	2.0m	6.0m	Wild Oil Palm (Elaeis guineensis)
270	2.0m	6.0m	Wild Oil Palm (Elaeis guineensis)
271	2.0m	6.0m	Wild Oil Palm (Elaeis guineensis)
272	0.4m	6.0m	Wild Oil Palm (Elaeis guineensis)
273	0.3m	6.0m	Sapling
274	0.3m	6.0m	Sapling
275	0.3m	6.0m	Sapling
276	0.3m	6.0m	Sapling
277	0.7m	10.0m	Kayu Manis Hutan (Cinnamomum iners Reinw. ex Blume)
278	0.5m	6.0m	Kayu Manis Hutan (Cinnamomum iners Reinw. ex Blume)
279	1.6m	6.0m	Kayu Manis Hutan (Cinnamomum iners Reinw. ex Blume)
280	0.5m	6.0m	Kayu Manis Hutan (Cinnamomum iners Reinw. ex Blume)
281	1.9m	10.0m	Rubber Tree (Ficus elastica Roxb. ex Hornem.)
282	0.3m	7.0m	Sapling
283	0.3m	7.0m	Sapling
284	0.3m	7.0m	Sapling
285	0.3m	7.0m	Sapling
286	0.3m	7.0m	Sapling
287	0.3m	7.0m	Sapling
288	0.3m	7.0m	Sapling
289	0.3m	7.0m	Sapling
290	0.6m	7.0m	Sapling
291	1.2m	12.0m	Kayu Manis Hutan (Cinnamomum iners Reinw. ex Blume)
292	0.3m	4.0m	Kayu Manis Hutan (Cinnamomum iners Reinw. ex Blume)
293	1.5m	10.0m	Kayu Manis Hutan (Cinnamomum iners Reinw. ex Blume)
294	0.5m	6.0m	Kayu Manis Hutan (Cinnamomum iners Reinw. ex Blume)
295	0.5m	6.0m	Kayu Manis Hutan (Cinnamomum iners Reinw. ex Blume)
296	0.3m	4.0m	Kayu Manis Hutan (Cinnamomum iners Reinw. ex Blume)
297	0.3m	5.0m	Sapling
298	0.6m	7.0m	Kayu Manis Hutan (Cinnamomum iners Reinw. ex Blume)
299	0.6m	8.0m	Sapling
300	0.3m	6.0m	Sapling
301	0.3m	6.0m	Sapling
302	0.3m	6.0m	Sapling
303	0.3m	6.0m	Sapling
304	0.3m	6.0m	Sapling
305	0.3m	6.0m	Sapling
306	0.3m	6.0m	Sapling
307	0.3m	6.0m	Sapling
308	0.3m	6.0m	Sapling
309	0.3m	6.0m	Sapling
310	0.8m	8.0m	Frangipani (Plumeria cultivars)
311	0.3m	6.0m	Frangipani (Plumeria cultivars)
312	1.0m	6.0m	Chengal Pasir (Hopea odorata Roxb.)
313	0.6m	8.0m	Chengal Pasir (Hopea odorata Roxb.)
314	0.8m	8.0m	Chengal Pasir (Hopea odorata Roxb.)
315	0.9m	14.0m	Chengal Pasir (Hopea odorata Roxb.)
316	0.7m	13.0m	Chengal Pasir (Hopea odorata Roxb.)
317	0.6m	12.0m	Chengal Pasir (Hopea odorata Roxb.)
318	1.0m	15.0m	Chengal Pasir (Hopea odorata Roxb.)
319	0.7m	10.0m	Chengal Pasir (Hopea odorata Roxb.)
320	0.8m	10.0m	Chengal Pasir (Hopea odorata Roxb.)
321	0.6m	8.0m	Rubber Tree (Ficus elastica Roxb. ex Hornem.)
322	0.6m	8.0m	Rubber Tree (Ficus elastica Roxb. ex Hornem.)
323	0.7m	7.0m	Derum Seluchor (Crotaxylum cochinchinense (Lour.) Blum)
324	0.4m	6.0m	Sea Apple (Syzygium grande (Wight) Walp.)
325	1.5m	10.0m	Yellow Flame (Peltophorum pterocarpum (DC.) Backer ex K.Heyne)
326	1.8m	5.0m	African Sandalwood Tree (Osyris lanceolata)
327	0.4m	8.0m	Kelat sil (Syzygium myrtifolium (Roxb.) Walp.)
328	0.4m	8.0m	Kelat sil (Syzygium myrtifolium (Roxb.) Walp.)
329	0.4m	8.0m	Kelat sil (Syzygium myrtifolium (Roxb.) Walp.)
330	1.0m	8.0m	Kelat sil (Syzygium myrtifolium (Roxb.) Walp.)
331	0.8m	8.0m	Kelat sil (Syzygium myrtifolium (Roxb.) Walp.)
332	0.8m	8.0m	Kelat sil (Syzygium myrtifolium (Roxb.) Walp.)
333	0.4m	8.0m	Kelat sil (Syzygium myrtifolium (Roxb.) Walp.)
334	0.3m	6.0m	Soursop (Annona muricata L.)
335	0.4m	2.0m	Water Gum (Tristaniopsis laurina)
336	0.1m	3.0m	Yellow Cow Wood (Cratoxylum cochinchinense (Lour.) Blume)
337	0.5m	6.0m	Soursop (Annona muricata L.)
338	0.05m	0.3m	Water Gum (Tristaniopsis laurina)
339	0.05m	3.0m	Yellow Cow Wood (Cratoxylum cochinchinense (Lour.) Blume)
340	0.5m	5.0m	Soursop (Annona muricata L.)
341	0.1m	3.0m	Water Gum (Tristaniopsis laurina)
342	0.1m	3.0m	Yellow Cow Wood (Cratoxylum cochinchinense (Lour.) Blume)
343	0.3m	4.0m	Soursop (Annona muricata L.)
344	0.1m	4.0m	Water Gum (Tristaniopsis laurina)
345	0.2m	4.0m	Yellow Cow Wood (Cratoxylum cochinchinense (Lour.) Blume)
346	0.4m	6.0m	Soursop (Annona muricata L.)
347	0.03m	3.0m	Water Gum (Tristaniopsis laurina)
348	0.2m	4.0m	Yellow Cow Wood (Cratoxylum cochinchinense (Lour.) Blume)
349	0.4m	5.0m	Soursop (Annona muricata L.)
350	0.03m	4.0m	Water Gum (Tristaniopsis laurina)
351	0.2m	1.0m	Yellow Cow Wood (Cratoxylum cochinchinense (Lour.) Blume)
352	0.4m	5.0m	Soursop (Annona muricata L.)
353	0.02m	3.0m	Water Gum (Tristaniopsis laurina)
354	0.2m	3.0m	Yellow Cow Wood (Cratoxylum cochinchinense (Lour.) Blume)
355	0.4m	6.0m	Soursop (Annona muricata L.)
356	0.02m	3.0m	Water Gum (Tristaniopsis laurina)

NO.	GIRTH	HEIGHT	TREE_NAME
357	0.2m	4.0m	Yellow Cow Wood (Cratoxylum cochinchinense (Lour.) Blume)
358	0.4m	6.0m	Soursop (Annona muricata L.)
359	0.02m	3.0m	Water Gum (Tristaniopsis laurina)
360	0.4m	6.0m	Rain Tree (Samanea saman (Jacq.) Merr.)
361	0.07m	3.0m	Water Gum (Tristaniopsis laurina)
362	0.3m	5.0m	Rain Tree (Samanea saman (Jacq.) Merr.)
363	0.3m	5.0m	Water Gum (Tristaniopsis laurina)
364	0.6m	6.0m	Rain Tree (Samanea saman (Jacq.) Merr.)
365	0.2m	4.0m	Yellow Cow Wood (Cratoxylum cochinchinense (Lour.) Blume)
366	0.5m	4.0m	Neem Tree (Azadirachta indica A. Juss.)
367	0.4m	5.0m	Rain Tree (Samanea saman (Jacq.) Merr.)
368	1.0m	4.0m	Yellow Cow Wood (Cratoxylum cochinchinense (Lour.) Blume)
369	0.7m	5.0m	Neem Tree (Azadirachta indica A. Juss.)
370	0.8m	6.0m	Rain Tree (Samanea saman (Jacq.) Merr.)
371	0.1m	4.0m	Yellow Cow Wood (Cratoxylum cochinchinense (Lour.) Blume)
372	0.4m	3.0m	Neem Tree (Azadirachta indica A. Juss.)
373	0.5m	5.0m	Rain Tree (Samanea saman (Jacq.) Merr.)
374	0.2m	4.0m	Yellow Cow Wood (Cratoxylum cochinchinense (Lour.) Blume)
375	0.6m	6.0m	Neem Tree (Azadirachta indica A. Juss.)
376	0.8m	6.0m	Rain Tree (Samanea saman (Jacq.) Merr.)
377	0.1m	4.0m	Yellow Cow Wood (Cratoxylum cochinchinense (Lour.) Blume)
378	0.6m	6.0m	Neem Tree (Azadirachta indica A. Juss.)
379	0.6m	6.0m	Rain Tree (Samanea saman (Jacq.) Merr.)
380	0.1m	5.0m	Yellow Cow Wood (Cratoxylum cochinchinense (Lour.) Blume)
381	0.6m	7.0m	Neem Tree (Azadirachta indica A. Juss.)
382	0.6m	6.0m	Rain Tree (Samanea saman (Jacq.) Merr.)
383	0.1m	5.0m	Yellow Cow Wood (Cratoxylum cochinchinense (Lour.) Blume)
384	0.2m	3.0m	Neem Tree (Azadirachta indica A. Juss.)
385	0.1m	3.0m	White Mulberry (Morus alba)
386	0.1m	3.0m	White Mulberry (Morus alba)
387	0.1m	3.0m	White Mulberry (Morus alba)
388	0.1m	3.0m	White Mulberry (Morus alba)
389	0.1m	3.0m	White Mulberry (Morus alba)
390	0.1m	3.0m	White Mulberry (Morus alba)
391	0.1m	3.0m	White Mulberry (Morus alba)
392	0.1m	3.0m	White Mulberry (Morus alba)
393	0.1m	3.0m	White Mulberry (Morus alba)
394	0.1m	3.0m	White Mulberry (Morus alba)
395	0.1m	3.0m	White Mulberry (Morus alba)
396	0.1m	3.0m	White Mulberry (Morus alba)
397	0.1m	3.0m	White Mulberry (Morus alba)
398	0.1m	3.0m	White Mulberry (Morus alba)
399	0.1m	3.0m	White Mulberry (Morus alba)
400	0.1m	3.0m	White Mulberry (Morus alba)
401	0.1m	3.0m	White Mulberry (Morus alba)
402	0.1m	3.0m	White Mulberry (Morus alba)
403	0.1m	3.0m	White Mulberry (Morus alba)
404	0.1m	3

Appendix B – Flora Data

S/N	Species	Family (Final)	Origin	Status
1	*Acacia auriculiformis*	Fabaceae	Non-Native	Naturalised
2	*Acalypha siamensis*	Euphorbiaceae	Non-Native	Naturalised
3	*Adenanthera pavonina*	Fabaceae	Non-Native	Naturalised
4	*Adiantum latifolium*	Pteridaceae	Non-Native	Naturalised
5	*Adina eurhyncha*	Rubiaceae	Native	Vulnerable
6	*Adinandra dumosa*	Pentaphylacaceae	Native	Least Concern
7	*Agelaea macrophylla*	Connaraceae	Native	Least Concern
8	*Aglaonema commutatum*	Araceae	Non-Native	Casual
9	*Allamanda cathartica*	Apocynaceae	Non-Native	Naturalised
10	*Alocasia macrorrhizos*	Araceae	Non-Native	Naturalised
11	*Alsophila latebrosa*	Cyatheaceae	Native	Least Concern
12	*Alstonia scholaris*	Apocynaceae	Non-Native	Naturalised
13	*Alstonia angustiloba*	Apocynaceae	Native	Least Concern
14	*Alternanthera 'Sissoo'*	Amaranthaceae	Non-Native	Cultivated
15	*Amblovenatum opulentum*	Thelypteridaceae	Native	Least Concern
16	*Ananas comosus*	Bromeliaceae	Non-Native	Cultivated
17	*Andira inermis*	Fabaceae	Non-Native	Casual
18	*Angelesia splendens*	Chrysobalanaceae	Native	Vulnerable
19	*Angiopteris evecta*	Marattiaceae	Native	Vulnerable
20	*Anisophyllea disticha*	Anisophylleaceae	Native	Least Concern
21	*Aphanamixis polystachya*	Meliaceae	Native	Least Concern
22	*Aporosa benthamiana*	Phyllanthaceae	Native	Vulnerable
23	*Aporosa frutescens*	Phyllanthaceae	Native	Least Concern
24	*Archidendron microcarpum*	Fabaceae	Native	Endangered
25	*Archidendron clypearia*	Fabaceae	Native	Least Concern
26	*Ardisia elliptica*	Primulaceae	Native	Least Concern
27	*Areca catechu*	Arecaceae	Non-Native	Casual
28	*Arthrophyllum jackianum*	Araliaceae	Native	Least Concern
29	*Artocarpus dadah*	Moraceae	Native	Endangered
30	*Artocarpus elasticus*	Moraceae	Native	Least Concern
31	*Artocarpus heterophyllus*	Moraceae	Non-Native	Casual
32	*Artocarpus integer* var. *integer*	Moraceae	Cryptogenic	Cryptogenic
33	*Aspidopterys concava*	Malpighiaceae	Native	Endangered
34	*Asplenium longissimum*	Aspleniaceae	Native	Least Concern
35	*Asplenium nidus* var. *nidus*	Aspleniaceae	Native	Least Concern
36	*Asystasia gangetica* subsp. *micrantha*	Acanthaceae	Non-Native	Naturalised
37	*Averrhoa carambola*	Oxalidaceae	Non-Native	Casual
38	*Axonopus compressus*	Poaceae	Non-Native	Naturalised
39	*Baccaurea motleyana*	Phyllanthaceae	Native	Critically Endangered (Cultivated)
40	*Bambusa vulgaris*	Poaceae	Non-Native	Casual
41	*Baphia nitida*	Fabaceae	Non-Native	Casual
42	*Bergera koenigii*	Rutaceae	Non-Native	Casual
43	*Bhesa paniculata*	Centroplacaceae	Native	Least Concern
44	*Blechnopsis finlaysoniana*	Blechnaceae	Native	Least Concern
45	*Blechnopsis orientalis*	Blechnaceae	Native	Least Concern
46	*Bouea macrophylla*	Anacardiaceae	Native	Critically Endangered
47	*Breynia androgyna*	Phyllanthaceae	Native	Vulnerable
48	*Bridelia stipularis*	Phyllanthaceae	Native	Least Concern
49	*Bromheadia finlaysoniana*	Orchidaceae	Native	Least Concern
50	*Caladium bicolor cultivars*	Araceae	Non-Native	Cultivated
51	*Callicarpa longifolia*	Lamiaceae	Native	Vulnerable

S/N	Species	Family (Final)	Origin	Status
52	*Callisia repens*	Commelinaceae	Non-Native	Cultivated
53	*Calophyllum soulattri*	Calophyllaceae	Native	Critically Endangered (Cultivated)
54	*Calophyllum tetrapterum*	Calophyllaceae	Native	Vulnerable
55	*Campnosperma auriculatum*	Anacardiaceae	Native	Least Concern
56	*Caryota mitis*	Arecaceae	Native	Least Concern
57	*Causonis trifolia*	Vitaceae	Native	DD
58	*Centella asiatica*	Apiaceae	Native	Least Concern
59	*Centotheca lappacea*	Poaceae	Native	Least Concern
60	*Cerbera odollam*	Apocynaceae	Native	Vulnerable
61	*Cinnamomum iners*	Lauraceae	Native	Least Concern
62	*Cissus repens*	VItaceae	Native	Vulnerable
63	*Cissus hastata*	Vitaceae	Native	Least Concern
64	*Claoxylon indicum*	Euphorbiaceae	Native	Least Concern
65	*Clerodendrum disparifolium*	Lamiaceae	Native	Least Concern
66	*Clerodendrum paniculatum*	Lamiaceae	Non-Native	Naturalised
67	*Coccinia grandis*	Cucurbitaceae	Non-Native	Naturalised
68	*Cocos nucifera*	Arecaceae	Non-Native	Naturalised
69	*Coleus monostachyus*	Lamiaceae	Non-Native	Naturalised
70	*Colocasia esculenta*	Araceae	Non-Native	Casual
71	*Commelina diffusa*	Commelinaceae	Cryptogenic	Cryptogenic
72	*Congea tomentosa*	Lamiaceae	Non-Native	Casual
73	*Costus lucanusianus*	Costaceae	Non-Native	Casual
74	*Costus woodsonii*	Costaceae	Non-Native	Cultivated
75	*Cryptocarya rugulosa*	Lauraceae	Native	Critically Endangered
76	*Cyathula prostrata*	Amaranthaceae	Native	Least Concern
77	*Cynodon dactylon*	Poaceae	Non-Native	Naturalised
78	*Cyperus brevifolius*	Cyperaceae	Native	Vulnerable
79	*Cyperus sphacelatus*	Cyperaceae	Non-Native	Naturalised
80	*Cyrtophyllum fragrans*	Gentianaceae	Native	Least Concern
81	*Cyrtostachys renda*	Arecaceae	Native	Critically Endangered (Cultivated)
82	*Dalbergia junghuhnii*	Fabaceae	Native	Critically Endangered
83	*Davallia denticulata*	Davalliaceae	Native	Least Concern
84	*Delonix regia*	Fabaceae	Non-Native	Cultivated
85	*Dendrophthoe pentandra*	Loranthaceae	Native	Least Concern
86	*Derris elliptica*	Fabaceae	Non-Native	Naturalised
87	*Dicranopteris linearis*	Gleicheniaceae	Native	Least Concern
88	*Dieffenbachia amoena*	Araceae	Non-Native	Casual
89	*Dillenia suffruticosa*	Dilleniaceae	Native	Least Concern
90	*Dimocarpus lichi*	Sapindaceae	Native	DD
91	*Dimocarpus longan*	Sapindaceae	Non-Native	Casual
92	*Dioscorea pyrifolia*	Dioscoreaceae	Native	Least Concern
93	*Dioscorea sansibarensis*	Dioscoreaceae	Non-Native	Naturalised
94	*Dioscorea tenuifolia*	Dioscoreaceae	Native	Least Concern
95	*Dracaena fragrans*	Asparagaceae	Non-Native	Casual
96	*Dracaena reflexa*	Asparagaceae	Non-Native	Cultivated
97	*Dracaena surculosa*	Asparagaceae	Non-Native	Naturalised
98	*Durio zibethinus*	Malvaceae	Non-Native	Casual
99	*Ehretia microphylla*	Boraginaceae	Non-Native	Naturalised
100	*Elaeis guineensis*	Arecaceae	Non-Native	Casual
101	*Elaeocarpus ferrugineus*	Elaeocarpaceae	Native	Vulnerable
102	*Elaeocarpus mastersii*	Elaeocarpaceae	Native	Least Concern
103	*Elaeocarpus petiolatus*	Elaeocarpaceae	Native	Least Concern

S/N	Species	Family (Final)	Origin	Status
104	*Elephantopus scaber*	Asteraceae	Non-Native	Naturalised
105	*Embelia ribes*	Primulaceae	Native	Least Concern
106	*Emblica urinaria*	Phyllanthaceae	Non-Native	Naturalised
107	*Epipremnum aureum*	Araceae	Non-Native	Casual
108	*Epipremnum pinnatum*	Araceae	Non-Native	Naturalised
109	*Eurycoma longifolia*	Simaroubaceae	Native	Endangered
110	*Erycibe tomentosa*	Convolvulaceae	Native	Least Concern
111	*Falcataria falcata*	Fabaceae	Non-Native	Naturalised
112	*Fibraurea tinctoria*	Menispermaceae	Native	Least Concern
113	*Ficus apiocarpa*	Moraceae	Native	Endangered
114	*Ficus aurata*	Moraceae	Native	Least Concern
115	*Ficus benjamina*	Moraceae	Cryptogenic	Cryptogenic
116	*Ficus fistulosa*	Moraceae	Native	Least Concern
117	*Ficus grossularioides*	Moraceae	Native	Least Concern
118	*Ficus heteropleura*	Moraceae	Native	Least Concern
119	*Ficus hispida*	Moraceae	Non-Native	Casual
120	*Ficus microcarpa*	Moraceae	Native	Least Concern
121	*Ficus punctata*	Moraceae	Native	Least Concern
122	*Ficus religiosa*	Moraceae	Non-Native	Naturalised
123	*Ficus variegata*	Moraceae	Native	Least Concern
124	*Fimbristylis dichotoma*	Cyperaceae	Native	Least Concern
125	*Flagellaria indica*	Flagellariaceae	Native	Least Concern
126	*Galearia fulva*	Pandaceae	Native	Vulnerable
127	*Garcinia mangostana*	Clusiaceae	Native	Critically Endangered (Cultivated)
128	*Glochidion zeylanicum* var. *zeylanicum*	Phyllanthaceae	Native	Vulnerable
129	*Gnetum gnemon* var. *gnemon*	Gnetaceae	Native	Critically Endangered (Cultivated)
130	*Grona heterophylla*	Fabaceae	Native	Least Concern
131	*Grona trifloral*	Fabaceae	Native	Least Concern
132	*Grypothrix triphylla*	Thelypteridaceae	Native	Least Concern
133	*Guioa pubescens*	Sapindaceae	Native	Least Concern
134	*Gymnopetalum scabrum*	Cucurbitaceae	Native	Least Concern
135	*Gynochthodes coriacea*	Rubiaceae	Native	Least Concern
136	*Gynochthodes rigida*	Rubiaceae	Native	Vulnerable
137	*Gynochthodes umbellata*	Rubiaceae	Native	Least Concern
138	*Gynotroches axillaris*	Rhizophoraceae	Native	Least Concern
139	*Heliconia psittacorum* (cultivars)	Heliconiaceae	Non-Native	Cultivated
140	*Heptapleurum actinophyllum*	Araliaceae	Non-Native	Casual
141	*Heterotis rotundifolia*	Melastomataceae	Non-Native	Cultivated
142	*Hevea brasiliensis*	Euphorbiaceae	Non-Native	Naturalised
143	*Hibiscus tiliaceus*	Malvaceae	Native	Least Concern
144	*Horsfieldia polyspherula*	Myristicaceae	Native	Vulnerable
145	*Ilex cymosa*	Aquifoliaceae	Native	Least Concern
146	*Ischaemum muticum*	Poaceae	Native	Least Concern
147	*Ixonanthes reticulata*	Ixonanthaceae	Native	Least Concern
148	*Khaya grandifoliola*	Meliaceae	Non-Native	Cultivated
149	*Leea indica*	Vitaceae	Native	Least Concern
150	*Leea rubra*	Vitaceae	Native	Presumed Nationally Extinct (Cultivated)
151	*Legazpia polygonoides*	Linderniaceae	Cryptogenic	Cryptogenic
152	*Lagerstroemia speciosa*	Lythraceae	Non-Native	Cultivated
153	*Lepisanthes rubiginosa*	Sapindaceae	Native	Least Concern
154	*Leucaena leucocephala*	Fabaceae	Non-Native	Naturalised
155	*Leuenbergeria bleo*	Cactaceae	Non-Native	Cultivated

S/N	Species	Family (Final)	Origin	Status
156	*Licuala grandis*	Arecaceae	Non-Native	Cultivated
157	*Licuala spinosa*	Arecaceae	Native	Least Concern
158	*Limacia scandens*	Menispermaceae	Native	Least Concern
159	*Lindernia sessiliflora*	Linderniaceae	Non-Native	Casual
160	*Litsea elliptica*	Lauraceae	Native	Least Concern
161	*Litsea grandis*	Lauraceae	Native	Endangered
162	*Litsea umbellata (sensu lato)*	Lauraceae	Native	Vulnerable
163	*Ludwigia hyssopifolia*	Onagraceae	Cryptogenic	Cryptogenic
164	*Lygodium circinnatum*	Lygodiaceae	Cryptogenic	Cryptogenic
165	*Lygodium microphyllum*	Lygodiaceae	Native	Least Concern
166	*Macaranga conifera*	Euphorbiaceae	Native	Least Concern
167	*Macaranga gigantea*	Euphorbiaceae	Native	Least Concern
168	*Macaranga griffithiana*	Euphorbiaceae	Native	Vulnerable
169	*Macaranga heynei*	Euphorbiaceae	Native	Least Concern
170	*Macaranga hypoleuca*	Euphorbiaceae	Native	Least Concern
171	*Maesa sumatrana*	Fabaceae	Native	Vulnerable
172	*Mallotus paniculatus*	Euphorbiaceae	Native	Least Concern
173	*Mangifera indica*	Anacardiaceae	Non-Native	Casual
174	*Manihot carthaginensis*	Euphorbiaceae	Non-Native	Naturalised
175	*Melastoma malabathricum*	Melastomataceae	Native	Least Concern
176	*Melicope lunu-ankenda*	Rutaceae	Native	Endangered
177	*Melothria pendula*	Cucurbitaceae	Non-Native	Casual
178	*Miconia crenata*	Melastomataceae	Non-Native	Naturalised
179	*Miconia dependens*	Melastomataceae	Non-Native	Naturalised
180	*Mikania micrantha*	Asteraceae	Non-Native	Naturalised
181	*Mimosa pudica*	Fabaceae	Non-Native	Naturalised
182	*Mimusops elengi*	Sapotaceae	Non-Native	Casual
183	*Moeroris amara*	Phyllanthaceae	Non-Native	Naturalised
184	*Morella esculenta*	Myricaceae	Native	Least Concern
185	*Musa cultivar*	Musaceae	Non-Native	Cultivated
186	*Neolitsea cassia*	Lauraceae	Native	Least Concern
187	*Nepenthes gracilis*	Nepenthaceae	Native	Least Concern
188	*Nephelium lappaceum*	Sapindaceae	Cryptogenic	Cryptogenic
189	*Nephrolepis biserrata*	Nephrolepidaceae	Native	Least Concern
190	*Ochna kirkii*	Ochnaceae	Non-Native	Naturalised
191	*Oncosperma horridum*	Arecaceae	Native	Vulnerable
192	*Oxyceros longiflorus*	Rubiaceae	Native	Least Concern
193	*Paederia foetida*	Rubiaceae	Native	Least Concern
194	*Palhinhaea cernua*	Lycopodiaceae	Native	Least Concern
195	*Pandanus amaryllifolius*	Pandanaceae	Non-Native	Casual
196	*Parkia speciosa*	Fabaceae	Native	Vulnerable
197	*Passiflora laurifolia*	Passifloraceae	Non-Native	Naturalised
198	*Peltophorum pterocarpum*	Fabaceae	Native	Critically Endangered (Cultivated)
199	*Peperomia pellucida*	Piperaceae	Non-Native	Naturalised
200	*Philodendron subincisum*	Araceae	Non-Native	Cultivated
201	*Peristrophe bivalvis*	Acanthaceae	Cryptogenic	Cryptogenic
202	*Pilea nummulariifolia*	Urticaceae	Non-Native	Casual
203	*Pinanga coronata*	Arecaceae	Non-Native	Cultivated
204	*Piper aduncum*	Piperaceae	Non-Native	Naturalised
205	*Piper betle*	Piperaceae	Non-Native	Casual
206	*Piper crassipes*	Piperaceae	Native	Least Concern
207	*Piper sarmentosum*	Piperaceae	Native	Least Concern

S/N	Species	Family (Final)	Origin	Status
208	*Pipturus argenteus*	Urticaceae	Cryptogenic	Cryptogenic
209	*Planchonella obovata*	Sapotaceae	Native	Least Concern
210	*Podocarpus rumphii*	Podocarpaceae	Non-Native	Cultivated
211	*Procris repens*	Urticaceae	Native	Presumed Nationally Extinct (Cultivated)
212	*Pteris ensiformis*	Pteridaceae	Cryptogenic	Cryptogenic
213	*Pterocarpus indicus*	Fabaceae	Non-Native	Casual
214	*Ptychosperma macarthurii*	Arecaceae	Non-Native	Naturalised
215	*Pyrrosia piloselloides*	Polypodiaceae	Native	Least Concern
216	*Rhodamnia cinerea*	Myrtaceae	Native	Least Concern
217	*Ruellia repens*	Acanthaceae	Cryptogenic	Cryptogenic
218	*Samanea saman*	Fabaceae	Non-Native	Casual
219	*Sandoricum koetjape*	Meliaceae	Native	Vulnerable
220	*Santiria apiculata* var. *apiculata*	Burseraceae	Native	Least Concern
221	*Scleria ciliaris*	Cyperaceae	Native	Least Concern
222	*Selaginella ciliaris*	Selaginellaceae	Native	Least Concern
223	*Senegalia rugata*	Fabaceae	Cryptogenic	Cryptogenic
224	*Senna alata*	Fabaceae	Non-Native	Naturalised
225	*Senna siamea*	Fabaceae	Non-Native	Cultivated
226	*Sieruela rutidosperma*	Cleomaceae	Non-Native	Naturalised
227	*Smilax setosa*	Smilacaceae	Native	Least Concern
228	*Solanum torvum*	Solanaceae	Non-Native	Naturalised
229	*Spathodea campanulata*	Bignoniaceae	Non-Native	Naturalised
230	*Spermacoce exilis*	Rubiaceae	Non-Native	Naturalised
231	*Spermacoce latifolia*	Rubiaceae	Non-Native	Naturalised
232	*Sphagneticola trilobata*	Asteraceae	Non-Native	Naturalised
233	*Sporobolus indicus*	Poaceae	Native	Least Concern
234	*Stenochlaena palustris*	Blechnaceae	Native	Least Concern
235	*Sterculia foetida*	Malvaceae	Non-Native	Cultivated
236	*Sterculia oblongata*	Malvaceae	Non-Native	Cultivated
237	*Sterculia parviflora*	Malvaceae	Native	Critically Endangered (Cultivated)
238	*Strobilanthes alternata*	Acanthaceae	Non-Native	Cultivated
239	*Strobilanthes crispa*	Acanthaceae	Non-Native	Cultivated
240	*Strobilanthes reptans*	Acanthaceae	Non-Native	Naturalised
241	*Strophanthus caudatus*	Apocynaceae	Native	Endangered
242	*Syngonium angustatum*	Araceae	Non-Native	Naturalised
243	*Syngonium chiapense*	Araceae	Non-Native	Cultivated
244	*Syzygium borneense*	Myrtaceae	Native	Least Concern
245	*Syzygium cerasiforme*	Myrtaceae	Native	Least Concern
246	*Syzygium grande*	Myrtaceae	Native	Least Concern
247	*Syzygium jambos*	Myrtaceae	Non-Native	Casual
248	*Syzygium myrtifolium*	Myrtaceae	Native	Critically Endangered (Cultivated)
249	*Syzygium polyanthum*	Myrtaceae	Native	Least Concern
250	*Syzygium zeylanicum*	Myrtaceae	Native	Least Concern
251	*Taenitis blechnoides*	Pteridaceae	Native	Least Concern
252	*Tamarindus indica*	Fabaceae	Non-Native	Casual
253	*Terminalia catappa*	Combretaceae	Native	Least Concern
254	*Tetracera indica*	Dilleniaceae	Native	Least Concern
255	*Thunbergia fragrans*	Acanthaceae	Non-Native	Naturalised
256	*Thunbergia grandiflora*	Acanthaceae	Non-Native	Casual
257	*Thunbergia laurifolia*	Acanthaceae	Non-Native	Casual
258	*Tinospora crispa*	Menispermaceae	Non-Native	Casual
259	*Trema cannabina*	Cannabaceae	Native	Least Concern

S/N	Species	Family (Final)	Origin	Status
260	*Triadica cochinchinensis*	Euphorbiaceae	Native	Least Concern
261	*Typhonium trilobatum*	Araceae	Non-Native	Naturalised
262	*Uncaria cordata*	Rubiaceae	Native	Endangered
263	*Uncaria gambir*	Rubiaceae	Non-Native	Naturalised
264	*Uncaria longiflora* var. *pteropoda*	Rubiaceae	Native	Endangered
265	*Vitex pinnata*	Lamiaceae	Native	Least Concern
266	*Xanthophyllum ellipticum*	Polygalaceae	Native	Critically Endangered
267	*Xanthophyllum stipitatum*	Polygalaceae	Native	Critically Endangered
268	*Xanthosoma sagittifolium*	Araceae	Non-Native	Cultivated
269	*Xanthostemon chrysanthus*	Myrtaceae	Non-Native	Cultivated
	Uncertain IDs	**Family**	**Origin**	**Remarks**
	Confirmed Genus			
270	*Dalbergia* cf. *parviflora*	Fabaceae	Native	Consulted NParks Herbarium. Consensus on keeping ID to genus level.
271	*Dieffenbachia* cf. *parlatorei*	Araceae	Non-Native	Ornamental non-native, generic appearance
272	*Eleocharis* cf. *baldwinii*	Cyperaceae	Indeterminate	No distinct botanical features present to confirm species.
273	*Salacia* cf. *korthalsiana*	Celastraceae	Native	Consulted NParks Herbarium. Consensus on keeping ID to genus level.
274	*Syzygium* cf. *borneense*	Myrtaceae	Indeterminate	Consulted NParks Herbarium. Consensus on keeping ID to genus level.
275	*Alpinia* sp.	Zingiberaceae	Indeterminate	Young sapling, No distinct botanical features present to confirm species.
276	*Ixora* sp.	Rubiaceae	Indeterminate	No distinct fertile botanical features for narrowing ID.
277	*Mangifera* sp.	Anacardiaceae	Indeterminate	Consulted NParks Herbarium. Consensus on keeping ID to genus level.
278	*Paspalum* sp.	Poaceae	Indeterminate	All native species in this genus are Least Concern.
279	*Suregada* sp.	Euphorbiaceae	Indeterminate	Either *multiflora* or *glomerulata* (CR). No consensus due to vagueness in taxonomic classification.
	Confirmed Family			
280	Cf. *Archonthophoenix alexandriae*	Arecaceae	Indeterminate	Non-native palm - likely ornamental.
281	Cf. *Bambusa vulgaris*	Poaceae	Indeterminate	Likely *bambusa vulgaris*, a non-native ornamental bamboo.
282	UnID bamboo cluster	Poaceae	Indeterminate	No distinct botanical features present to confirm species.
283	UnID Timber Bamboo	Poaceae	Indeterminate	No distinct botanical features present to confirm species.
284	UnID Grass 2	Poaceae	Indeterminate	No distinct botanical features present to confirm species.
285	UnID Grass 1	Poaceae	Indeterminate	No distinct botanical features present to confirm species.
	No ID			
286	UnID young shrub	Primulaceae	Indeterminate	Young specimen, no distinct botanical features present to confirm species.

Appendix C – Fauna Data

S/N	Taxa	Scientific Name	Common Name	Origin	IUCN	SRDB3	Abundance			
							T1	T2	I/Aq^/Ct[t]	Total
1	Bird	*Acridotheres javanicus*	Javan Myna	Introduced	VU	N.A.	6	10	0	16
2	Bird	*Aethopyga siparaja*	Crimson Sunbird	Native	LC	LC	0	1	0	1
3	Bird	*Amaurornis phoenicurus*	White-breasted Waterhen	Native	LC	LC	0	2	0	2
4	Bird	*Aplonis panayensis*	Asian Glossy Starling	Native	LC	LC	2	10	0	12
5	Bird	*Caprimulgus macrurus*	Large-tailed Nightjar	Native	LC	LC	0	1	3	4
6	Bird	*Chrysophlegma miniaceum*	Banded Woodpecker	Native	LC	LC	0	1	0	1
7	Bird	*Cinnyris ornatus*	Ornate Sunbird	Native	LC	LC	1	2	0	3
8	Bird	*Copsychus saularis*	Oriental Magpie-robin	Native	LC	VU	0	0	1	1
9	Bird	*Dicrurus paradiseus*	Greater Racket-tailed Drongo	Native	LC	LC	1	0	2	3
10	Bird	*Dinopium javanense*	Common Flameback	Native	LC	LC	0	0	2	2
11	Bird	*Ducula bicolor*	Pied Imperial Pigeon	Native + Introduced	LC	DD	1	0	0	1
12	Bird	*Gallus gallus*	Red Junglefowl	Native	LC	NT	0	6	3	9
13	Bird	*Garrulax leucolophus*	White-crested Laughingthrush	Introduced	LC	N.A.	7	20	2	29
14	Bird	*Geopelia striata*	Zebra Dove	Native	LC	LC	1	0	0	1
15	Bird	*Halcyon smyrnensis*	White-throated Kingfisher	Native	LC	LC	0	0	1	1
16	Bird	*Ichthyophaga leucogaster*	White-bellied Sea Eagle	Native	LC	LC	0	0	1	1
17	Bird	*Ketupa ketupu*	Buffy Fish Owl	Native	LC	VU	1	0	0	1
18	Bird	*Merops viridis*	Blue-throated Bee-eater	Native	LC	LC	0	0	1	1
19	Bird	*Mixornis gularis*	Pin-striped Tit-Babbler	Native	LC	LC	1	18	0	19
20	Bird	*Nisaetus cirrhatus*	Changeable Hawk-eagle	Native	LC	VU	0	0	3	3
21	Bird	*Oriolus chinensis*	Black-naped Oriole	Native	LC	LC	0	2	3	5
22	Bird	*Orthotomus atrogularis*	Dark-necked Tailorbird	Native	LC	LC	2	3	0	5
23	Bird	*Orthotomus sericeus*	Rufous-tailed Tailorbird	Native	LC	NT	1	0	0	1
24	Bird	*Otus lettia*	Collared Scops Owl	Native	LC	LC	0	1	0	1
25	Bird	*Picus vittatus*	Laced Woodpecker	Native	LC	LC	0	0	2	2
26	Bird	*Psilopogon lineatus*	Lineated Barbet	Introduced	LC	N.A.	2	3	0	5

S/N	Taxa	Scientific Name	Common Name	Origin	IUCN	SRDB3	Abundance			
							T1	T2	I/Aq^/Ct[t]	Total
27	Bird	*Psittacula alexandri*	Red-breasted Parakeet	Introduced	NT	N.A.	2	1	0	3
28	Bird	*Pycnonotus goiavier*	Yellow-vented Bulbul	Native	LC	LC	1	5	0	6
29	Bird	*Pycnonotus jocosus*	Red-whiskered Bulbul	Introduced	LC	N.A.	3	0	1	4
30	Bird	*Pycnonotus plumosus*	Olive-winged Bulbul	Native	LC	LC	3	3	0	6
31	Bird	*Pycnonotus zeylanicus*	Straw-headed Bulbul	Native	CR	EN	7	2	0	9
32	Bird	*Rallina fasciata*	Red-legged Crake	Native	LC	NT	0	0	1	1
33	Bird	*Rhipidura javanica*	Malaysian Pied Fantail	Native	LC	LC	0	0	2	2
34	Bird	*Spilopelia chinensis*	Spotted Dove	Native	LC	LC	1	2	0	3
35	Bird	*Zosterops simplex*	Swinhoe's White-eye	Native + Introduced	LC	VU	0	0	1	1
36	Butterfly	*Ancistroides nigrita maura*	Chocolate Demon	Native	N.A.	LC	0	1	0	1
37	Butterfly	*Erionota* sp.	Banana Skipper sp.	Native	N.A.	LC	0	2	0	2
38	Butterfly	*Bibasis harisa consobrina*	Orange Awlet	Native	N.A.	LC	1	1	0	2
39	Butterfly	*Catopsilia pomona pomona*	Lemon Emigrant	Native	N.A.	LC	0	2	0	2
40	Butterfly	*Chilades pandava pandava*	Cycad Blue	Native	N.A.	LC	0	3	0	3
41	Butterfly	*Delias hyparete metarete*	Painted Jezebel	Native	N.A.	LC	0	1	0	1
42	Butterfly	*Doleschallia bisaltide ?bisaltide* var.	Autumn Leaf	Native	N.A.	LC	1	0	0	1
43	Butterfly	*Elymnias hypermnestra agina*	Common Palmfly	Native	N.A.	LC	1	3	0	4
44	Butterfly	*Eooxylides tharis distanti*	Branded Imperial	Native	N.A.	LC	3	2	0	5
45	Butterfly	*Eurema hecabe contubernalis*	Common Grass Yellow	Native	N.A.	LC	0	1	0	1
46	Butterfly	*Eurema sari sodalis*	Chocolate Grass Yellow	Native	N.A.	LC	0	0	1	1
47	Butterfly	*Euthalia aconthea gurda*	Baron	Native	N.A.	LC	0	2	0	2
48	Butterfly	*Hesperidae* sp.	Undetermined	Indeterminate	N.A.	N.A.	0	0	1	1
49	Butterfly	*Iambrix salsala salsala*	Chestnut Bob	Resident	N.A.	LC	1	0	0	1
50	Butterfly	*Junonia hedonia ida*	Chocolate Pansy	Native	N.A.	LC	1	2	0	3
51	Butterfly	*Lasippa/Pantaporia* sp.	Lascar sp.	Native	N.A.	N.A.	4	0	0	4
52	Butterfly	*Nacaduba* sp.	Line Blue sp.	Indeterminate	N.A.	N.A.	0	1	0	1
53	Butterfly	*Neptis harita harita*	Chocolate Sailor	Resident	N.A.	NT	0	2	0	2

S/N	Taxa	Scientific Name	Common Name	Origin	IUCN	SRDB3	Abundance			
							T1	T2	I/Aq^/Ct[t]	Total
54	Butterfly	*Papilio polytes romulus*	Common Mormon	Native	N.A.	LC	0	1	0	1
55	Butterfly	*Semanga superba deliciosa*	Red Edge	Native	N.A.	LC	0	0	1	1
56	Butterfly	*Spalgis epius epius*	The Apefly	Native	N.A.	LC	0	1	0	1
57	Butterfly	*Tanaecia iapis puseda*	Horsfield's Baron	Native	N.A.	LC	1	0	1	2
58	Butterfly	*Ypthima baldus newboldi*	Common Five Ring	Native	N.A.	LC	1	2	1	4
59	Butterfly	*Zizina otis lampa*	Lesser Grass Blue	Native	N.A.	LC	0	2	0	2
60	Herpetofauna	*Ahaetulla prasina*	Oriental Whip Snake	Native	LC	LC	0	0	1	1
61	Herpetofauna	*Bronchocela cristatella*	Green Crested Lizard	Native	LC	LC	1	0	1	2
62	Herpetofauna	*Dendrelaphis pictus*	Painted Bronzeback	Native	LC	LC	0	0	2	2
63	Herpetofauna	*Duttaphrynus* cf. *melanostictus*	Asian Toad	Introduced	LC	LC	1	0	0	1
64	Herpetofauna	*Eleutherodactylus planirostris*	Greenhouse Frog	Introduced	LC	N.A.	5	22	0	27
65	Herpetofauna	*Eutropis multifasciatus*	Common Sun Skink	Native	N.A.	LC	0	3	13	16
66	Herpetofauna	*Fejervarya limnocharis*	Field Frog	Native	LC	LC	1	1	1	3
67	Herpetofauna	*Gekko monarchus*	Spotted House Gecko	Native	LC	LC	1	1	0	2
68	Herpetofauna	*Hemidactylus frenatus*	Spiny-Tailed House Gecko	Native	LC	LC	1	0	0	1
69	Herpetofauna	*Hylarana labialis*	Copper-cheeked Frog	Native	LC	LC	0	6	0	6
70	Herpetofauna	*Limnonectes blythii*	Malayan Giant Frog	Native	LC	LC	80	25	1	106
71	Herpetofauna	*Lygosoma bowringii*	Supple Skink	Native	N.A.	LC	1	1	0	2
72	Herpetofauna	*Microhyla butleri*	Painted Chorus Frog	Native	LC	LC	1	0	5	6
73	Herpetofauna	*Microhyla heymonsi*	Dark-sided Chorus Frog	Native	LC	LC	61	52	6	119
74	Herpetofauna	*Microhyla* cf. *mukhlesuri*	Mukhlesur's Narrow-mouthed Frog	Introduced	LC	N.A.	8	0	0	8
75	Herpetofauna	*Naja sumatrana*	Equatorial Spitting Cobra	Native	LC	LC	0	0	1	1
76	Herpetofauna	*Polypedates leucomystax*	Common Tree Frog	Native	LC	LC	6	22	1	29
77	Herpetofauna	*Hylarana guentheri*	Guenther's Frog	Introduced	LC	N.A.	1	0	0	1
78	Herpetofauna	*Varanus nebulosus*	Clouded Monitor	Native	N.A.	LC	0	0	1	1
79	Herpetofauna	*Varanus salvator*	Malayan Water Monitor	Native	LC	LC	0	0	11	11
80	Mammal	*Callosciurus notatus*	Plantain Squirrel	Native	LC	LC	1	0	2	3

S/N	Taxa	Scientific Name	Common Name	Origin	IUCN	SRDB3	Abundance			
							T1	T2	I/Aq^/Ct[t]	Total
81	Mammal	*Macaca fascicularis*	Long-tailed Macaque	Native	EN	LC	0	0	96	96
82	Mammal	*Sus scrofa*	Eurasian Wild Boar	Native	LC	LC	0	0	3	3
83	Mammal [t]	*Tupaia glis*	Common Treeshrew	Native	LC	LC	0	0	1	1
84	Mammal [t]	*Paradoxurus musangus*	Sumatran Palm Civet	Native	LC	LC	0	0	1	1
85	Mammal [t]	*Rattus* sp.	Rat sp.	Indeterminate	N.A.	N.A.	0	0	1	1
86	Mammal (Bat)	*Cynopterus brachyotis*	Lesser Short-nosed Fruit Bat	Native	LC	LC	6	0	0	6
87	Mammal (Bat)	*Myotis muricola*	Asian Whiskered Myotis	Native	LC	LC	0	1	0	1
88	Mammal (Bat)*	*Myotis horsfieldii*	Horsfield's Myotis	Native	LC	LC	0	0	1	1*
89	Mammal (Bat)	*Pipistrellus javanicus*	Javan Pipistrelle	Native	LC	LC	2	2	0	4
90	Mammal (Bat)*	*Pipistrellus stenopterus*	Narrow-winged Pipistrelle	Native	LC	LC	0	0	1	1*
91	Mammal (Bat)	*Rhinolophus refulgens*	Glossy Horseshoe Bat	Native	N.A.	LC	3	0	0	3
92	Mammal (Bat)*	*Saccolaimus saccolaimus*	Pouched Tomb Bat	Native	LC	LC	0	0	1	1*
93	Mammal (Bat)	*Scotophilus kuhlii*	Lesser Asian House Bat	Native	LC	LC	0	2	0	2
94	Mammal (Bat)	*Tylonycteris* sp.	Bamboo Bat sp.	Native	N.A.	VU	0	2	0	2
95	Moth	*Pompelon marginata*	Day Flying Pompelon	Indeterminate	N.A.	LC	0	0	1	1
96	Moth	*Traminda aventiaria*	Cross-line Wave Moth	Indeterminate	N.A.	LC	0	0	1	1
97	Moth	*Un-ID Moth1*	Moth sp. #1	Indeterminate	N.A.	N.A.	0	0	1	1
98	Moth	*Un-ID Moth2*	Moth sp. #2	Indeterminate	N.A.	N.A.	0	0	1	1
99	Moth	*Un-ID Moth3*	Nolid Caterpillar	Indeterminate	N.A.	N.A.	0	0	1	1
100	Odonata	*Agrionoptera insignis*	Grenadier	Native	LC	LC	4	6	1	11
101	Odonata	*Gynacantha* sp.	Undetermined	Native	N.A.	N.A.	1	0	0	1
102	Odonata	*Gynacantha subinterrupta*	Dingy Duskhawker	Native	LC	LC	3	1	0	4
103	Odonata	*Nesoxenia lineata*	Striped Grenadier	Native	LC	LC	0	1	0	1
104	Odonata	*Neurothemis fluctuans*	Common Parasol	Native	LC	LC	0	2	0	2
105	Odonata	*Orthetrum chrysis*	Spine-tufted Skimmer	Native	LC	LC	3	8	2	13
106	Odonata	*Orthetrum luzonicum*	Slender Blue Skimmer	Native	LC	LC	0	1	0	1
107	Odonata	*Trithemis festiva*	Indigo Dropwing	Native	LC	LC	0	2	0	2

S/N	Taxa	Scientific Name	Common Name	Origin	IUCN	SRDB3	Abundance			
							T1	T2	I/Aq^/Ct[t]	Total
108	Fish^	*Poecilia reticulata*	Guppy	Introduced	N.A.	N.A.	0	0	20	20
109	Fish^	*Monopterus javanensis*	Sunda Swamp Eel	Native	N.A.	LC	0	0	1	1
110	Fish	*Clarias batrachus*	Common Walking Catfish	Native	N.A.	NT	0	0	6	6
111	Mollusc^	*Quantula striata*	Bioluminescent Land Snail	Native	N.A.	LC	0	0	1	1
112	Insect^	*Laccotrephes simulatus*	Water Scorpion	Native	N.A.	LC	0	0	1	1
113	Hemiptera	*Un-ID hemiptera*	Undetermined	Indeterminate	N.A.	N.A.	0	0	1	1
						Total	**248**	**283**	**223**	**754**

*Three bat species (*Myotis horsfieldii*, *Pipistrellus stenopterus*, *Saccolaimus saccolaimus*) were only recorded in the song meters and are hence marked as incidental records. They were detected on multiple occasions in the song meter recordings, but recordings alone cannot ascertain the number of individuals. Hence, their abundance is listed as 1

^Aq stands for aquatic fauna survey

[t]Ct stands for camera trap.

Appendix D – Proposed Planting Palette

Scientific Name	Native Status	Common Name	Plant Habit	Forest Enhancement	Street/ Promenade	Attracts Butterflies/ Host Plant	Market Availability	Found in Study Area?	Associated Fauna Found on Site	Target Fauna Observed	Suitability			Forest Layer				Remarks
											PRA (forest edge, scrubland)	Former Jurong Railway Line slope works	PRA stabilising wall	Canopy/ Emergent	Understory	Undergrowth/ Ground cover	Epiphyte	
Alsophila latebrosa	Native	Tree Fern	Tree	Yes			Yes	Yes			Yes	Yes			Yes		Yes	Riparian species, aesthetic value
Alstonia angustiloba	Native	Common Pulai	Tree	Yes	Yes		Yes	Yes			Yes			Yes				
Angiopteris evecta	Native	Elephant Fern	Herb	Yes			Yes	Yes			Yes	Yes	Yes		Yes		Yes	
Ardisia elliptica	Native	Sea-shore Ardisia	Tree	Yes	Yes	Yes	Yes	Yes			Yes	Yes			Yes	Yes		Host plant for *Abisara saturata, Taxila haquinus*
Aristolochia acuminata	Near Native	Dutchman's Pipe	Climber			Yes	Yes		Yes		Yes		Yes				Yes	Host plant for Common Birdwing, Common Rose
Arthrophyllum jackianum	Native	Common Ivy Palm	Tree	Yes		Yes		Yes	Yes	Orange awlet	Yes	Yes		Yes	Yes			Host plant for Awlet butterflies
Asplenium nidus var. *nidus*	Native	Birds' Nest Fern	Epiphyte	Yes	Yes		Yes	Yes										Epiphytes for canopy trees. Refugia for fauna
Bromheadia finlaysoniana	Native	Finlayson's Bromheadia	Herb/Orchid	Yes				Yes			Yes	Yes	Yes			Yes		
Caryota mitis	Native	Fishtail Palm	Palm	Yes	Yes	Yes	Yes	Yes	Yes	Common Palmfly	Yes	Yes			Yes			Host plant for Palmfly butterflies
Centotheca lappacea	Native	Rumput Darah	Grass	Yes				Yes			Yes	Yes	Yes			Yes		Possibly host plant for Bush Brown and Ring butterflies
Cyrtophyllum fragrans	Native	Tembusu	Tree	Yes	Yes		Yes	Yes			Yes				Yes			
Cyrtostachys renda	Native	Red Lipstick Palm	Palm	Yes	Yes	Yes	Yes / Transplant	Yes	Yes	Various birds	Yes	Yes	Yes		Yes			Host plant for urban adapted Dart butterflies such as Yellow Palm Dart - likely to be found on site after urban development
Elaeocarpus mastersii	Native	Small Leaf oil fruit	Shrub/Tree	Yes	Yes		Yes	Yes			Yes	Yes		Yes	Yes			Provides food for birds
Etlingera elatior	Near Native	Torch Ginger	Shrub	Yes	Yes	Yes	Yes		Yes									
Ficus apiocarpa	Native	Ara akar	Climber	Yes		-		Yes	Yes	Various Birds	Yes	Yes	Yes				Yes	
Ficus microcarpa	Native	Malayan Banyan	Tree	Yes	Yes	Yes	Yes	Yes	Yes	Various Birds	Yes			Yes	Yes	Yes	Yes	Attracts a variety of birds and mammals, Host plant for *Euploea* spp. such as Striped Blue Crow butterfly
Ficus variegata	Native	Variegated fig	Tree	Yes		-	Yes	Yes	Yes	Various Birds	Yes			Yes	-	-		Attracts a variety of birds, mammals, some butterflies
Hibiscus tiliaceus	Native	Sea Hibiscus	Tree	Yes	Yes	Yes	Yes	Yes		Various Butterflies as nectar	Yes	Yes			Yes	–		Good forest edge buffer species, nectar plant for larger Papilio butterflies
Ixora congesta	Native	Jungle Flame	Shrub	Yes	Yes	Yes	Yes	Yes	Yes	Various Butterflies as nectar	Yes	Yes	Yes		Yes	Yes		Good forest edge buffer species, nectar plant for various butterflies, host plant for butterflies such as Knight, Fluffy Tit etc
Leea Rubra	Native	Red Leea	Shrub/Small Tree	Yes	Yes	Yes	Yes	Yes	Yes	Various Butterflies as nectar	Yes	Yes			Yes	Yes		Attracts several butterflies for their nectar
Leea Indica	Native	Bandicoot Berry	Shrub/Small Tree	Yes	Yes	Yes	Yes	Yes	Yes	Various Butterflies as nectar	Yes	Yes			Yes	Yes		Attracts several butterflies for their nectar
Melastoma malabathricum	Native	Senduduk	Shrub	Yes	Yes	Yes	Yes	Yes	Yes	Red Edge (*Semanga superba deliciosa*), *Tanaecia iapis puseda*	Yes	Yes	Yes		Yes	Yes		Host plant *for Rapala iarbus iarbus , Spindasis lohita senama , Tanaecia iapis puseda* and *Semanga superba deliciosa*.
Macaranga conifera	Native		Tree	Yes			Transplant	Yes			Yes	Yes		Yes	Yes			Pioneer species, with active ecological role, restoring micro-climate before further restoration. Reduce invasive species establishment
Macaranga gigantea	Native	Mahang	Tree	Yes		Yes	Yes / Transplant	Yes			Yes	Yes		Yes				Pioneer species, with active ecological role, restoring micro-climate before further restoration. Reduce invasive species establishment; host plant for butterflies such as Malay Baron

Scientific Name	Native Status	Common Name	Plant Habit	Forest Enhancement	Street/ Promenade	Attracts Butterflies/ Host Plant	Market Availability	Found in Study Area?	Associated Fauna Found on Site	Target Fauna Observed	Suitability			Forest Layer				Remarks
											PRA (forest edge, scrubland)	Former Jurong Railway Line slope works	PRA stabilising wall	Canopy/ Emergent	Understory	Undergrowth/ Ground cover	Epiphyte	
Macaranga griffithiana	Native	Mahang Bulan	Shrub/Small Tree	Yes			Yes / Transplant	Yes			Yes	Yes		Yes	Yes			Pioneer species, with active ecological role, restoring micro-climate before further restoration. Reduce invasive species establishment
Mallotus paniculatus	Native	Turn-in-the-wind	Small Tree	Yes			Transplant	Yes										Forest structure restoration
Nephrolepis biserrata	Native	Giant Sword Fern	Fern	Yes			Yes	Yes			Yes	Yes	Yes		Yes		Yes	
Piper sarmentosum	Native	Wild Pepper	Shrub/ Groundcover	Yes	Yes		Yes	Yes			Yes		Yes			Yes		
Planchonella obovata	Native	Sea Gutta	Tree	Yes	Yes		Yes	Yes			Yes			Yes	Yes			Later stage restoration, fruits for birds (e.g. Yellow vented bulbul)
Pterocarpus indicus	Native	Angsana	Tree	Yes	Yes		Yes	Yes			Yes			Yes	Yes			
Rhodamnia cinerea	Native	Silverback tree	Tree	Yes			Yes	Yes			Yes			Yes	Yes			
Sandoricum koetjape	Native	Santol/Sentul	Tree	Yes	Yes		-	Yes			Yes			Yes	Yes			
Sterculia parviflora	Native	Common Sterculia	Tree	Yes	Yes	Yes	Yes	Yes	Yes	Various Birds	Yes			Yes	Yes			Fruits and flowers attract many butterflies and birds
Syzygium polyanthum	Native	Indonesian Bay Leaf	Tree	Yes	Yes	Yes	Yes	Yes	Yes	Various Butterflies, Birds								Fruits and flowers attract many butterflies and birds
Syzygium zeylanicum	Native	Kelat Nasi Nasi	Shrub/Tree	Yes	Yes	Yes	Yes	Yes	Yes	Various Butterflies, Birds	Yes	Yes			Yes	Yes		Fruits and flowers attract many butterflies and birds
Taenitis blechnoides	Native		Fern	Yes			Transplant	Yes			Yes	Yes	Yes			Yes		
Terminalia catappa	Native	Sea Almond	Tree	Yes	Yes		Yes	Yes	Yes	Various Butterflies, Birds	Yes			Yes	Yes			Fruits attract birds, host plant for butterflies such as Centaur Oakblue which are likely found on site
Trema cannabina	Native		Small Tree	Yes			Transplant	Yes				Yes						Forest structure restoration
Samanea saman	Non-native	Rain Tree	Tree		Yes		Yes	Yes			Yes (near roads)							Good shade tree, commonly planted along roads
Not Found in Study Area														-	-	-	-	
Arundina graminifolia	Native	Bamboo Orchid	Herb/Orchid	–	Yes		Yes	No			Yes	Yes	Yes		Yes	Yes		
Calophyllum inophyllum	Native	Penaga Laut	Tree	Yes	Yes		Yes	No			Yes				Yes			
Hoya spp.	Native	-	Epiphyte				Yes	No			Yes	Yes					Yes	Aesthetic value
Memecylon coeruleum	Native		Shrub/Small Tree			Yes		No			Yes	Yes			Yes			
Memecylon edule	Native		Shrub/Small Tree			Yes		No			Yes	Yes			Yes			

Appendix E – Surface Water Quality Laboratory Report

TEST REPORT

(This Report is issued subject to the terms & conditions set out below)

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Setsco Services Pte Ltd
531 Bukit Batok Street 23
Singapore 659547
Tel : (65) 6566 7777
Fax: (65) 6566 7718
www.setsco.com
Business Reg No 196900269D

Your Ref:

Date : 08/07/2025

Our Ref : EN8500368384/LWW

Subject : Analysis of water samples submitted by **Aurecon Singapore Pte Ltd** on **12/06/2025** and testing commenced on **12/06/2025**.

Tested for : **Aurecon Singapore Pte Ltd**
152 Beach Road
#22-02 Gateway East
Singapore 189721
Attn : Ms. Koh Lay Kuan

Sample Reference : Nine (09) water samples were received.

Results : Refer to next page.

MARIVIE VIANA GAPUD
SENIOR CHEMIST

LEE WEI WAH
SENIOR MANAGER

BIOLOGICAL AND CHEMICAL TECHNOLOGY DIVISION

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RESULTS :

Test Parameters	Units	Test Methods	Dry Weather									Client's Spec
			WQ01	WQ02	WQ03	WQ04	WQ05	WQ06	WQ07	WQ08	WQ09	
			12/06/2025	12/06/2025	12/06/2025	12/06/2025	12/06/2025	12/06/2025	12/06/2025	12/06/2025	12/06/2025	
Biochemical Oxygen Demand	mg/L	APHA : Pt 5210B	<2	<2	<2	<2	<2	<2	<2	<2	<2	2 mg/L
Chemical Oxygen Demand	mgO_2/L	HACH Method 8000	6.1	4.5	10.5	3.4	5.8	7.7	6.1	3.6	<2	2 mg/L
Turbidity	NTU	APHA : Pt 2130B	50	6.1	9.5	6.6	8.3	18	11	8.0	1.4	-
Total Alkalinity as $CaCO_3$	mg/L	APHA : Pt 2320B	9.55	<2	<2	41.2	39.2	39.2	<2	<2	<2	-
Total Phosphorus as TP	mg/L	APHA : Pt 4500-P (J)	0.16	0.023	0.074	0.0068	0.011	0.029	0.015	0.0039	0.012	0.01 mg/L
Total Nitrogen as TN	mg/L	APHA : Pt 4500-P (J)	0.48	1.45	0.44	0.42	0.38	0.46	0.99	0.87	1.11	0.01 mg/L
Total Organic Carbon	mg/L	APHA : Pt 5310B	3.62	1.31	3.06	2.02	2.04	3.09	<1	<1	<1	1 mg/L
Nitrate as NO_3-N	mg/L	APHA : Pt 4500-NO_3 (I)	<0.015	0.37	0.096	0.26	0.25	<0.015	0.63	0.85	1.04	0.015 mg/L
Ammonical Nitrogen as NH_3-N	mg/L	APHA : Pt 4500-NH_3 (H)	0.21	0.11	0.099	0.058	0.057	0.40	0.064	<0.01	<0.01	-
Orthophosphate as PO_4-P	mg/L	APHA : Pt 4500-P (G)	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.025 mg/L
Total Dissolved Solids	mg/L	APHA : Pt 2540C	23.5	18.8	16.8	95.0	91.0	72.0	34.0	34.5	35.0	10 mg/L
Total Suspended Solids	mg/L	APHA : Pt 2540D	57.3	<10	10.8	<10	22.0	20.0	<10	25.6	<10	10 mg/L
Lead as Pb	mg/L	APHA : Pt 3125B	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	5 mg/L
Zinc as Zn	mg/L	APHA : Pt 3120B	0.013	0.016	0.024	0.0079	0.0085	0.010	0.035	0.045	0.051	5 mg/L
Mercury as Hg	mg/L	APHA : Pt 3112B	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	-
Arsenic as As	mg/L	APHA : Pt 3125B	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023	5 mg/L
Barium as Ba	mg/L	APHA : Pt 3120B	0.014	0.016	0.020	0.017	0.015	0.013	0.027	0.032	0.031	5 mg/L
Tin as Sn	mg/L	APHA : Pt 3120B	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	5 mg/L
Iron as Fe	mg/L	APHA : Pt 3120B	7.47	1.00	1.49	0.60	0.78	7.94	0.95	0.24	0.11	5 mg/L
Boron as B	mg/L	APHA : Pt 3120B	0.010	0.0051	0.0070	0.015	0.015	0.016	0.0050	0.0057	0.0051	5 mg/L
Manganese as Mn	mg/L	APHA : Pt 3120B	0.068	0.084	0.19	0.049	0.053	0.14	0.080	0.082	0.099	5 mg/L
Cadmium as Cd	mg/L	APHA : Pt 3120B	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	5 mg/L
Chromium as Cr (trivalent)	mg/L	APHA : Pt 3500-Cr (B)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	5 mg/L
Chromium as Cr (Hexavalent)	mg/L	APHA : Pt 3120B / APHA : Pt 3500-Cr (B)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	5 mg/L
Copper as Cu	mg/L	APHA : Pt 3120B	<0.0015	<0.0015	0.0022	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	5 mg/L
Nickel as Ni	mg/L	APHA : Pt 3120B	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	5 mg/L
Silver as Ag	mg/L	APHA : Pt 3120B	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	0.0068	<0.0015	<0.0015	5 mg/L
Beryllium as Be	mg/L	APHA : Pt 3120B	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	5 mg/L
Selenium as Se	mg/L	APHA : Pt 3125B	<0.045	<0.045	<0.045	<0.045	<0.045	<0.045	<0.045	<0.045	<0.045	5 mg/L
Metals in Total	mg/L	By Calculation	<0.045	<0.045	<0.045	<0.045	<0.045	<0.045	<0.045	0.045	0.054	5 mg/L
Enterococcus	cfu/mL	APHA : Pt 9230C	<1	2	3	1	<1	1	6	9	2	1 cfu/mL
Grease and Oil (Hydrocarbon)	mg/L	BCTD/Env/SOP/050 Rev (4) (Ref. APHA : Pt 5520C using PCE Solvent Extraction)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1 mg/L
Grease and Oil (Total)	mg/L		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1 mg/L

Remarks:

1. APHA is a Standard Method for the Determination of Water and Waste Water - APHA 24th Edition : 2023
2. The tested result applies only to the sample as received by the laboratory.
3. "<" = Not Detectable (The reported values are less than (<) the detection limits of the test methods).

TEST REPORT

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Fax: (65) 6566 7718
www.setsco.com
Business Reg No 196900269D

Your Ref:

Date : 08/07/2025

Our Ref : EN8500368730/LWW

Subject : Analysis of water samples submitted by **Aurecon Singapore Pte Ltd** on **16/06/2025** and testing commenced on **16/06/2025**.

Tested for : **Aurecon Singapore Pte Ltd**
152 Beach Road
#22-02 Gateway East
Singapore 189721
Attn : Ms. Koh Lay Kuan

Sample Reference : Nine (09) water samples were received.

Results : Refer to next page.

MARIVIE VIANA GAPUD
SENIOR CHEMIST

LEE WEI WAH
SENIOR MANAGER

BIOLOGICAL AND CHEMICAL TECHNOLOGY DIVISION

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RESULTS :

Test Parameters	Units	Test Methods	Dry Weather									Client's Spec
			WQ01	WQ02	WQ03	WQ04	WQ05	WQ06	WQ07	WQ08	WQ09	
			16/06/2025	16/06/2025	16/06/2025	16/06/2025	16/06/2025	16/06/2025	16/06/2025	16/06/2025	16/06/2025	
Biochemical Oxygen Demand	mg/L	APHA : Pt 5210B	2.7	2.3	13.9	<2	<2	4.5	<2	<2	<2	2 mg/L
Chemical Oxygen Demand	mgO_2/L	HACH Method 8000	37.9	17.8	32.1	4.8	3.7	35.1	<2	4.5	4.8	2 mg/L
Turbidity	NTU	APHA : Pt 2130B	170	20	700	5.6	15	26	2.1	0.25	6.1	-
Total Alkalinity as $CaCO_3$	mg/L	APHA : Pt 2320B	13.1	4.52	22.1	40.2	36.2	56.3	<2	<2	<2	-
Total Phosphorus as TP	mg/L	APHA : Pt 4500-P (J)	0.31	0.19	0.70	<0.003	<0.003	0.087	<0.003	0.0072	0.015	0.01 mg/L
Total Nitrogen as TN	mg/L	APHA : Pt 4500-P (J)	1.22	0.81	6.35	0.43	0.36	0.84	0.88	0.76	0.55	0.01 mg/L
Total Organic Carbon	mg/L	APHA : Pt 5310B	4.22	3.19	10.4	1.90	1.83	4.07	<1	<1	1.03	1 mg/L
Nitrate as NO_3-N	mg/L	APHA : Pt 4500-NO_3 (I)	<0.015	<0.015	<0.015	0.28	0.23	<0.015	0.84	0.71	0.45	0.015 mg/L
Ammonical Nitrogen as NH_3-N	mg/L	APHA : Pt 4500-NH_3 (H)	0.45	0.25	2.15	0.066	0.044	0.57	0.023	0.034	0.060	-
Orthophosphate as PO_4-P	mg/L	APHA : Pt 4500-P (G)	0.048	<0.025	0.10	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.025 mg/L
Total Dissolved Solids	mg/L	APHA : Pt 2540C	27.5	18.5	37.0	94.0	80.0	83.0	37.0	36.0	30.0	10 mg/L
Total Suspended Solids	mg/L	APHA : Pt 2540D	154	26.7	498	<10	17.6	58.6	<10	<10	20.0	10 mg/L
Lead as Pb	mg/L	APHA : Pt 3125B	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	5 mg/L
Zinc as Zn	mg/L	APHA : Pt 3120B	0.015	0.0098	0.16	0.011	0.0091	0.0064	0.043	0.039	0.033	5 mg/L
Mercury as Hg	mg/L	APHA : Pt 3112B	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	-
Arsenic as As	mg/L	APHA : Pt 3125B	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023	5 mg/L
Barium as Ba	mg/L	APHA : Pt 3120B	0.021	0.011	0.073	0.019	0.017	0.012	0.032	0.032	0.027	5 mg/L
Tin as Sn	mg/L	APHA : Pt 3120B	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	5 mg/L
Iron as Fe	mg/L	APHA : Pt 3120B	13.3	4.14	23.7	0.71	0.95	9.78	0.10	0.057	0.82	5 mg/L
Boron as B	mg/L	APHA : Pt 3120B	0.016	0.013	0.032	0.016	0.016	0.022	0.0071	0.0072	0.0099	5 mg/L
Manganese as Mn	mg/L	APHA : Pt 3120B	0.072	0.070	0.33	0.061	0.051	0.16	0.12	0.089	0.090	5 mg/L
Cadmium as Cd	mg/L	APHA : Pt 3120B	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	5 mg/L
Chromium as Cr (trivalent)	mg/L	APHA : Pt 3500-Cr (B)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	5 mg/L
Chromium as Cr (Hexavalent)	mg/L	APHA : Pt 3120B / APHA : Pt 3500-Cr (B)	<0.01	<0.01	0.024	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	5 mg/L
Copper as Cu	mg/L	APHA : Pt 3120B	0.0025	<0.0015	0.026	<0.0015	<0.0015	<0.0015	<0.0015	0.0047	0.0018	5 mg/L
Nickel as Ni	mg/L	APHA : Pt 3120B	<0.0045	<0.0045	0.011	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	5 mg/L
Silver as Ag	mg/L	APHA : Pt 3120B	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	5 mg/L
Beryllium as Be	mg/L	APHA : Pt 3120B	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	5 mg/L
Selenium as Se	mg/L	APHA : Pt 3125B	<0.045	<0.045	<0.045	<0.045	<0.045	<0.045	<0.045	<0.045	<0.045	5 mg/L
Metals in Total	mg/L	By Calculation	<0.045	<0.045	0.23	<0.045	<0.045	<0.045	<0.045	<0.045	<0.045	5 mg/L
Enterococcus	cfu/mL	APHA : Pt 9230C	<1	<1	<1	1	3	5	<1	1	2	1 cfu/mL
Grease and Oil (Hydrocarbon)	mg/L	BCTD/Env/SOP/050 Rev (4) (Ref. APHA : Pt 5520C using PCE Solvent Extraction)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1 mg/L
Grease and Oil (Total)	mg/L		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1 mg/L

Remarks:

1. APHA is a Standard Method for the Determination of Water and Waste Water - APHA 24th Edition : 2023
2. The tested result applies only to the sample as received by the laboratory.
3. "<" = Not Detectable (The reported values are less than (<) the detection limits of the test methods).

TEST REPORT

(This Report is issued subject to the terms & conditions set out below)

SETSCO

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531 Bukit Batok Street 23
Singapore 659547
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Fax: (65) 6566 7718
www.setsco.com
Business Reg No 196900269D

Your Ref:

Our Ref : EN8500368964/LWW

Date : 08/07/2025

Subject : Analysis of water samples submitted by **Aurecon Singapore Pte Ltd** on **17/06/2025** and testing commenced on **17/06/2025**.

Tested for : **Aurecon Singapore Pte Ltd**
152 Beach Road
#22-02 Gateway East
Singapore 189721
Attn : Ms. Koh Lay Kuan

Sample Reference : Nine (09) water samples were received.

Results : Refer to next page.

MARIVIE VIANA GAPUD
SENIOR CHEMIST

LEE WEI WAH
SENIOR MANAGER

BIOLOGICAL AND CHEMICAL TECHNOLOGY DIVISION

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RESULTS :

Test Parameters	Units	Test Methods	Wet Weather									Client's Spec
			WQ01	WQ02	WQ03	WQ04	WQ05	WQ06	WQ07	WQ08	WQ09	
			17/06/2025	17/06/2025	17/06/2025	17/06/2025	17/06/2025	17/06/2025	17/06/2025	17/06/2025	17/06/2025	
Biochemical Oxygen Demand	mg/L	APHA : Pt 5210B	<2	3.4	3.5	<2	<2	5.2	<2	<2	<2	2 mg/L
Chemical Oxygen Demand	mgO_2/L	HACH Method 8000	24.9	27.9	36.2	15.1	18.1	32.6	14.5	10.5	10.1	2 mg/L
Turbidity	NTU	APHA : Pt 2130B	60	110	290	26	35	65	55	29	29	-
Total Alkalinity as $CaCO_3$	mg/L	APHA : Pt 2320B	5.00	2.50	3.00	37.0	32.0	13.5	<2	<2	<2	-
Total Phosphorus as TP	mg/L	APHA : Pt 4500-P (J)	0.093	0.20	0.28	0.022	0.015	0.032	0.013	0.0041	0.0096	0.01 mg/L
Total Nitrogen as TN	mg/L	APHA : Pt 4500-P (J)	0.83	2.99	2.91	1.02	0.91	3.75	1.80	1.70	1.57	0.01 mg/L
Total Organic Carbon	mg/L	APHA : Pt 5310B	3.76	3.73	7.46	3.31	3.24	5.74	2.39	1.80	1.78	1 mg/L
Nitrate as NO_3-N	mg/L	APHA : Pt 4500-NO_3 (I)	0.25	0.99	1.06	0.47	0.48	0.46	0.98	1.21	1.30	0.015 mg/L
Ammonical Nitrogen as NH_3-N	mg/L	APHA : Pt 4500-NH_3 (H)	0.25	0.045	0.19	0.14	0.14	0.30	0.062	0.018	0.022	-
Orthophosphate as PO_4-P	mg/L	APHA : Pt 4500-P (G)	<0.025	<0.025	0.039	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.025 mg/L
Total Dissolved Solids	mg/L	APHA : Pt 2540C	26.0	25.0	29.0	81.0	70.0	46.0	29.0	33.0	34.0	10 mg/L
Total Suspended Solids	mg/L	APHA : Pt 2540D	45.0	88.8	112	<10	<10	19.0	13.6	<10	<10	10 mg/L
Lead as Pb	mg/L	APHA : Pt 3125B	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	5 mg/L
Zinc as Zn	mg/L	APHA : Pt 3120B	0.013	0.021	0.075	0.0095	0.0099	0.016	0.033	0.038	0.041	5 mg/L
Mercury as Hg	mg/L	APHA : Pt 3112B	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	-
Arsenic as As	mg/L	APHA : Pt 3125B	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023	5 mg/L
Barium as Ba	mg/L	APHA : Pt 3120B	0.014	0.017	0.030	0.015	0.014	0.014	0.026	0.029	0.028	5 mg/L
Tin as Sn	mg/L	APHA : Pt 3120B	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	5 mg/L
Iron as Fe	mg/L	APHA : Pt 3120B	3.14	4.12	6.03	1.67	1.81	2.89	1.83	0.80	0.78	5 mg/L
Boron as B	mg/L	APHA : Pt 3120B	0.014	0.017	0.030	0.021	0.020	0.021	0.011	0.014	0.012	5 mg/L
Manganese as Mn	mg/L	APHA : Pt 3120B	0.045	0.061	0.10	0.042	0.050	0.071	0.071	0.078	0.089	5 mg/L
Cadmium as Cd	mg/L	APHA : Pt 3120B	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	5 mg/L
Chromium as Cr (trivalent)	mg/L	APHA : Pt 3500-Cr (B)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	5 mg/L
Chromium as Cr (Hexavalent)	mg/L	APHA : Pt 3120B / APHA : Pt 3500-Cr (B)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	5 mg/L
Copper as Cu	mg/L	APHA : Pt 3120B	0.0022	0.0050	0.0082	0.0039	0.0032	0.0055	0.0039	0.0041	0.0024	5 mg/L
Nickel as Ni	mg/L	APHA : Pt 3120B	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	5 mg/L
Silver as Ag	mg/L	APHA : Pt 3120B	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	5 mg/L
Beryllium as Be	mg/L	APHA : Pt 3120B	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	5 mg/L
Selenium as Se	mg/L	APHA : Pt 3125B	<0.045	<0.045	<0.045	<0.045	<0.045	<0.045	<0.045	<0.045	<0.045	5 mg/L
Metals in Total	mg/L	By Calculation	<0.045	<0.045	0.092	<0.045	<0.045	<0.045	<0.045	<0.045	<0.045	5 mg/L
Enterococcus	cfu/mL	APHA : Pt 9230C	130	70	220	30	30	80	40	50	40	1 cfu/mL
Grease and Oil (Hydrocarbon)	mg/L	BCTD/Env/SOP/050 Rev (4) (Ref. APHA : Pt 5520C using PCE Solvent Extraction)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1 mg/L
Grease and Oil (Total)	mg/L		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1 mg/L

Remarks:

1. APHA is a Standard Method for the Determination of Water and Waste Water - APHA 24th Edition : 2023
2. The tested result applies only to the sample as received by the laboratory.
3. "<" = Not Detectable (The reported values are less than (<) the detection limits of the test methods).

WQ1

Date Time	pH (pH) (944343	Specific Conductivity (µS/cm) (744594	RDO Concentration (mg/L) (102508	Salinity (PSU) (744594	Temperature (°C) (607618	Temperature (°C) (919197	Marked
############	6.453214	78.357735	5.037915	0.036236346	27.058172	27.408333	
############	6.439725	78.3404	4.9689455	0.036227938	27.057886	27.41012	
############	6.3672066	78.305534	4.7913513	0.036210958	27.060913	27.428795	
############	6.261122	78.23884	4.6576743	0.036178507	27.064802	27.438602	
############	6.213814	78.22376	4.5400505	0.03617114	27.071106	27.456585	
############	6.20475	78.219666	4.522346	0.03616914	27.071957	27.458921	
############	6.1660757	78.213264	4.429173	0.036165934	27.07452	27.47772	
############	6.130547	78.16329	4.346487	0.03614164	27.076721	27.48791	
############	6.125224	78.157455	4.3340654	0.0361388	27.077044	27.489698	
############	6.096976	78.17952	4.2107697	0.03614946	27.079666	27.498936	
	6.24586543	**78.2399464**	**4.58387777**	**0.036178986**	**27.0692787**	**27.455562**	

WQ2

Date Time	pH (pH) (944343	Specific Conductivity (µS/cm) (744594	RDO Concentration (mg/L) (102508	Salinity (PSU) (744594	Temperature (°C) (607618	Temperature (°C) (919197	Marked
############	5.8190846	37.728607	5.146421	0.016491143	26.828922	28.38	
############	5.8190846	37.728607	5.146421	0.016491143	26.828922	28.38	
############	5.816318	37.745995	5.0810523	0.016499577	26.829144	28.389324	
############	5.8159075	37.748573	5.071351	0.016500829	26.829176	28.390709	
############	5.807166	37.76906	5.0374403	0.016510772	26.829744	28.389917	
############	5.794505	37.750015	5.0127892	0.016501542	26.828083	28.398699	
############	5.792767	37.748707	5.0086436	0.016500907	26.82792	28.399664	
############	5.7895565	37.75823	4.9874134	0.016511384	26.827856	28.399948	
############	5.7859674	37.78705	4.9647865	0.016520178	26.8269	28.408718	
############	5.785474	37.790592	4.9615426	0.016521554	26.826797	28.409666	
	5.80258306	**37.7555436**	**5.04178609**	**0.016504903**	**26.8283464**	**28.3946645**	

WQ3

Date Time	pH (pH) (944343	Specific Conductivity (µS/cm) (744594	RDO Concentration (mg/L) (102508	Salinity (PSU) (744594	Temperature (°C) (607618	Temperature (°C) (919197	Marked
############	5.3501267	47.647957	4.6061416	0.021313444	26.673838	28.55	
############	5.3501267	47.647957	4.6061416	0.021313444	26.673838	28.55	

##########	5.3534255	47.645203	4.5514684	0.021312103	26.673721	28.55
##########	5.353889	47.644817	4.543787	0.021311915	26.673704	28.55
##########	5.3584676	47.642868	4.5270596	0.021310976	26.672918	28.56833
##########	5.3650546	47.660557	4.5058036	0.021319568	26.676697	28.56946
##########	5.365938	47.662376	4.5027733	0.021320453	26.677074	28.570257
##########	5.368908	47.657684	4.4912953	0.021318123	26.678644	28.57
##########	5.375079	47.658566	4.476021	0.021318542	26.679655	28.57
##########	5.375839	47.658447	4.473986	0.02131848	26.679813	28.57
	5.36168541	**47.6526432**	**4.52844774**	**0.021315705**	**26.6759902**	**28.5618047**

WQ4

Date Time	pH (pH) (944343	Specific Conductivity (µS/cm) (744594	RDO Concentration (mg/L) (102508	Salinity (PSU) (744594	Temperature (°C) (607618	Temperature (°C) (919197	Marked
##########	6.3815866	114.516556	7.5450935	0.05376997	26.861242	28.65	
##########	6.393417	114.51112	7.524786	0.0537673	26.86204	28.659365	
##########	6.395129	114.51034	7.5218472	0.053766917	26.862154	28.66072	
##########	6.4051023	114.52096	7.5206923	0.05377207	26.861803	28.659922	
##########	6.4224377	114.51278	7.5198913	0.053768106	26.862186	28.668667	
##########	6.4247174	114.51228	7.519715	0.053767864	26.862217	28.669605	
##########	6.4325953	114.513374	7.5156016	0.053768374	26.862703	28.688362	
##########	6.440956	114.52115	7.5077095	0.053772144	26.862825	28.69827	
##########	6.4421344	114.522064	7.5066934	0.053772587	26.862856	28.700045	
##########	6.447603	114.52536	7.5011134	0.053774193	26.86253	28.699963	
	6.41856787	**114.5165984**	**7.51831432**	**0.053769953**	**26.8622556**	**28.6754919**	

WQ5

Date Time	pH (pH) (944343	Specific Conductivity (µS/cm) (744594	RDO Concentration (mg/L) (102508	Salinity (PSU) (744594	Temperature (°C) (607618	Temperature (°C) (919197	Marked
##########	6.000314	103.91395	7.270241	0.048633896	26.842463	28.42	
##########	6.0180087	103.90494	7.255579	0.048629537	26.842216	28.42	
##########	6.0206375	103.9036	7.2534003	0.04862889	26.84218	28.42	
##########	6.035323	103.89755	7.2541604	0.048625957	26.842735	28.42917	
##########	6.064376	103.90143	7.243646	0.04862781	26.843758	28.44723	
##########	6.0682116	103.9016	7.2424726	0.04862789	26.843893	28.44959	

##########	6.083526	103.88739	7.231324	0.04862101	26.84395	28.449959
##########	6.0984054	103.88024	7.215096	0.04861755	26.843685	28.467686
##########	6.1006	103.8789	7.2129016	0.048616897	26.843657	28.46962
##########	6.113826	103.874466	7.2063847	0.048614725	26.844488	28.4607
	6.06032282	**103.8944066**	**7.23852056**	**0.048624416**	**26.8433025**	**28.4433955**

WQ6

Date Time	pH (pH) (944343	Specific Conductivity (µS/cm) (744594	RDO Concentration (mg/L) (102508	Salinity (PSU) (744594	Temperature (°C) (607618	Temperature (°C) (919197	Marked
##########	5.5036383	73.90373	4.033418	0.034078937	26.723497	29.32	
##########	5.5089765	73.87762	4.0022264	0.03406622	26.724632	29.32899	
##########	5.522998	73.86967	3.9715385	0.03406235	26.72681	29.32964	
##########	5.5247197	73.86783	3.9670072	0.034061454	26.727089	29.330044	
##########	5.535512	73.825874	3.9405086	0.034041055	26.727106	29.347765	
##########	5.5398607	73.81928	3.9082148	0.034037825	26.728926	29.35771	
##########	5.5406637	73.8171	3.9038103	0.03403676	26.72912	29.359436	
##########	5.4463186	75.3565	3.6084015	0.03478293	26.823109	29.359837	
##########	5.47151	75.46194	3.4757197	0.034833934	26.836525	29.36	
##########	5.470876	75.529236	3.4504828	0.034866538	26.841398	29.36	
	5.50650735	**74.332878**	**3.82613278**	**0.0342868**	**26.7588212**	**29.3453422**	

WQ7

Date Time	pH (pH) (944343	Specific Conductivity (µS/cm) (744594	RDO Concentration (mg/L) (102508	Salinity (PSU) (744594	Temperature (°C) (607618	Temperature (°C) (919197	Marked
##########	5.201671	46.287743	7.0641866	0.020663045	25.592518	29.13	
##########	5.195471	46.289818	7.029232	0.020664012	25.596476	29.13	
##########	5.194539	46.29013	7.0239806	0.020664157	25.597069	29.13	
##########	5.1937532	46.28628	7.0249376	0.020662254	25.600586	29.138985	
##########	5.1847277	46.284786	7.008947	0.020661492	25.604153	29.148186	
##########	5.1836853	46.284473	7.007173	0.020661335	25.604685	29.149551	
##########	5.1811147	46.291443	6.9950047	0.020664696	25.611479	29.149878	
##########	5.172114	46.28416	6.992398	0.02066109	25.614843	29.167387	
##########	5.1710296	46.283604	6.991698	0.020660808	25.615469	29.169353	
##########	5.1654544	46.29304	6.978412	0.020665374	25.618704	29.169928	

5.18435599	**46.2875477**	**7.01159695**	**0.020662826**	**25.6055982**	**29.1483268**	

WQ8

Date Time	pH (pH) (944343	Specific Conductivity (µS/cm) (744594	RDO Concentration (mg/L) (102508	Salinity (PSU) (744594	Temperature (°C) (607618	Temperature (°C) (919197	Marked
##########	4.655636	50.926773	7.5141306	0.022922162	25.395153	29.29	
##########	4.655636	50.926773	7.5141306	0.022922162	25.395153	29.29	
##########	4.653558	50.927784	7.526008	0.022922622	25.398645	29.29	
##########	4.653264	50.927925	7.5276875	0.022922687	25.39914	29.29	
##########	4.649379	50.92865	7.5192494	0.022923	25.403276	29.29	
##########	4.647357	50.923256	7.5188336	0.02291995	25.411104	29.29	
##########	4.6470013	50.92269	7.518503	0.022919627	25.412106	29.29	
##########	4.6512527	50.917538	7.5144997	0.022917416	25.417141	29.298956	
##########	4.648967	50.911747	7.5185227	0.02291457	25.422302	29.308083	
##########	4.6488786	50.910954	7.5188136	0.022914194	25.423016	29.309395	
	4.65109296	**50.922409**	**7.51903787**	**0.022919839**	**25.4077036**	**29.2946434**	

WQ9

Date Time	pH (pH) (944343	Specific Conductivity (µS/cm) (744594	RDO Concentration (mg/L) (102508	Salinity (PSU) (744594	Temperature (°C) (607618	Temperature (°C) (919197	Marked
##########	6.096543	52.987743	7.7708445	0.023927348	25.169275	28.84	
##########	6.06901	53.02231	7.779051	0.023944138	25.172386	28.858578	
##########	6.0649066	53.02746	7.780274	0.023946641	25.17285	28.861345	
##########	6.0391774	53.04918	7.7628503	0.023957213	25.172583	28.850735	
##########	5.990056	53.081642	7.766303	0.023973009	25.172947	28.867453	
##########	5.9836845	53.086063	7.7660394	0.02397516	25.172983	28.86891	
##########	5.953798	53.109722	7.7704897	0.023986693	25.170609	28.878828	
##########	5.9298944	53.12238	7.7695985	0.023992864	25.16906	28.888308	
##########	5.926308	53.124554	7.769645	0.023993924	25.1688	28.889656	
##########	5.907155	53.14806	7.755443	0.024005394	25.166365	28.889889	
	5.99605329	**53.0759114**	**7.76905384**	**0.023970238**	**25.1707858**	**28.8693702**	

WQ1

Date Time	pH (pH) (944343)	Temperature (Â°C) (607618)	Specific Conductivity (ÂµS/cm) (744594)	RDO Concentration (mg/L) (1025082)	Salinity (PSU) (744594)	Temperature (Â°C) (919197)
12/06/2025 11:12	4.983965	27.234524	54.51572	3.8637505	0.024647137	30.72
12/06/2025 11:12	5.0164804	27.23493	54.500458	3.2858396	0.024639709	30.729332
12/06/2025 11:12	5.020977	27.234985	54.49835	3.2059166	0.02463868	30.730623
12/06/2025 11:12	5.0417104	27.236408	54.469425	3.0657964	0.024624595	30.748125
12/06/2025 11:12	5.075314	27.236317	54.44403	2.9004009	0.02461224	30.783978
12/06/2025 11:12	5.079717	27.236359	54.440235	2.876671	0.024610393	30.788465
12/06/2025 11:12	5.0971694	27.23762	54.37577	2.7387943	0.024579024	30.807583
12/06/2025 11:12	5.110148	27.238148	54.342945	2.6171527	0.02456306	30.800764
12/06/2025 11:12	5.112077	27.238249	54.3372	2.5995831	0.024560263	30.800627
12/06/2025 11:12	5.121258	27.23849	54.31233	2.3991501	0.02454816	30.818121
12/06/2025 11:12	5.129633	27.2402	54.290237	2.3081152	0.024537392	30.810766
12/06/2025 11:12	5.1308317	27.240393	54.28704	2.2914655	0.024535835	30.810627
12/06/2025 11:12	5.14907	27.23926	54.27547	2.2153242	0.02453023	30.846062
12/06/2025 11:12	5.1573973	27.241665	54.251408	2.1492307	0.024518518	30.882458
12/06/2025 11:12	5.1589303	27.241879	54.248455	2.1395738	0.024517082	30.887703
12/06/2025 11:12	5.1620893	27.240997	54.195953	2.081007	0.024491528	30.898108
12/06/2025 11:12	5.162702	27.241009	54.18965	2.072556	0.02448846	30.900581
12/06/2025 11:12	5.1728754	27.240763	54.173706	2.0223777	0.024480714	30.881468
12/06/2025 11:12	5.179932	27.240324	54.15906	1.9416114	0.024473595	30.880487
12/06/2025 11:12	5.1810293	27.240274	54.157013	1.9314761	0.024472598	30.879717
	5.112165325	**27.2386397**	**54.32322275**	**2.53528964**	**0.024553461**	**30.82027975**

WQ2

Date Time	pH (pH) (944343)	Temperature (Â°C) (607618)	Specific Conductivity (ÂµS/cm) (744594)	RDO Concentration (mg/L) (1025082)	Salinity (PSU) (744594)	Temperature (Â°C) (919197)
12/06/2025 10:52	6.9462333	27.526997	0.052415203	7.217743	0	30.309008
12/06/2025 10:52	6.932505	27.41625	0.052468583	6.776341	0	30.347054
12/06/2025 10:52	6.70651	27.051088	33.152092	6.231354	0.014482299	30.36672
12/06/2025 10:52	6.682194	27.008715	36.62066	6.1583657	0.015999923	30.370152
12/06/2025 10:52	6.257104	26.950918	37.468662	5.0783806	0.01636958	30.379198
12/06/2025 10:53	5.9922447	26.94956	37.636753	4.0317264	0.016445369	30.388512
12/06/2025 10:53	5.9490423	26.947687	37.6402	3.8825655	0.016447062	30.389824
12/06/2025 10:53	5.760187	26.952303	37.730976	3.5883214	0.01649107	30.40838
12/06/2025 10:53	5.524666	26.951025	37.801132	3.3602955	0.016525133	30.4269
12/06/2025 10:53	5.493136	26.951027	37.811745	3.3266273	0.016530281	30.429523
12/06/2025 10:53	5.4024796	26.950026	37.826126	3.1576934	0.016537275	30.502693
12/06/2025 10:53	5.330753	26.948317	37.825424	3.0154476	0.016536951	30.542324
12/06/2025 10:53	5.320279	26.948105	37.825764	2.9945762	0.016537119	30.54913
12/06/2025 10:53	5.265698	26.94846	37.77423	2.8796751	0.016512102	30.558756
12/06/2025 10:53	5.215645	26.949947	37.75485	2.7860765	0.016502678	30.576998
	5.91857846	**27.03002833**	**32.33156652**	**4.299012613**	**0.014127789**	**30.4363448**

WQ3

Date Time	pH (pH) (944343)	Temperature (Â°C) (607618)	Specific Conductivity (ÂµS/cm) (744594)	RDO Concentration (mg/L) (1025082)	Salinity (PSU) (744594)	Temperature (Â°C) (919197)
12/06/2025 11:01	4.707481	26.946388	30.289076	3.0746415	0.012886599	30.011206
12/06/2025 11:02	4.712841	26.947445	30.292883	2.99846	0.012888437	30.02794
12/06/2025 11:02	4.708023	26.947784	30.29967	2.91264	0.012891708	30.055107
12/06/2025 11:02	4.707713	26.94786	30.300533	2.900349	0.012892124	30.058645
12/06/2025 11:02	4.7136874	26.94891	30.306892	2.8198407	0.012895188	30.13111
12/06/2025 11:02	4.710005	26.950119	30.309076	2.7495983	0.012896232	30.162663
12/06/2025 11:02	4.7098317	26.950285	30.309513	2.7394228	0.012896441	30.168512
12/06/2025 11:02	4.7066364	26.949896	30.313368	2.6720877	0.012898308	30.17851
12/06/2025 11:02	4.7096076	26.949121	30.322948	2.6116297	0.012902943	30.18814
12/06/2025 11:02	4.709831	26.949018	30.324123	2.6028512	0.012903512	30.189463
12/06/2025 11:02	4.7142906	26.949348	30.330889	2.5056849	0.012906776	30.19874
12/06/2025 11:02	4.7091208	26.948038	30.331633	2.460528	0.012907147	30.23345
12/06/2025 11:02	4.7086997	26.94791	30.331919	2.4523623	0.012907286	30.237541
12/06/2025 11:02	4.7068176	26.946503	30.336239	2.4093318	0.012909381	30.257078
12/06/2025 11:02	4.70361	26.944273	30.339907	2.3734648	0.012911683	30.31822
12/06/2025 11:02	4.7032146	26.943985	30.340464	2.3681448	0.012912011	30.325478
12/06/2025 11:02	4.706468	26.942364	30.355509	2.3318934	0.012918784	30.33751
	4.708698729	**26.94760276**	**30.31968482**	**2.646054759**	**0.012901445**	**30.18113606**

WQ4

Date Time	pH (pH) (944343)	Temperature (Â°C) (607618)	Specific Conductivity (ÂµS/cm) (744594)	RDO Concentration (mg/L) (1025082)	Salinity (PSU) (744594)	Temperature (Â°C) (919197)
12/06/2025 10:33	6.1341324	27.341763	150.38736	7.1981425	0.0711313	30.57946
12/06/2025 10:33	6.136789	27.341335	150.40157	7.195041	0.071138196	30.580761
12/06/2025 10:33	6.1493177	27.339664	150.43144	7.1855493	0.071152724	30.607552
12/06/2025 10:33	6.160675	27.3369	150.45174	7.171158	0.071162626	30.626669
12/06/2025 10:33	6.1623883	27.336538	150.45525	7.1692276	0.07116433	30.629707
12/06/2025 10:33	6.186524	27.334656	150.45908	7.1655254	0.07116626	30.66655
12/06/2025 10:33	6.1964464	27.331047	150.48206	7.1653337	0.07118879	30.69466
12/06/2025 10:33	6.1983624	27.330605	150.48459	7.1651974	0.071191214	30.698938
12/06/2025 10:34	6.206442	27.327396	150.53416	7.1559796	0.07120386	30.708727
12/06/2025 10:34	6.215651	27.32451	150.55582	7.145991	0.07121383	30.726954
12/06/2025 10:34	6.2169166	27.324095	150.55988	7.1445823	0.07121529	30.729198
12/06/2025 10:34	6.2220535	27.323683	150.55107	7.132391	0.07121115	30.729767
12/06/2025 10:34	6.2296395	27.320498	150.56078	7.1316495	0.07121594	30.755493
12/06/2025 10:34	6.230605	27.320152	150.56145	7.1311526	0.07121627	30.758184
12/06/2025 10:34	6.246065	27.318296	150.55125	7.137134	0.071211405	30.80446
	6.19280052	**27.33007587**	**150.4951667**	**7.15960366**	**0.071185546**	**30.686472**

WQ5

Date Time	pH (pH) (944343)	Temperature (Â°C) (607618)	Specific Conductivity (ÂµS/cm) (744594)	RDO Concentration (mg/L) (1025082)	Salinity (PSU) (744594)	Temperature (Â°C) (919197)
12/06/2025 9:59	7.008102	27.343067	133.75668	6.8882446	0.073725805	31.85337
12/06/2025 9:59	6.9940624	27.315113	133.75587	6.8786592	0.07484879	31.85984
12/06/2025 9:59	6.981976	27.294666	156.85066	6.8655515	0.07515732	31.878227
12/06/2025 9:59	6.970391	27.295738	158.32613	6.821417	0.07528951	31.88823
12/06/2025 9:59	6.968856	27.295553	159.33423	6.816381	0.07529684	31.889944
12/06/2025 9:59	6.9537783	27.29266	158.92612	6.7606363	0.07527085	31.889936
12/06/2025 9:59	6.93701	27.28234	158.95804	6.749694	0.07528663	31.898712
12/06/2025 9:59	6.93469	27.281124	158.95915	6.7465587	0.07528721	31.899635
12/06/2025 10:00	6.853036	27.277086	158.94164	6.729313	0.07527885	31.954458
12/06/2025 10:00	6.851819	27.262945	159.04855	6.7075653	0.07533102	31.992775
12/06/2025 10:00	6.8488064	27.261314	159.05923	6.7046204	0.07533623	31.998796
12/06/2025 10:00	6.830582	27.247574	159.44049	6.69018	0.07552154	32.008476
12/06/2025 10:00	6.8178425	27.247463	159.4547	6.6826653	0.07552845	32.018223
12/06/2025 10:00	6.8158045	27.247017	159.46904	6.6814094	0.075535424	32.019527
12/06/2025 10:00	6.806694	27.258678	159.35326	6.665429	0.07547893	32.046925
12/06/2025 10:00	6.797923	27.267736	159.40945	6.656019	0.07550588	32.04044
	6.898210819	**27.27937963**	**155.8152025**	**6.752771481**	**0.075229955**	**31.94609463**

WQ6

Date Time	pH (pH) (944343)	Temperature (Â°C) (607618)	Specific Conductivity (ÂµS/cm) (744594)	RDO Concentration (mg/L) (1025082)	Salinity (PSU) (744594)	Temperature (Â°C) (919197)
12/06/2025 10:09	5.9363585	27.17905	115.972275	4.0351157	0.054467738	32.301285
12/06/2025 10:09	5.9325314	27.183634	115.97555	3.6637597	0.054469217	32.317345
12/06/2025 10:09	5.9273405	27.189514	115.97111	3.510946	0.05446693	32.32763
12/06/2025 10:09	5.9266415	27.190315	115.97073	3.4809277	0.05446673	32.32933
12/06/2025 10:09	5.9175563	27.189672	115.980316	3.3717043	0.054471385	32.391922
12/06/2025 10:09	5.9103975	27.192595	115.97876	3.2734287	0.054464407	32.439217
12/06/2025 10:09	5.9093094	27.192867	115.97895	3.2592695	0.054463815	32.44661
12/06/2025 10:09	5.9036846	27.190182	115.53349	3.1734934	0.054254275	32.475513
12/06/2025 10:09	5.902837	27.19002	115.486885	3.1609457	0.054232094	32.480267
12/06/2025 10:09	5.895466	27.192772	115.507126	3.0893726	0.054242115	32.479935
12/06/2025 10:09	5.8956804	27.195055	115.52144	2.95932	0.05424902	32.506428
12/06/2025 10:09	5.895434	27.1954	115.52417	2.943068	0.05425033	32.5092
12/06/2025 10:09	5.8932705	27.197353	115.55467	2.8848124	0.054265063	32.51916
12/06/2025 10:09	5.889848	27.198359	115.58117	2.8410506	0.05427787	32.57187
12/06/2025 10:09	5.8894086	27.198534	115.585045	2.8344839	0.054279745	32.57765
12/06/2025 10:09	5.8877754	27.2041	115.82679	2.7899837	0.054396693	32.616035
12/06/2025 10:09	5.8109565	27.16093	115.08206	2.6324687	0.05403702	32.61886
	5.901440947	**27.19060894**	**115.7076786**	**3.170832388**	**0.054338497**	**32.46519159**

WQ7

Date Time	pH (pH) (944343)	Temperature (Â°C) (607618)	Specific Conductivity (ÂµS/cm) (744594)	RDO Concentration (mg/L) (1025082)	Salinity (PSU) (744594)	Temperature (Â°C) (919197)
12/06/2025 13:17	4.67171	28.06798	53.838024	6.6960297	0.02430627	31.03
12/06/2025 13:17	4.684004	28.06387	53.861824	6.595758	0.024317889	31.039358
12/06/2025 13:17	4.6857157	28.063297	53.86514	6.5817924	0.024319507	31.04066
12/06/2025 13:17	4.6926894	28.061872	53.86576	6.5572925	0.024319835	31.085508
12/06/2025 13:17	4.7061515	28.058466	53.865612	6.5280285	0.024319813	31.131561
12/06/2025 13:17	4.7078595	28.058044	53.86566	6.523838	0.024319844	31.138117
12/06/2025 13:17	4.7142906	28.05176	53.88054	6.5098705	0.024325855	31.18384
12/06/2025 13:17	4.718936	28.04742	53.872242	6.4908414	0.024323031	31.213734
12/06/2025 13:17	4.7196183	28.04675	53.87185	6.48838	0.024322929	31.218393
12/06/2025 13:17	4.7251906	28.043919	53.883923	6.4691677	0.0243289	31.219547
12/06/2025 13:17	4.728659	28.038904	53.87758	6.4458265	0.024325907	31.237011
12/06/2025 13:17	4.7292233	28.038269	53.87736	6.4426603	0.024325809	31.23886
12/06/2025 13:17	4.7317753	28.034243	53.875546	6.4215746	0.024324989	31.257584
12/06/2025 13:17	4.736928	28.028196	53.87622	6.411984	0.024325395	31.293047
12/06/2025 13:17	4.7375674	28.027414	53.87626	6.410264	0.024325423	31.297499
	4.712687907	**28.0486936**	**53.87023607**	**6.504887207**	**0.024322093**	**31.17498127**

WQ8

Date Time	pH (pH) (944343)	Temperature (Â°C) (607618)	Specific Conductivity (ÂµS/cm) (744594)	RDO Concentration (mg/L) (1025082)	Salinity (PSU) (744594)	Temperature (Â°C) (919197)
12/06/2025 12:56	5.774902	27.789963	59.564903	7.153168	0.027094664	32.29182
12/06/2025 12:56	5.7216535	27.793621	59.772335	7.0828013	0.027195457	32.31099
12/06/2025 12:56	5.7128797	27.792782	59.7846	7.073672	0.02720143	32.313602
12/06/2025 12:56	5.7041063	27.79194	59.79686	7.0645423	0.027207404	32.316216
12/06/2025 12:56	5.6953325	27.7911	59.80912	7.055413	0.027213378	32.31883
12/06/2025 12:56	5.6600294	27.778196	59.688408	7.0430284	0.027154878	32.30248
12/06/2025 12:57	5.6546044	27.777454	59.69101	7.038121	0.027156154	32.302834
12/06/2025 12:57	5.649179	27.776714	59.69361	7.033214	0.02715743	32.30319
12/06/2025 12:57	5.643754	27.775974	59.696213	7.028307	0.027158706	32.30354
12/06/2025 12:57	5.585418	27.782722	59.71749	7.0038543	0.027168958	32.300198
12/06/2025 12:57	5.581094	27.782656	59.71766	7.0013714	0.027169041	32.300014
12/06/2025 12:57	5.57677	27.782587	59.71783	6.998889	0.027169125	32.29983
12/06/2025 12:57	5.572446	27.782518	59.718002	6.9964066	0.027169209	32.299644
12/06/2025 12:57	5.5054145	27.793856	59.671783	6.9847484	0.027146569	32.317287
12/06/2025 12:57	5.5011883	27.794424	59.67061	6.983472	0.027145987	32.31802
12/06/2025 12:57	5.496962	27.794992	59.669434	6.982196	0.027145408	32.31875
	5.62723335	**27.78634369**	**59.71124175**	**7.032700294**	**0.027165862**	**32.30732781**

WQ9

Date Time	pH (pH) (944343)	Temperature (Â°C) (607618)	Specific Conductivity (ÂµS/cm) (744594)	RDO Concentration (mg/L) (1025082)	Salinity (PSU) (744594)	Temperature (Â°C) (919197)
12/06/2025 12:49	7.450732	29.477598	0.050615598	7.099197	0	31.571114
12/06/2025 12:49	7.806933	28.379156	50.510025	7.277689	0.022958761	31.570446
12/06/2025 12:49	7.844996	28.25909	55.98251	7.287987	0.025448712	31.57011
12/06/2025 12:49	7.5416803	28.104752	58.01201	7.283997	0.02636388	31.614851
12/06/2025 12:49	7.414104	28.088774	59.41999	7.255347	0.02701975	31.626642
12/06/2025 12:49	7.388061	28.085472	59.46179	7.251487	0.027040118	31.629538
12/06/2025 12:49	7.279301	28.100142	59.531242	7.2382836	0.027073657	31.629818
12/06/2025 12:49	7.183887	28.104328	59.55096	7.2000213	0.027083185	31.63
12/06/2025 12:49	7.169977	28.105251	59.553417	7.1954956	0.027084365	31.63
12/06/2025 12:49	7.0858903	28.107485	59.545174	7.183559	0.027080314	31.638868
12/06/2025 12:49	7.0736585	28.107838	59.544563	7.1807985	0.02708001	31.639784
12/06/2025 12:49	6.9484887	28.10916	59.742123	7.1641035	0.027176028	31.677029
12/06/2025 12:49	6.8936	28.097187	59.88059	7.151166	0.02717781	31.705349
	7.313946831	**28.24047946**	**53.9065392**	**7.213010115**	**0.024506661**	**31.62565762**

WQ1

Date Time	pH (pH) (944343)	Temperature (Â°C) (607618)	Specific Conductivity (ÂµS/cm) (744594)	RDO Concentration (mg/L) (1025082)	Salinity (PSU) (744594)	Temperature (Â°C) (919197)
16/06/2025 10:50	6.429833	27.480923	71.751236	7.730422	0.03320493	29.806921
16/06/2025 10:50	6.431048	27.480309	74.36724	7.7301173	0.034416445	29.807903
16/06/2025 10:50	5.8921638	27.357193	77.872086	6.806313	0.036068697	29.817291
16/06/2025 10:50	5.8695726	27.35162	79.045135	6.766694	0.0366132	29.818077
16/06/2025 10:50	5.8469815	27.346045	80.218185	6.7270746	0.037157707	29.818863
16/06/2025 10:50	5.8243904	27.34047	81.39124	6.6874557	0.03770221	29.819649
16/06/2025 10:50	5.707035	27.340101	81.35562	4.8973026	0.0376865	29.836851
16/06/2025 10:50	5.6923127	27.337877	81.37901	4.804623	0.037697896	29.837738
16/06/2025 10:50	5.6775904	27.335655	81.40241	4.711944	0.03770929	29.838623
16/06/2025 10:50	5.6628685	27.333431	81.425804	4.6192646	0.03772068	29.839508
	5.90337959	**27.3703624**	**79.0207966**	**6.14812108**	**0.036597756**	**29.8241424**

WQ2

Date Time	pH (pH) (944343)	Temperature (Â°C) (607618)	Specific Conductivity (ÂµS/cm) (744594)	RDO Concentration (mg/L) (1025082)	Salinity (PSU) (744594)
16/06/2025 10:56	5.3312464	26.78919	38.609947	1.466049	0.016919361
16/06/2025 10:56	5.336981	26.78919	38.607887	1.4248793	0.016918361
16/06/2025 10:56	5.338139	26.78919	38.607468	1.4165655	0.016918158
16/06/2025 10:56	5.3403463	26.789286	38.59948	1.387713	0.01691425
16/06/2025 10:56	5.3431635	26.791683	38.59147	1.3590596	0.016910333
16/06/2025 10:56	5.341323	26.794445	38.58804	1.3312702	0.016908662
16/06/2025 10:56	5.341219	26.794876	38.587303	1.3267084	0.016908303
16/06/2025 10:56	5.346256	26.795572	38.588245	1.3026537	0.016908737
16/06/2025 10:56	5.3475966	26.79771	38.578106	1.279743	0.016903797
16/06/2025 10:56	5.3449454	26.799194	38.573635	1.2576176	0.016901618
	5.34112162	**26.7930336**	**38.5931581**	**1.35522593**	**0.016911158**

WQ3

Date Time	pH (pH) (944343)	Temperature (Â°C) (607618)	Specific Conductivity (ÂµS/cm) (744594)	RDO Concentration (mg/L) (1025082)	Salinity (PSU) (744594)
16/06/2025 11:05	5.6957808	27.102877	92.55723	3.6865213	0.043124225
16/06/2025 11:05	5.6971025	27.102913	92.55375	3.6638591	0.043122534
16/06/2025 11:05	5.701487	27.103647	92.52868	3.5738587	0.04311039
16/06/2025 11:05	5.7081676	27.102968	92.510956	3.4968042	0.043101784

16/06/2025 11:05	5.7136927	27.103493	92.23129	3.4222796	0.042966202	
16/06/2025 11:05	5.714629	27.103527	92.19555	3.4103065	0.04294887	
16/06/2025 11:05	5.687191	27.102507	87.1492	3.2979095	0.040501926	
16/06/2025 11:05	5.7037606	27.084936	86.58864	3.082658	0.04023017	
16/06/2025 11:05	5.7157774	27.07709	86.51634	2.9316795	0.040195145	
16/06/2025 11:05	5.71801	27.075436	86.50526	2.9051933	0.040189777	
16/06/2025 11:05	5.726709	27.074286	86.477936	2.7945392	0.04017653	
16/06/2025 11:05	5.7319965	27.07403	86.497856	2.699691	0.04018619	
	5.709525342	**27.09230917**	**89.52605733**	**3.247108325**	**0.041654479**	

WQ4

Date Time	pH (pH) (944343)	Temperature (Â°C) (607618)	Specific Conductivity (ÂµS/cm) (744594)	RDO Concentration (mg/L) (1025082)	Salinity (PSU) (744594)	Temperature (Â°C) (919197)
16/06/2025 10:09	6.2063375	26.867943	159.71014	6.5488815	0.07566381	28.74
16/06/2025 10:09	6.194804	26.868444	159.6717	6.4981585	0.075645186	28.730907
16/06/2025 10:09	6.1931353	26.868517	159.66615	6.4908185	0.0756425	28.729591
16/06/2025 10:09	6.1835546	26.872221	159.6687	6.472142	0.07564359	28.74801
16/06/2025 10:09	6.162198	26.874386	159.66837	6.451315	0.07564338	28.774374
16/06/2025 10:09	6.159542	26.874754	159.66841	6.4483814	0.0756434	28.777887
16/06/2025 10:09	6.1501904	26.877928	159.66356	6.435966	0.07564868	28.78821
16/06/2025 10:10	6.148397	26.878334	159.66307	6.433942	0.07564924	28.7903
16/06/2025 10:10	6.1389775	26.879875	159.70186	6.4197955	0.07566003	28.799301
16/06/2025 10:10	6.1328225	26.881386	159.69785	6.411319	0.07565766	28.79978
	6.16699588	**26.8743788**	**159.677981**	**6.46107194**	**0.075649748**	**28.767836**

WQ5

Date Time	pH (pH) (944343)	Temperature (Â°C) (607618)	Specific Conductivity (ÂµS/cm) (744594)	RDO Concentration (mg/L) (1025082)	Salinity (PSU) (744594)	Temperature (Â°C) (919197)
16/06/2025 10:05	6.662798	27.041494	116.154045	6.759015	0.054558706	28.359165
16/06/2025 10:05	6.636634	27.047043	98.010544	6.677346	0.045768112	28.368486
16/06/2025 10:05	6.6327543	27.047918	95.242424	6.6652255	0.04442709	28.369797
16/06/2025 10:05	6.605612	27.052408	94.037224	6.5578494	0.04384271	28.379135
16/06/2025 10:06	6.58421	27.05721	112.42769	6.514937	0.052753292	28.388428
16/06/2025 10:06	6.5809846	27.057877	114.33992	6.506544	0.053679794	28.38974
16/06/2025 10:06	6.53862	27.059473	113.292015	6.4735203	0.05317235	28.417397
16/06/2025 10:06	6.5156126	27.060146	111.85799	6.4405317	0.052477743	28.43652

16/06/2025 10:06	6.511642	27.060268	111.6235	6.4358406	0.052364163	28.439554
16/06/2025 10:06	6.49632	27.060333	86.69072	6.413272	0.04027895	28.467112
	6.57651875	**27.054417**	**105.3676072**	**6.54440815**	**0.049332291**	**28.4015334**

WQ6

Date Time	pH (pH) (944343)	Temperature (Â°C) (607618)	Specific Conductivity (ÂµS/cm) (744594)	RDO Concentration (mg/L) (1025082)	Salinity (PSU) (744594)	Temperature (Â°C) (919197)
16/06/2025 10:25	5.9977317	26.842419	164.32373	2.791168	0.077901654	28.98961
16/06/2025 10:25	5.9972963	26.842445	164.32845	2.7553701	0.07790394	28.990404
16/06/2025 10:25	5.9944634	26.842474	164.39844	2.5953343	0.07793788	28.999256
16/06/2025 10:25	5.9795985	26.835573	164.4373	2.270242	0.07795693	29.00859
16/06/2025 10:25	5.977941	26.83485	164.444	2.2303965	0.0779602	29.009903
16/06/2025 10:25	5.9728885	26.83674	164.41014	2.1067936	0.07794373	29.028366
16/06/2025 10:25	5.9726944	26.838621	164.4232	2.0152035	0.07795	29.064426
16/06/2025 10:25	5.9725094	26.838896	164.42334	2.00147	0.07795006	29.068863
16/06/2025 10:25	5.9674826	26.839203	164.41406	1.9370332	0.077941954	29.088142
16/06/2025 10:25	5.9675174	26.839987	164.40698	1.8846307	0.07794171	29.080751
16/06/2025 10:25	5.967333	26.840078	164.40584	1.8768125	0.077941366	29.08062
	5.978859655	**26.83920782**	**164.4014073**	**2.224041309**	**0.077939039**	**29.03717555**

WQ7

Date Time	pH (pH) (944343)	Temperature (Â°C) (607618)	Specific Conductivity (ÂµS/cm) (744594)	RDO Concentration (mg/L) (1025082)	Salinity (PSU) (744594)	Temperature (Â°C) (919197)
16/06/2025 12:50	3.9933581	27.430056	50.27239	7.5253243	0.022580864	30.9
16/06/2025 12:50	3.9933581	27.430056	50.27239	7.5253243	0.022580864	30.9
16/06/2025 12:50	4.029151	27.433413	49.30373	7.423808	0.022109749	30.919123
16/06/2025 12:50	4.0340204	27.43387	49.171947	7.409997	0.022045657	30.921726
16/06/2025 12:50	4.046569	27.437798	48.78456	7.314034	0.021857223	30.938295
16/06/2025 12:50	4.0608487	27.446707	41.44565	7.271848	0.018290028	30.956802
16/06/2025 12:50	4.0628867	27.44778	40.669235	7.2637	0.017912636	30.959375
16/06/2025 12:50	4.0724616	27.448809	50.645252	7.2354307	0.022762138	30.987331
16/06/2025 12:50	4.074483	27.457859	52.114418	7.2091637	0.024003161	31.01526
16/06/2025 12:50	4.075023	27.458838	52.655785	7.2053785	0.024322253	31.019217
16/06/2025 12:50	4.0838046	27.46299	52.142593	7.188811	0.0235366	31.028906
16/06/2025 12:50	4.0876613	27.464724	50.48962	7.1672072	0.02270363	31.03835
	4.051135458	**27.446075**	**48.9972975**	**7.311668892**	**0.022058734**	**30.96536542**

WQ8

Date Time	pH (pH) (944343)	Temperature (Â°C) (607618)	Specific Conductivity (ÂµS/cm) (744594)	RDO Concentration (mg/L) (1025082)	Salinity (PSU) (744594)	Temperature (Â°C) (919197)
16/06/2025 12:43	5.20068	27.71933	60.745136	7.1449895	0.027729098	30.861717
16/06/2025 12:43	5.137121	27.641798	66.2484	7.1355147	0.03032199	30.869244
16/06/2025 12:43	5.0605755	27.616957	67.55261	7.0277205	0.030980336	30.897285
16/06/2025 12:44	4.9689236	27.626064	67.620415	6.9354467	0.031012317	30.907864
16/06/2025 12:44	4.95615	27.626795	67.61446	6.9218564	0.031009413	30.909935
16/06/2025 12:44	4.858509	27.632496	67.6119	6.8188033	0.031008074	30.92803
16/06/2025 12:44	4.7983627	27.637093	67.5406	6.7760925	0.030973362	30.946688
16/06/2025 12:44	4.7886868	27.637743	67.53353	6.7680817	0.030969914	30.949306
16/06/2025 12:44	4.7447023	27.640335	67.49009	6.746109	0.030948767	30.967997
16/06/2025 12:44	4.6932592	27.643902	67.375244	6.726648	0.030892903	31.029564
16/06/2025 12:44	4.6862803	27.644367	67.3616	6.7238317	0.030886268	31.036764
16/06/2025 12:44	4.6652045	27.640823	67.34516	6.6929173	0.030878343	31.056822
16/06/2025 12:44	4.649146	27.632524	67.36009	6.6808424	0.030885732	31.06775
	4.862123146	**27.64155592**	**66.87686423**	**6.853757977**	**0.030653578**	**30.95607431**

WQ9

Date Time	pH (pH) (944343)	Temperature (Â°C) (607618)	Specific Conductivity (ÂµS/cm) (744594)	RDO Concentration (mg/L) (1025082)	Salinity (PSU) (744594)	Temperature (Â°C) (919197)
16/06/2025 13:00	4.3458066	27.459915	56.03241	6.900448	0.02538175	30.92
16/06/2025 13:00	4.395637	27.45498	56.045593	6.6986337	0.025388222	30.92
16/06/2025 13:00	4.4027596	27.454275	56.047478	6.669787	0.025389148	30.92
16/06/2025 13:00	4.424551	27.45846	56.032593	6.474054	0.025381852	30.946697
16/06/2025 13:00	4.44626	27.462688	56.043518	6.398971	0.025387103	30.965668
16/06/2025 13:00	4.449399	27.463305	56.044174	6.383819	0.025387416	30.968706
16/06/2025 13:00	4.4741855	27.46678	56.057987	6.3254066	0.025394084	31.005072
16/06/2025 13:00	4.4775395	27.467308	56.059914	6.3170733	0.025395013	31.00956
16/06/2025 13:00	4.487875	27.472279	56.060963	6.2701902	0.025401153	31.037918
16/06/2025 13:00	4.4947286	27.473331	56.07044	6.229911	0.025400631	31.074718
16/06/2025 13:00	4.4958234	27.473627	56.071465	6.223962	0.025400804	31.079601
	4.444960473	**27.464268**	**56.05150318**	**6.444750527**	**0.025391561**	**30.98617636**

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