



Specialist Consultancy Services for Environmental Impact Assessment (EIA) in Northern Area (Sembawang N5)

Executive Summary

Commissioned by NParks, on behalf of HDB

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Quality information

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List of Acronyms

AHEV	Area of High Ecological Value
AMEV	Area of Moderate Ecological Value
ASEAN	Association of Southeast Asian Nations
BIA	Biodiversity Impact Assessment
BOD ₅	Biochemical Oxygen Demand (5 days)
Cn	Cumulative Impact (RIAM criterion)
COD	Chemical Oxygen Demand
COP	Code of Practice
COPPC	Code of Practice for Pollution Control
CR	Critically Endangered (Conservation Status)
CS	Conservation Significance
cfu/100mL	Colony Forming Units per 100 milliliters
dB(A)	Decibels, A-weighted (Noise)
DO	Dissolved Oxygen
EHS	Environmental, Health and Safety
EIA	Environmental Impact Assessment
EMMP	Environmental Management and Monitoring Plan
EN	Endangered (Conservation Status)
ERT	Emergency Response Team
ES	Environmental Score
ECB	Erosion Control Blanket
ECM	Earth Control Measures
ECO	Environmental Control Officer
EJS	East Johor Straits
GHS	Globally Harmonised System (for chemical labelling)
ha	Hectares (Area)
HDB	Housing & Development Board
IUCN	International Union for Conservation of Nature
K, U, Th	Potassium, Uranium, Thorium (elements)
LWC	Licensed Waste Collector
L _{Aeq}	Equivalent Continuous Sound Level (Noise)
LC	Least Concern (Conservation Status)
m	Meters
mg/L	Milligrams per liter (concentration)
Mn	Magnitude (RIAM criterion)
N.A.	Not Applicable
NAAQS	National Ambient Air Quality Standards
NEA	National Environment Agency
NH ₃ -N	Ammonia (as Nitrogen)
NO ₃ -N	Nitrate (as Nitrogen)
NMMP	Noise Management and Monitoring Plan
NParks	National Parks Board
NT	Near Threatened (Conservation Status)
NTU	Nephelometric Turbidity Unit
O&G	Oil & Grease, mg/L
pH	pH scale (unitless)
PE (Civil/Geo)	Professional Engineer (Civil/Geotechnical)
PMEs	Powered Mechanical Equipment
PO ₄ -P	Orthophosphate (as Phosphorus)
PRO	Public Relations Officer
PSU	Practical Salinity Unit
PUB	Public Utilities Board
QP	Qualified Person
RAC	Recommended Area of Conservation
RTO	Resident Technical Officer
RIAM	Rapid Impact Assessment Matrix
Rn	Reversibility (RIAM criterion)
SIDS	Silty Imagery Detection System

SO Rep	Superintending Officer Representative
SRDB	Singapore Red Data Book
SS602	Singapore Standard for Noise Control at Construction Sites
SS593	Singapore Standard for Pollution Control
TBC	To Be Confirmed
TDS	Total Dissolved Solids
TN	Total Nitrogen
TNIA	Traffic Noise Impact Assessment
TOC	Total Organic Carbon
TP	Total Phosphorus
TPZ	Tree Protection Zone
TSS	Total Suspended Solids
UNECE	United Nations Economic Commission for Europe
USEPA	United States Environmental Protection Agency
VU	Vulnerable (Conservation Status)
WHO	World Health Organization
µS/cm	Microsiemens per centimeter (Conductivity)
°C	Degrees Celsius (Temperature)
mm	Millimeters

Executive Summary

Housing & Development Board (HDB) is proposing to develop an approximately 21-hectare plot of vegetated and undulating land bounded by Canberra Road, Ottawa Road and Canada Road at a location known as Sembawang Neighbourhood 5 (N5). The proposed development, which is subject to ongoing detailed master planning, will entail conversion of the land for future residential use to meet Singapore's housing demand. The site development activities will include civil engineering works that include (but not be limited to) the following: site clearance, soil investigation, earthworks, construction of access roads, drains, sewers, substructures, superstructures, and landscaping. At this stage, the layout and listing of the proposed developments are not yet available.

The upcoming Sembawang N4 residential estate is to the west of the Environmental Impact Assessment (EIA) Study Area of Sembawang N5, and medium to low-density residential blocks and buildings are surrounding the rest of the EIA Study Area. An EIA was previously conducted for Sembawang N4 in August 2024, and the relevant baseline data from that study has been incorporated and considered in the preparation of this EIA.

The land use of the area has undergone significant changes over the years. The area transitioned from a natural mangrove swamp with Sungei Sembawang in the late 19th century to a naval zone by the 1940s, featuring accommodations for military personnel. After the closure of the Sembawang Naval Base in the late 1960s, the site began to regenerate and revegetate, marking a shift in its environmental landscape. By 2002, most of the buildings and roads in the EIA Study Area had been removed, and this pattern persisted until 2010.

This EIA outlines: (1) the baseline ecological and environmental conditions of the site and its surroundings; (2) potential impacts on local biodiversity and the environment during pre-construction, construction and operational phases of the project; (3) proposed mitigation measures; and (4) a broad Environmental Management and Monitoring Plan (EMMP) to be implemented for the project.

The succeeding sections highlight the key findings of this EIA.

Environmental Baseline Findings

The baseline of this study has been extracted from EIA of Sembawang N4. In addition to that, a site reconnaissance was conducted on the 27th October 2025.

A summary of the baseline findings for biodiversity, air quality, water quality and airborne noise is provided below. More information is detailed in **Sections 6, 7, and 8** of this report, respectively.

- **Biodiversity (Habitats)** – The EIA Study Area comprises six (6) habitat types over approximately 21.0 ha. Abandoned land forest is the dominant habitat (36.7%), followed by Scrubland (30.7%) and Exotic-dominated secondary forest (24.8%). Minor habitat components include Grassland (3.24%), Urban vegetation in the form of managed turf (3.11%), and areas of Infrastructure (1.43%).
- **Biodiversity (Flora)** – A total of 198 plant species were recorded within the N5 EIA Study Area, comprising 98 native species (49.5%), 95 exotic species (48%), and five cryptogenic species (2.5%). Seventeen (17) species were identified as being of conservation significance, including two (2) nationally Critically Endangered species, *Horsfieldia crassifolia* and *Neoscortechinia sumatrensis*. These species, together with the nationally Vulnerable *Horsfieldia polyspherula* var. *polyspherula* and *Santiria laevigata*, typically associated with freshwater swamp forests, reflect likely historical connectivity with remnant swamp forest habitats near Seletar Reservoir. Other notable threatened species recorded include the nationally Endangered *Melicope lunu-ankenda* and *Calophyllum inophyllum*, as well as Vulnerable species such as *Macaranga griffithiana* and *Uncaria cordata*.
- **Biodiversity (Fauna)** – A total of one hundred and forty-eight (148) fauna species were recorded within the N5 EIA Study Area, with birds (57 species) and butterflies (32 species) comprising the majority of the assemblage. Eleven (11) species were identified as being of conservation significance, including seven (7) bird species and four (4) mammal species. Notable conservation-significant fauna recorded include the nationally Critically Endangered straw-headed bulbul (*Pycnonotus zeylanicus*) and Sunda pangolin (*Manis javanica*), as well as Vulnerable species such as the Changeable hawk-eagle (*Nisaetus cirrhatus*) and Bamboo bat (*Tylonycteris sp.*).

- Biodiversity (Area of High/Moderate Ecological Value)** – Within the N5 EIA Study Area, two (2) separate plots were identified as areas of high ecological value (AHEV) due to the clusters of swamp-associated conservation significant (CS) species recorded. These species include *Horsfieldia crassifolia* and *Neoscortechinia sumatrensis*. Besides these swamp associate species, other conservation significant species such as *Meliocope lunu ankeda* and *Santiria laevigata* were also recorded in the AHEV patches. To enhance the ecological resilience of the AHEVs, two AMEV patches, M1 and M2, were recommended to be conserved. M1 provides ecological connectivity between H1 and H2 to secure species movement and future gene flow and dispersal between vegetated patches. Maintaining and enhancing M1 ensures the broader ecological functionality of the site. M2 on the other hand functions as a buffer for CS species in H1. Without M2 functioning as a buffer, CS species within H1 may experience reduced survivability, while long-term regeneration and dispersal could be adversely affected by development-induced changes in hydrology

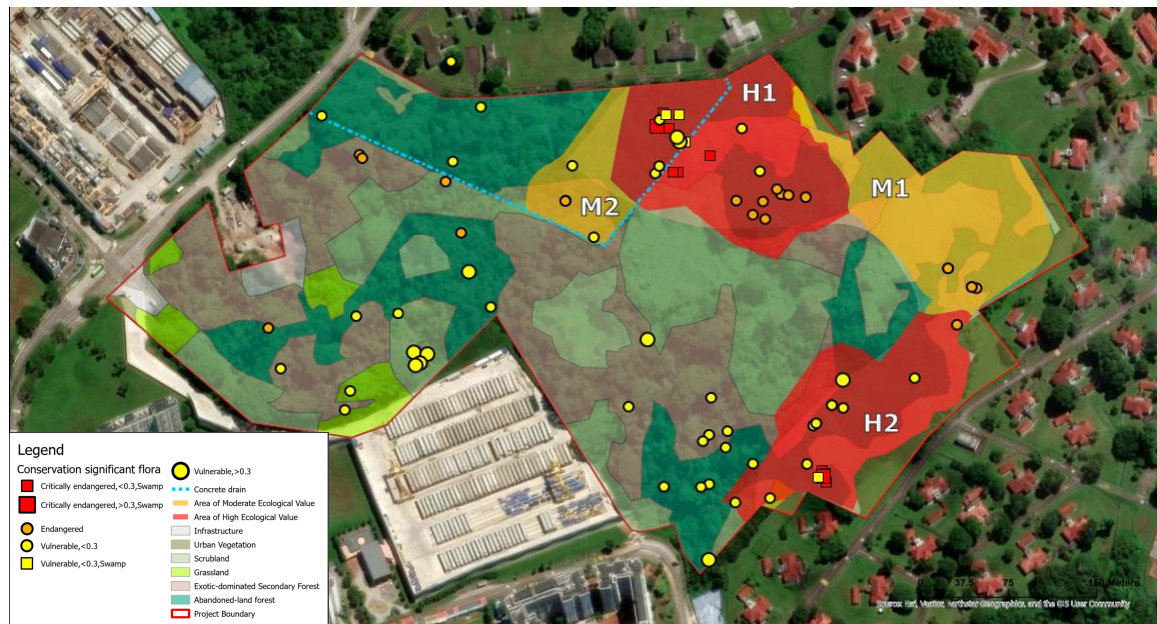


Figure 1.1.1 Areas of high/moderate ecological value (AHEV/AMEV) in the N5 EIA Study Area

- Hydrology** – One concrete drain (D1) has been identified as the key watercourse within the EIA Study Area in Sembawang N4 EIA [Ref. 7-1]. Other watercourses within the N5 EIA Study Area consist of smaller, roadside concrete drains with ephemeral flow. Catchment delineation indicates that the N5 EIA Study Area

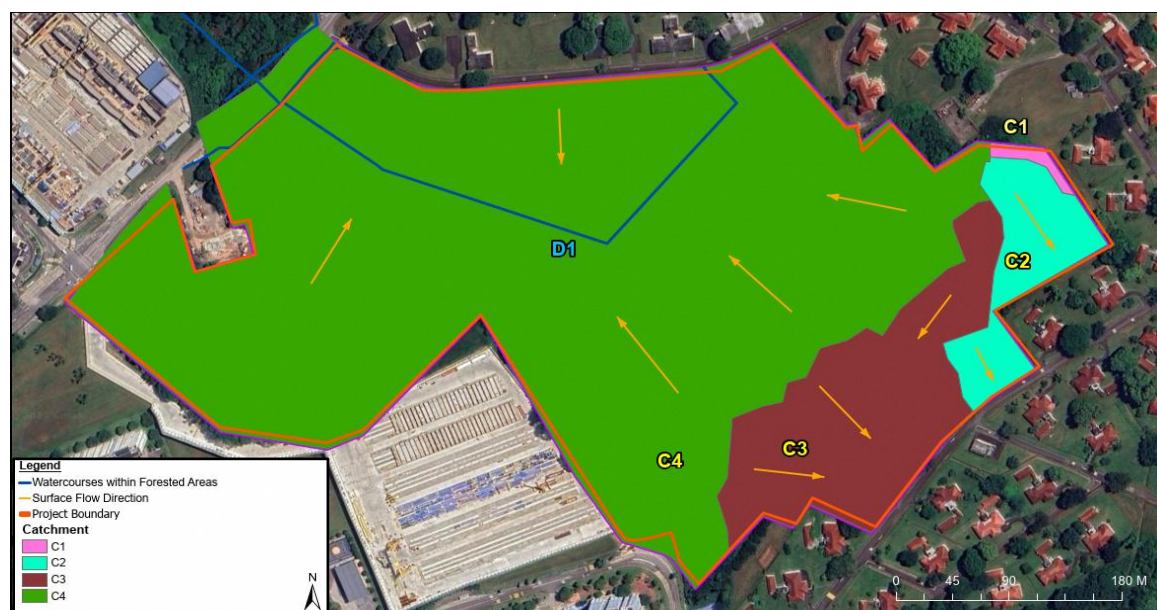


Figure 1.1.2 Catchment map of N5 EIA Study Area

the N5 EIA Study Area can be divided into 4 smaller catchments with the largest (C4) discharging water into the concrete drain. This concrete drain subsequently releases the water into a semi-naturalised drain via a culvert below Canberra Road. All water from the EIA Study Area eventually discharges into the sea.

- Surface Water Quality** – The surface water quality conditions were established based on surface water sampling events conducted during Sembawang N4 EIA at one (1) location during both dry and wet weather conditions at the downstream of D1 within Sembawang N5 [Ref. 7-1]. The results were evaluated against the National Environment Agency (NEA) guidelines for freshwater as well as the standards for freshwater aquatic life. During dry weather conditions, orthophosphates concentrations exceeded guideline values established for the protection of freshwater aquatic life. The elevated orthophosphate concentrations may be attributed to diffuse nutrient inputs from surrounding urbanized catchments, including industrial and residential land uses, as well as natural processes like the decomposition of vegetation in and around the water-courses. The baseline quality of other parameters met the adopted criteria according to the previous EIA study for Sembawang N4 [Ref. 7-1].
- Airborne Noise** – Baseline monitoring was carried out at one (1) location within the EIA Study Area. Average baseline noise levels $L_{Aeq}(12hrs)$ ranged between 44–55 dB(A) and are below the most stringent NEA construction noise criteria. These low ambient noise levels are consistent with the area's relatively isolated setting and vegetated nature. A single exceedance (i.e. max L_{Aeq} (5 mins) 7pm–10pm) was recorded over the course of one week, which was likely attributable to transient aircraft noise associated with the operations at nearby Sembawang Air Base.

Impact Assessment and Key Mitigation Measures

Table 1.1 summarises the impact significance levels and corresponding key mitigation measures that have been developed to minimise the adverse impacts throughout the course of the Project. The proposed development boundary has been scaled back to exclude the AHEV/AMEV and project activities should minimise encroachment into the AHEV/AMEV. These mitigation measures, as well as findings from the baseline studies were shared and discussed during a Nature Group engagement on 30 March 2026.

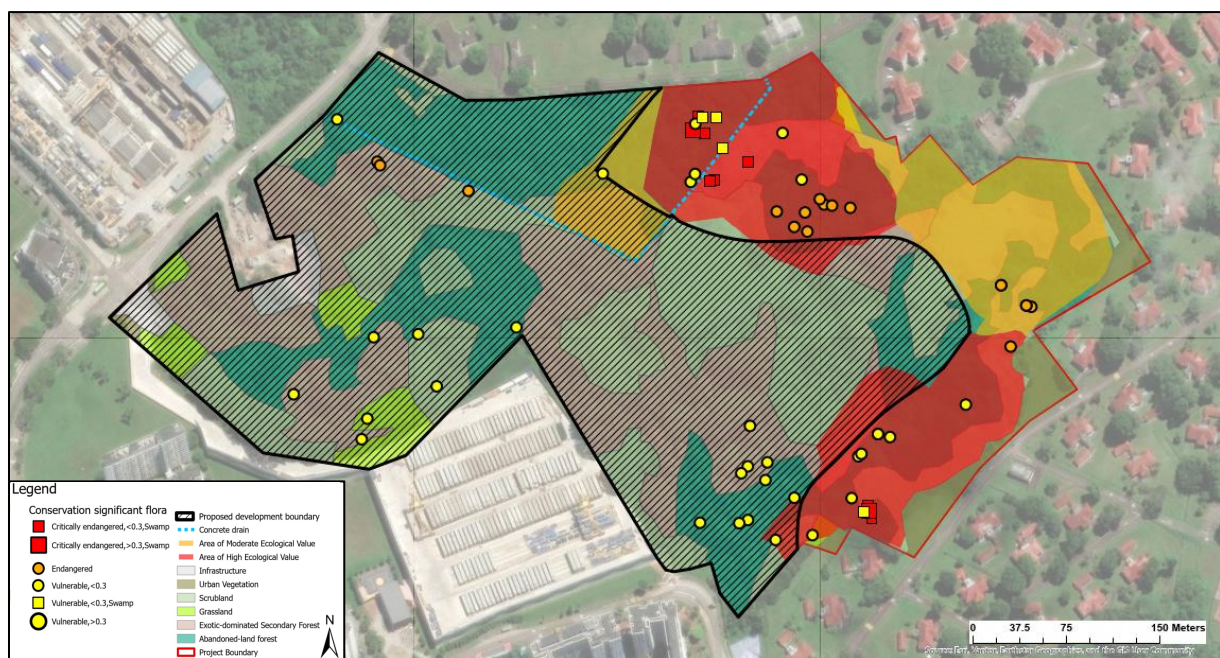


Figure 1.1.3 Proposed development boundary within EIA Study Area

Table 1.1 Summary of impact significance levels and key minimum controls and mitigation measures

Environmental Aspect	Proposed Minimum Controls	Pre-mitigation Impact Significance	Proposed Mitigation Measures	Mitigated Impact Significance
Pre-Construction and Construction Phase				
Biodiversity	- Set up physical barriers around the perimeter of the proposed development boundary to prevent accidental access and intrusion by wildlife. - Set up Tree Protection Zones (TPZ) around all trees beyond proposed development area where the root system may overlap underneath the soil into the site. The Tree Protection Zones will be set up in accordance with National Parks Board's (NParks') guidelines. Soil erosion control measures will be executed once vegetation has been removed and soil is exposed. Where necessary, ensure silt fences or other silt control measures along the site hoarding are installed and maintained properly. - Engage a Qualified Erosion Control Professional (QECF) to formulate Earth Control Measures (ECM) plan in accordance with Public Utilities Board (PUB) and NParks' requirements and have the construction team implement the ECM plan. - Transplantation of conservation significant flora should be carried out where necessary. - Regular inspections and monitoring will be conducted to ensure compliance with the tree protection measures, and any deviations or potential risks will be promptly addressed. - Before vegetation removal, pre-felling fauna inspections will be conducted by an Ecologist to identify wildlife or nesting structures that are being actively used such as bird nests, tree hollows, burrows and bamboos clusters. - Implement soil erosion control measures to prevent seedlings and seeds from being eroded or smothered. The measures should also be executed to avoid fast-growing exotics from proliferating. - Wildlife shepherding via directional clearing will be adopted. This will be planned and overseen by an Ecologist. - Execute Wildlife Response Plan according to the Wildlife Act to minimise animal injury and mortality by responding appropriately whenever a trapped / injured / dead / dangerous animal is encountered around or within the worksite. - Train site personnel on biodiversity awareness and actions to take when encountering wildlife. - Conduct pre-felling fauna inspection prior to vegetation removal by an Ecologist to identify wildlife or nesting features that are actively used. - Use only fully biodegradable erosion control blankets (ECBs) to avoid trapping fossorial fauna. - Trim overgrown vegetation near the worksite hoarding to prevent / reduce the potential of wildlife entering the site. - Implement soil erosion control measures such as erosion control blankets to reduce soil erosion and edge effects. - Implement dust control measures and noise barriers to reduce edge effects. - Installation of hoarding to delineate the worksite. - Providing well-maintained pitched roof, clearing discarded items daily, storing materials appropriately, levelling up ground depression/uneven surfaces, ensure effective drainage flow. - Daily checks by the Environmental Control Officer (ECO) on site to ensure contractor compliance and to identify potential fauna entrapments.	<u>Habitat:</u> Slight (Es: -36) to Minor (Es: -72) negative impact levels <u>Flora:</u> Minor (Es: -72) to Major (Es: -180) negative impact levels <u>Fauna:</u> Status quo (Es: 0) to Major (Es: -180) negative impact levels	<u>Design Phase</u> - Project design intends to avoid the Area of High/Moderate Ecological Value (AHEV/AMEV) as much as possible through early optimisation of layout, alignments, access routes and construction boundaries. - Design infrastructure to avoid large or conservation significant trees and incorporate bird-friendly features on buildings with glass. - Manage Artificial Light at Night using shielded, warm-toned LEDs with motion sensors or timers to reduce impacts on fauna. - Consider habitat restoration and enhancement within the AMEV, especially along urban vegetation edges. - Plant fast-growing native trees and shrubs to improve ecological connectivity and buffer impacts of human disturbance. <u>Pre-construction and Construction Phase</u> - Conduct regular inspections to ensure contractor compliance to the EMMP as well as to identify potential fauna entrapments, with oversight by NParks. - Ensure silt fences and other sediment control measures along the worksite hoarding are installed and maintained properly. - Where necessary, implement dust control measures such as dust screens and water suppression systems. - Engage qualified flora specialists to identify, delineate and demarcate areas and plants with conservation value prior to commencement of works. This would avoid clearing unnecessary working space, eliminate the need of removing plants of conservation significance as much as possible. - Engage International Society of Arborists (ISA) certified arborists to assess the health of trees monthly in the AHEV/AMEV adjacent to the worksite, and to ensure that works along the drainage reserve do not impact the health of the trees - Ensure there are no works and disturbances to areas outside of worksite and restrict entry of site personnel to areas outside the worksite. - It is recommended to avoid tree felling and vegetation clearance during peak bird breeding season (March to July) - Any tree found during pre-felling inspection to be harbouring an active nest should be left undisturbed until the nest is confirmed to be abandoned. - Quieter construction machinery/equipment should be used over loud and noisy machinery/equipment whenever possible. - Ensure good housekeeping controls such as provision of wildlife-proof bins and eating areas to prevent macaques and wild boars from accessing anthropogenic food sources. - Reduce use of heavy machinery during earthworks. - Avoid excessive use of artificial lighting to reduce light spillage into the AHEV/AMEV, and other N5 EIA Study Area.	<u>Habitat:</u> Status quo (Es: 0) to Minor (Es: -72) negative impact levels <u>Flora:</u> Minor (Es: -45) to Major (Es: -144) negative impact levels <u>Fauna:</u> Status quo (Es: 0) to Major (Es: -135) negative impact levels
Hydrology	- The Contractor must not interfere with the existing drainage system or flow pattern without prior approval from PUB. - Design adequate drainage in accordance with PUB Code of Practice (COP) to effectively manage runoff from within, upstream of, and adjacent to the work site. The proposed system must not cause flooding nearby. - Conduct regular maintenance of stormwater and drainage systems to prevent channel blockages and consequent flooding. - The Contractor must divert any existing drains affected by the works. The Contractor shall ensure that all diversion works shall be designed and constructed to maintain uninterrupted drainage and to prevent flooding, ponding, or adverse impacts to the Site and adjacent areas. Any abandoned sections	<u>Ecological:</u> Status quo (Es = 0) <u>Human:</u> Status quo (Es = 0)	–	No residual impact assessment has been conducted as no pre-mitigated impacts are assessed to be Moderate or higher.

Environmental Aspect	Proposed Minimum Controls	Pre-mitigation Impact Significance	Proposed Mitigation Measures	Mitigated Impact Significance
	of the existing drains resulting from diversion shall be completely decommissioned and backfilled with suitable material by the Contractor. - Develop water recycling systems on-site to minimise discharge from the construction site into the surface water drainage system. - Formulate a detailed emergency evacuation plan for potential flash floods on-site, including the development of an early warning system where applicable. - Install pumping stations to remove excess water accumulated within the site after heavy rainfall events. - Implement a construction EMMP and ensure complete preparation of associated plans and procedures.			
Groundwater Level	- Include geotechnical aspects of site slope stability, such as Earth Retaining Stabilising Structure (ERSS), in the detailed engineering design for the construction phase. - The design engineers must propose ERSS taking into account the site conditions and planned excavation requirements. Simultaneously, the Qualified Professional (QP) must ensure successful implementation of these measures during construction. - Install piezometers to monitor groundwater level change in accordance with Building Control Regulations 2003, as outlined in the instrumentation and monitoring plan endorsed by the Qualified Professional (QP). - Soil dewatering will be planned in phases to prevent the generation of large quantities of water discharged into receiving public sewer and stormwater drains. This phased approach will also decrease groundwater drawdown and minimise the reduction of baseflow feeding the stream.	<u>Ecological:</u> Moderate negative impact ($E_s = -90$) <u>Human:</u> Status quo ($E_s = 0$)	- Installation of monitoring wells or piezometers adjacent to the swamp associated CS species to track groundwater levels, if required. - Minimisation of impacts to groundwater levels by carrying out earthworks in a managed approach. - Implement of artificial recharge depending on the drawdown of groundwater level, if required.	<u>Ecological:</u> Slight negative impact ($E_s = -30$) <u>Human:</u> No residual impact assessment has been conducted as no pre-mitigated impacts are assessed to be Moderate or higher.
Water Quality	- The planning, design, and submission of ECM plans to PUB will be handled by a Qualified Erosion Control Professional. This includes the installation, maintenance, monitoring, reporting, provision of erosion control blankets, CCTV at discharge points, Siltation and Erosion Control Measures (SIDS), sedimentation tanks, to comply with PUB's COP on Surface Water Drainage. - Contractors must ensure that CCTV system is properly operated, maintained, and functional at all times and shall be integrated with the SIDS to enable automatic alerts for silt discharge events, as well as for occurrences of no image or poor-quality images, in accordance with PUB's circular on Preventing Muddy Waters from Construction Sites. This measure aims to detect non-compliant discharges and to deter any deliberate interference or tampering with the CCTV system intended to conceal silty discharge. - A Sediment Control Plan will be formulated, including measures such as sealing site hoarding and installing berms along the site hoarding, to prevent silty water from leaking out and accumulating at the site entrance. - Effective implementation of ECM and monitoring will adhere to the Code of Practice on Surface Water Drainage to ensure that discharge into the stormwater drainage system does not exceed prescribed limits for Total Suspended Solids (TSS) under the Sewerage and Drainage (Surface Water Drainage) Regulations. - Ensure containment ponds are made of impervious material and designed with sufficient capacity to hold the volumes of wastewater produced on site, accounting for turbid stormwater runoff before ECM treatment at ECM facility and firefighting needs as well. - In view of the deep excavation required for the construction of drains, sewers, and manholes, all earthworks and associated temporary works including shoring and protection works, together with excavation methods, construction sequences and contingency plans shall be designed and duly endorsed by the Contractor's appointed Professional Engineer (Civil) [referred to as PE (Civil)] and Professional Engineer (Geotechnical) [referred to as PE (Geo)], if necessary and required under BCA statutory requirements. The PE (Civil) and PE(Geo) shall submit the necessary design plans, method statements, safety measures, temporary work proposals, monitoring plans (movement, vibration, settlement cracks, etc.) and work procedures as required by the relevant Authorities for approval prior to construction. - The Contractor should coordinate and moderate the earthworks in tandem with the implementation of ECM, carefully managing excavation activities to avoid exposing areas beyond what can be effectively controlled. A programmatic Excavation, Cut and Fill, and Earthmoving plan should be undertaken, with construction work carried out in stages and segments to minimise the disturbed area at any given time. By limiting the disturbance to only what is necessary, potential for soil erosion and topsoil loss will be reduced. - Biodegradable erosion blankets must be promptly provided to areas with bare soil surfaces on the same day of soil exposure.	<u>Ecological:</u> Status quo ($E_s = 0$) <u>Human:</u> Status quo ($E_s = 0$)	–	No residual impact assessment has been conducted as no pre-mitigated impacts are assessed to be Moderate or higher.

Environmental Aspect	Proposed Minimum Controls	Pre-mitigation Impact Significance	Proposed Mitigation Measures	Mitigated Impact Significance
	- Where demolition works are required, demolition activities will be scheduled to minimise the accumulation of stockpiled materials on-site. - Topsoil removed will be stockpiled in a designated area and adequately covered to prevent soil loss from secondary erosion. The conserved soil can be used for backfilling and improving stream vegetation in areas lacking concrete slope protection, with excess soil material stored properly for reuse. - Re-vegetate earthworks and exposed areas / soil stockpiles to stabilise surfaces as soon as practicable. When a particular work is finished in an area, the soil will need to be reinstated upon completion, before moving on to different areas. - Approved materials of the same or superior quality as the surrounding area will be used for backfilling works. All backfilled material will be free of debris and of good soil quality. - For erodible / bare surface and stockpile materials, biodegradable ECB or equivalent coverings shall be removed in small sections during work, and not all at once, to limit surface exposure and reduce erosion risk. - Implement regular, dedicated procedures for stormwater collection, settling, testing, and discharge to watercourses, and, where feasible, segregate clean-water flows from silty-water flows to maximize sedimentation tank holding capacity. Where feasible, clean water flow will be segregated from silty water flow to maximize sedimentation tank holding capacity. - Provide sufficient treatment units or coagulant units to treat silty water before discharging into public drain within 10 hours of rain event - Manholes will always be adequately covered and temporarily sealed in accordance with the approval from PUB to prevent ingress of sediment-laden stormwater runoff, construction debris, and contaminants into the existing drainage network. - Finalise a complete inventory of all anticipated wastewater streams and volumes before the onset of construction phase works. - Maintain daily records of wastewater volume, as well as the volumes of sludge and other produced onsite. - Provide temporary storage facilities to accommodate overflow situations involving untreated wastewater. This temporary storage should have sufficient capacity to capture any unexpected additional volumes, ensuring that untreated wastewater is not released to watercourses and the forested areas unless it complies with NEA trade effluent discharge standards. - Equip containment ponds, as well as wastewater generating areas on site with spill clean-up kits. - Design adequate drainage systems, including cut-off drains, sump pit, road kerb, piping and toe walls to channel construction process wastewater streams (e.g. concrete wash water) and stormwater runoff separately through detailed design to capture and treatment in the containment pond(s)/ kerb(s). Where applicable, include oil-water separators. - Seek approval from relevant authorities (i.e. PUB and NEA) in accordance with PUB Sewerage and Drainage (Trade Effluent) Regulations, if the wastewater is planned to be disposed to public sewer, or NEA's Trade Effluent Discharge Limits to watercourse if disposal to surface watercourses is intended. If such discharges are not approved, the trade effluent will be stored, treated or recycled on site and finally disposed off-site. - Obtain comments and approval from relevant authorities (e.g., Singapore Civil Defence Force [SCDF] and NEA) for the use of treated wastewater for firefighting purposes. - Provide appropriate concrete washout areas, ensuring these are not located near watercourses. - All vehicles are to undergo a wheel washing process before leaving the site to prevent earth, mud, and debris from being disposed of on surrounding roads. The wastewater generated from this activity should be stored and removed for treatment and disposal offsite by an approved Waste Management Contractor or treated via onsite ECM treatment systems. - Establish regular and dedicated procedures for the inspection and maintenance of wastewater collection, storage, and treatment infrastructure (e.g., pipes, oil-water separators). - Develop a training programme for all onsite workers, including subcontractors, to educate them on their obligations regarding proper water quality management. - Prohibit the discharge of pumped groundwater from soil dewatering or any wastewater stream into aquatic habitats. All wastewater must be properly managed, treated, and controlled to prevent any unmanaged or non-compliant discharge to the environment. - No trade effluent other than the nature or type approved by the NEA will be discharged into any watercourse or land.			

Environmental Aspect	Proposed Minimum Controls	Pre-mitigation Impact Significance	Proposed Mitigation Measures	Mitigated Impact Significance
	• Apply the principles of reduce, reuse, and recycle to wastewater management onsite. • Store hazardous wastewater, such as oil water, thinners, solvents, or paints, on an impervious hardstand within a covered and bunded area designed to contain spills and leaks. The bund shall have sufficient capacity to prevent discharge to the environment. Any wastewater collected in the bund must be removed for treatment and disposed offsite by an approved Waste Management Contractor. Handle hazardous liquids as toxic industrial waste. • Provide spill trays for all waste containers and regularly maintain them to prevent rain from washing out pollutive substances. • Ensure appropriate disposal of toxic waste in accordance with the Environmental Public Health (Toxic Industrial Waste) Regulations by a Licensed Waste Operator/Collector and establish a consignment notification/tracking system and a transport emergency response plan for the transportation of toxic waste. • Develop a Standard Operating Procedure (SOP) for the safe handling, transfer, and storage of toxic and chemical waste. Conduct housekeeping checks at least once a day to ensure all toxic waste is properly contained, segregated, and stored in designated areas, ensuring no toxic waste is left unsecured or scattered within the working areas of the site. • Spillage or leakage of chemical waste to be controlled using suitable absorbent materials. Used absorbent materials should be disposed through a licensed third-party toxic industrial waste disposal contractor. • Any soil contamination with chemicals or oils shall be removed from site and sent to a licensed third-party toxic industrial waste collector for offsite disposal. The void created shall be filled with suitable materials. • Conduct leak detection tests periodically on large toxic waste storage containers and the containers with highly toxic and reactive chemicals. • Establish a consignment notification/tracking system and a transport emergency response plan for the transportation of toxic waste. • Provide an adequate number of enclosed bins. • Ensure waste disposal facilities are cleared up as often as necessary to prevent buildup. Conduct housekeeping checks at least once a day to ensure all litter is cleared from the site. • Develop a Standard Operating Procedure (SOP) for the safe handling, transfer, storage, and disposal of solid waste. • Conduct appropriate tests to ascertain the presence or absence of contamination in excavated soil. • Ensure appropriate disposal of any waste listed in the Environmental Public Health (General Waste Collection) Regulations by a licensed waste operator. • Remove any hazardous substances or chemicals if safer alternatives are available. • Ensure chemical storage areas are adequate, located on paved ground, bunded, sheltered with adequate ventilation, and positioned away from waterways and drains. Safety Data Sheets (SDS) must be kept together with the stored chemicals. • The storage area must have a volume of 110% of the largest volume of chemical substances to be stored. • Utilise secondary containment with a capacity of more than 10% volume for single large containers and 25% of the total volume for multiple containers for all chemical stores and diesel generators to minimise spillages and soil and surface water contamination. Take caution around watercourses to prevent leaks of toxic chemicals such as petrol, diesel, oil, paint, and thinner from equipment. • Chemical waste containers shall be labelled following the Globally Harmonised System (GHS) of Classification and Labelling of Chemicals in the four national languages (i.e., English, Chinese, Malay and Tamil) and other commonly used languages (such as Bengali) on site to avoid accidents. There shall also be clear instructions showing what action to take in the event of an accident; • Suitable containers shall be used to hold the chemical wastes to avoid leakage or spillage during storage, handling, and transport • Include oil-water separators in the proposed infrastructure for separate channelling of construction wastewater streams and stormwater runoff to capture inadvertent spills or leaked oils or greases, particularly in the vicinity of liquid storage or refuelling areas. • Immediately maintain within a properly contained area or remove off-site any construction equipment causing pollution to the water system due to oil or fuel leakage. Minor servicing such as oil top-up or filter replacement may be conducted on-site, while major works such as engine overhaul and fuel system repairs shall be carried out off-site; all such activities shall be conducted in appropriately			

Environmental Aspect	Proposed Minimum Controls	Pre-mitigation Impact Significance	Proposed Mitigation Measures	Mitigated Impact Significance
	contained areas (e.g., concreted area with proper containment), and all wastes channelled for proper treatment or disposal to meet regulations. - Prepare an emergency response plan, train the Emergency Response Team (ERT) to be competent in the response mechanism, and provide response kits for any spillages. - Implement good housekeeping practices to minimise careless spillage and maintain storage and workspace cleanliness. Assign a responsible person (e.g., ECO) to oversee the efficient operation of containment ponds/kerbs, adhering to good housekeeping practices. Regularly check containment ponds/kerbs at least daily to ensure proper functionality. Provide appropriate training, including safety codes and relevant manuals, to personnel handling chemicals on site. - Provide an adequate number of sanitary facilities, with minimum one portable toilet per 10 individuals, maintained and serviced at least once a week by NEA's Licensed Waste Collector (LWC). Locate toilet facilities away from drains and watercourses to prevent contamination to environment. - If on-site dormitories are present, it is advised to install container toilets and obtain written approval from PUB to connect them to public sewers. - Establish a regular maintenance schedule to check and maintain the cleanliness and functionality of sanitary facilities on site, at least once a week, depending on the number of facilities. - Conduct inspections and audits to assess the hygienic conditions on site.			
Airborne Noise	- Only well-maintained construction plants should be utilised on-site, and construction plants should be serviced regularly during the entire construction period; - The number of PMEs should be reduced as far as practicable when construction works are carried out at areas close to the noise sensitive receivers; - Silencers or mufflers on construction equipment if incorporated in a machine should be properly maintained; - Behavioural practices including no shouting, no loud stereos/ radios on site, no dropping of materials from height, no throwing of metal items should be ensured; - Night works, apart from advance works/ site clearance if approved by Agencies, will be prohibited after 6 pm to minimise noise disturbance to nocturnal animals; - Material stockpiles and other structures will be effectively utilised as noise barriers in the site layout planning, wherever practicable, to screen noise from on-site construction activities. Construction plants known to emit noise strongly in one direction should, wherever possible, be orientated so that the noise is directed away from the nearby noise sensitive receptors; - All handheld percussive breakers and air compressors used on site will comply with local legislation and requirements; - Activities may be scheduled to minimise noise generated at certain areas during periods which may be particularly sensitive to noise; - Noise awareness briefing should be conducted regularly and highlighted the noise mitigation measures such as position of machinery, making use of portable noise barriers and dos and don'ts for use of machinery at night; and - If noise remains an issue even after implementation of recommended mitigation measures such as noise barriers, contractor should consider implementation of proprietary noise barriers of high noise reduction capabilities to further reduce noise to acceptable levels.	<u>Ecological:</u> Major negative impact (Es = -140)	- It is recommended to reduce noise impact to avifauna by various administrative controls at the EIA Study Area. For example, schedule activities, as far as practicable, to avoid the breeding season (March to July), and minimise early-morning noisy works on site, particularly between 7:00 and 9:00 a.m. This may reduce some impacts on this fauna on behavioural aspects and communication. Machines (such as trucks) that may be in intermittent use should be shut down between work periods or should be throttled down to a minimum - PMEs that generate less noise will be prioritised for use in construction work. - Whenever possible, access routes near noise sensitive receptors will be oriented such that construction noise will be directed away from these receptors. - Construction respite: Restrict high noise generating drilling activities only in continuous blocks, not exceeding 3 hours each, with a minimum respite period of one hour between each block, if possible; - Periodic noise monitoring by an independent third party, to establish compliance with requirements and to advise on equipment causing concern, and additional potential mitigation measures - Where working near noise sensitive receptors is unavoidable, noise barriers can be installed between the construction site and noise sensitive receptors. Such noise barriers will be placed as close as possible to either the source or the receiver for maximum effectiveness. - When noise barriers are ineffective in mitigating noise, source noise control will be implemented, primarily through the use of equipment noise dampeners and/or acoustic sheds or enclosures.	<u>Ecological:</u> Major negative impact (Es = -105)
Operational Phase				
Biodiversity	- Artificial lighting should only be installed where required for human access and safety. - Place educational signboards around the residential development to educate people on the proper ways to managing human-wildlife encounters. - If the AHEV/AMEV is not conserved, transplantation of the conservation significant flora should be carried out. - Implement proper preventative source control practices for pest control such as application of AM oil and proper disposal of food waste to reduce sources of pests and thus the frequency of fumigation.	<u>Habitat:</u> Es: Not Applicable (Assumed 100% habitat loss) <u>Flora:</u> Es: Not Applicable (Assumed 100% habitat loss) <u>Fauna:</u> Status quo to (Es: 0) to Major Negative impact (Es: -180)	- Implement regular post-construction monitoring during the first three months to ensure mitigation measures are effective. - Use monitoring results to adapt and improve measures for fauna protection as necessary. - Install educational signboards to advise residents and visitors on wildlife encounters, proper food waste disposal, avoiding feeding wildlife, and emergency hotlines. - Educate residents on living near nature and the likelihood of encountering wildlife. - Use wildlife-proof bins to prevent fauna from rummaging through bins. - Use of native planting palette in landscape design. - Implement traffic calming measures to reduce the risk of roadkill accidents. - Incorporate bird-friendly glass design and avoid planting vegetation near glass to reduce bird collisions.	<u>Habitat:</u> Status quo (Es: 0) to Minor (Es: -72) negative impact levels (Assumed development boundary scaled back) <u>Flora:</u> Minor (Es: -45) to Minor (Es: -72) negative impact levels (Assumed development boundary scaled back)

Environmental Aspect	Proposed Minimum Controls	Pre-mitigation Impact Significance	Proposed Mitigation Measures	Mitigated Impact Significance
			- Manage artificial lighting to avoid peak nocturnal fauna activity (19:00–07:00), maintain illuminance below 100 lux, and prevent light spill into sensitive habitats. - Apply source reduction measures to minimise fumigation frequency and avoid fumigation on days with anticipated rainfall to prevent chemical runoff.	<u>Fauna:</u> Status quo (Es: 0) to Major (Es: -135) negative impact levels
Hydrology	- Ensure the future drainage system is designed in accordance with PUB COP to ensure appropriate water conveyance within the proposed future development and to prevent flooding of adjacent areas. - Geotechnical aspect of site's slope stability (such as Earth Retaining Stabilising Structure [ERSS]) will be included in detailed design engineering for the operational phase. - Providing more softscape area should be considered in the design of the development which will help to reduce the peak flow and reduce flood risk at downstream area. ABC Water design approach can be considered to reduce the peak flow.	<u>Ecological:</u> Status quo (Es = 0) <u>Human:</u> Status quo (Es = 0)	–	No residual impact assessment has been conducted as no pre-mitigated impacts are assessed to be Moderate or higher.
Groundwater Level	Incorporate more permeable surfaces in the development plan during design phase	<u>Ecological:</u> Major negative impact (Es = -120) <u>Human:</u> Status quo (Es = 0)	A hydrogeological assessment is required to evaluate the anticipated groundwater drawdown - specifically its magnitude, spatial extent, and seasonal variability - beneath and surrounding the swamp associated CS flora during the operational phase. Based on the assessment, various mitigation measures such as bioswale or rain gardens can be implemented.	<u>Ecological:</u> Slight negative impact (ES = -30) <u>Human:</u> No residual impact assessment has been conducted as no pre-mitigated impacts are assessed to be Moderate or higher.
Water Quality	- Adequate drainage, piping and/ or channelling of stormwater runoff to be assured through detailed design [e.g. ABC Water design approach] for capturing and treatment before discharge into receiving watercourses. - Regular and dedicated procedures for the inspection and maintenance of stormwater collection, storage, and treatment infrastructure, such as pipes, oil water separation and silt screens etc. - Regular and dedicated procedures for the management of stormwater collection, settling, testing and eventual discharge of 'clean' water to surface waters, including associated measures required to prevent high sediment concentration stormwater drainage to surface waters. - Prepare sufficient disposal bins surrounding the Project to avoid improper disposal of waste. - Conduct regular inspection on wastes' storage system of the Project. - Monitor the proposed watercourses and its surroundings with CCTV surveillance regularly to ensure no contamination occurred. - Develop an Emergency Response Plan and conduct adequate training to maintenance workers to cope the accidental contamination of water. - Raise awareness of various stakeholders with community/ stakeholder engagement (e.g. signage boards, warning signs, etc.). - No vehicles allowed within the future managed vegetation at development area.	<u>Ecological:</u> Status quo (Es = 0) <u>Human:</u> Status quo (Es = 0)	–	No residual impact assessment has been conducted as no pre-mitigated impacts are assessed to be Moderate or higher.
Airborne Noise	- Use low noise Air-Conditioning and Mechanical Ventilation (ACMV) system equipment, if applicable; - Ensure that mechanical ventilation system intakes and exhaust outlets is designed with adequate set back from site boundary; - Incorporate appropriate acoustic treatments into the system design; - Acoustic enclosures should be provided for outdoor mechanical equipment, if applicable; - Road design should be considered as part of land use planning to minimise potential impact of land traffic noise on existing residential buildings; - Traffic noise at drop-off points and parking areas shall be mitigated with low-speed postings, speed humps and speed limit signages. The addition of these speed control measures will likely lower noise levels for traffic as the vehicles would be cruising at lower speeds;	<u>Ecological:</u> Minor negative impact (Es= -45)	–	No residual impact assessment has been conducted as no pre-mitigated impacts are assessed to be Moderate or higher.

Environmental Aspect	Proposed Minimum Controls	Pre-mitigation Impact Significance	Proposed Mitigation Measures	Mitigated Impact Significance
	- Alternative siting/ alignment of roads should be considered during road design to propose road siting/ alignment away from existing noise sensitive development; and - Screening should be done to identify noise tolerant buildings (e.g. multi-storey car park building) and placing noise tolerant buildings between road traffic and existing residential buildings during road design phase.			