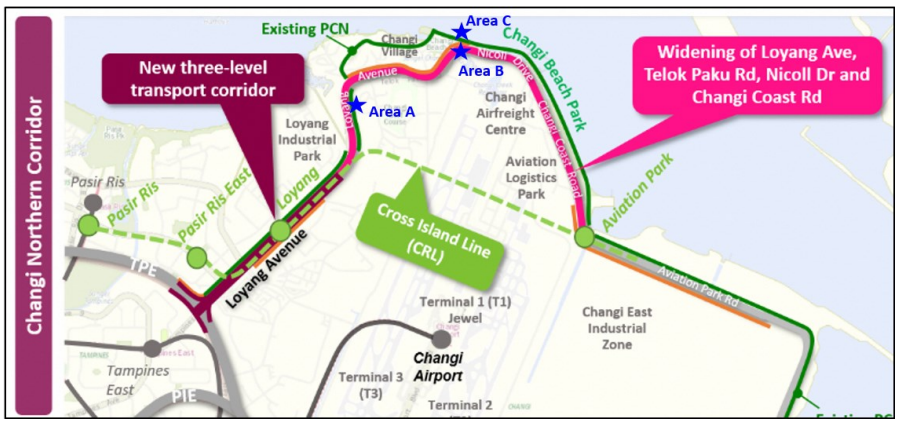
Environmental Impact Study (EIS) for Road Improvement Works along Loyang Avenue, Telok Paku Road, Nicoll Drive and Changi Coast Road

Non-technical Summary (NTS)

OVERVIEW

The Land Transport Authority (LTA) has planned to enhance the road network along Loyang Avenue, Telok Paku Road, Nicoll Drive and Changi Coast Road to support existing and new developments in the Loyang / Changi region such as the new Changi Airport Terminal 5 (T5). The proposed works are expected to cause some impact on the ecology and biodiversity of the areas at Loyang Ave (Area A) and Telok Paku Road / Nicoll Drive (Area B). Hence, LTA has appointed DHI Water & Environmental (S) Pte Ltd (DHI) to conduct an EIS to better understand the construction and operational impact on the environment for the proposed project. The EIS also covered Changi Beach Park (Area C). LTA will implement the recommended mitigation measures to minimise any impact.



With the implementation of the proposed mitigation measures by LTA, the residual effects from the loss of habitats, disturbance to flora and fauna and the changes in water quality during construction phase are projected to be reduced from minor negative to slight negative impact for Area A and from slight negative impact to no impact for Area B[1]. Area C is not affected by the proposed roadworks therefore there is no impact to the seagrass and intertidal areas along Area C shoreline.

The water exchange required for the mangrove in Area A would not be significantly disrupted by the road enhancement work, and the proposed construction work is assessed to cause no more than slight negative impact there after mitigation.

As the mangrove in Area B and its environment are highly tolerable to the level of suspended sediments generated from piling activities, it is assessed that the proposed construction works by LTA will not cause any change to the water quality and the mangrove there.

The sediment plume and suspended sediments generated from piling activities in Area B would be localised in Sungei Changi and together with the low water currents, the seagrass patches and intertidal areas in Area C will not be impacted by the proposed construction work.

This impact assessment was professionally validated by DHI. A stakeholder consultation with Nature Groups was conducted on 6 April 2022. They have supported the proposed mitigation measures.

[1] The EIS measures environmental impact as “No impact”, “Slight”, “Minor”, “Moderate” and “Major”, based on the Rapid Impact Assessment Matrix (RIAM) which takes into account the significance and likelihood of the impacts.

OBJECTIVE AND SCOPE OF EIS

DHI conducted an EIS for the construction and operational impacts on the environment for the proposed road improvement project.

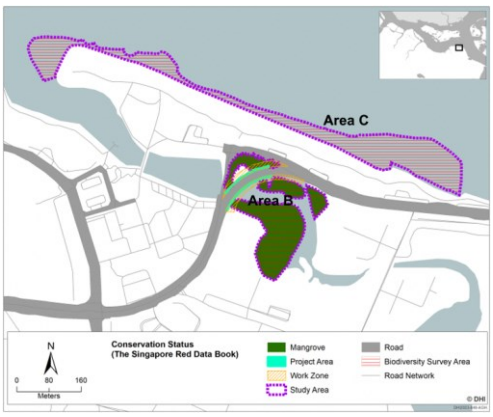
The EIS aims to:

- Identify Environmentally Sensitive Receptors (ESRs)
- Establish monitoring standards, with conditions before construction and operational works
- Identify potential environmental impacts on wildlife, noise levels, water quality and recreation for the proposed project
- Propose mitigation measures
- Recommend an Environmental Monitoring and Management Plan (EMMP)

The ESRs within the three locations of the EIS are:

- Area A - Sungei Selarang Mangroves and Forest
- Area B - Changi Creek Mangrove
- Area C - Seagrass along Changi Beach Park Shoreline

Area A (Sungei Selarang Mangroves and Forest)



Area B (Changi Creek), Area C (Changi Beach Park Shoreline)

STAKEHOLDER ENGAGEMENT

A consultation session with various Nature Groups was conducted to share the key findings of the study with a view to agree on the mitigation measures to address the potential environmental impacts.

This led to the proposed road works being further refined by LTA, taking in consideration safety and space constraints, and most importantly to minimise the environmental impacts. For example, LTA will create an opening in the drain at Area A during construction to allow continuous inundation of seawater into the mangrove.

BASELINE SURVEYS

An environmental field control study was carried out, comprising comprehensive desktop studies and site surveys at the areas adjacent to and within mangrove forests found in Areas A and B, and the intertidal area at Area C.

These studies covered:

- Terrestrial and aquatic biodiversity survey
- Hydrology and water quality
- Airborne noise

Terrestrial and Aquatic Biodiversity Surveys

From the terrestrial and aquatic biodiversity surveys, species of both conservation and non-conservation significance were found. Locally conservation significant flora and fauna species such as critically endangered flora, Yellow Flame (*Peltophorum pterocarpum*), Gedabu (*Sonneratia ovata*), and locally critically endangered fauna, Yellow-vented Flowerpecker (*Dicaeum chrysorrheum*) were found within/near to the project sites.

Hydrology and Water Quality
Water quality surveys were carried out at Sungei Selarang mangrove forest stream within Area A and Changi Creek mangrove within Area B. The water quality within Area A was found to be brackish and low in dissolved oxygen. The water quality in Area B was of higher salinity and turbidity levels than Area A. As mangroves are wetland ecosystems, they need to be periodically inundated. Thus, during construction work, it would be critical to ensure that works do not significantly disrupt water exchange in both areas.

Airborne Noise
Airborne noise levels were recorded on weekdays and weekends, at a residential space, a recreational space, and an educational institution near the project footprint. The baseline noise levels did present several exceedances when compared against the respective NEA maximum permissible noise levels for construction work especially during the evening hours, likely due to the higher volume of vehicular traffic.

IMPACT ASSESSMENT FINDINGS
Construction of the proposed development will potentially bring about changes to the environment in the proximity of the project. These changes may in turn cause some impact on the sensitive receptors nearby. In this case, the environmental changes for both sites are largely the same, except that the changes to Area B include intertidal habitats, marine infrastructure, and coastal residential/recreational users.

Ecology and Biodiversity
Baseline flora and fauna surveys within Areas A and B documented both terrestrial forest and mangroves flora and fauna species. Seagrass and intertidal surveys were conducted in Area C.

The following potential impacts on these flora and fauna are assessed:

- Direct loss of flora and fauna due to clearance and excavation;
- Disturbance to flora and fauna due to noise, visual disturbance, physical disturbance, and human presence; and
- Changes to terrestrial and marine environmental quality due to variation in water or air quality

Direct Loss of Environmental Habitats
In Area A, a fraction of the forest and Sungei Selarang mangrove will be affected by road widening works. One individual tree of local conservation significance, Yellow Flame (*Peltophorum pterocarpum*), critically endangered in Singapore Red Data Book (SRDB), and two Api-api Bulu (*Avicennia rumphiana*) vulnerable according to IUCN, will be affected. The Yellow Flame tree is frequently cultivated and commonly planted as roadside trees to provide shade and landscape. It is not usually a food source for fauna but may serve as a nesting and roosting tree. Branch cutting of the Yellow Flame, and propagules collection for these Api-api Bulu could be arranged to propagate these affected trees. Although the Senegal Mahogany (*Khaya senegalensis*), vulnerable according to IUCN, are affected, they are non-native trees planted along Loyang Ave for streetscape purpose. Therefore, the direct loss of habitat during the construction stage in Area A is assessed to be of slight negative impact after mitigation.

In Area B, the Changi Creek mangrove forest contains *Rhizophora stylosa* which is locally classified as ‘Vulnerable’ (Davison et al., 2008) in the Singapore Red Data Book and IUCN Red List. The area of impacted habitat is approximately 0.17ha (2.43%) out of 7ha of mangrove forest. With the appropriate mitigation measures in place to ensure natural tidal flow to Changi Creek Mangrove, the impact to Area B during construction was assessed to be of no impact after mitigation.

In Area C, the seagrass patches and sandy intertidal areas surveyed will not be affected by the road enhancement work.

Disturbance to Flora and Fauna

Physical and noise disturbances due to construction activities will be one of the key issues for consideration for the protection of key flora and fauna (such as mangroves, birds and mangrove associated fauna) during this phase. Airborne noise disturbance, physical disturbance and ecological light pollution were assessed.

Given the occurrence of certain fauna groups in the vicinity of the proposed works, with some listed as endangered locally and internationally, the impact due to physical disturbances is expected to be very minimal with the inclusion of conservation efforts directed at protected and threatened species.

Airborne Noise Disturbance

Amongst the fauna recorded during the baseline survey, birds of conservation significance tend to be more sensitive. From literature reviews, some birds can be more sensitive to road traffic noise (at least during breeding). Observations include reduced bird diversity and density of bird life near roads as well as reduced breeding success. Additionally, different bird species would react differently to noise, depending on the type of noise produced, including frequency, loudness, consistency, and duration (Ortega, 2012). It is also important to take into consideration the fact that the control noise monitoring carried out at a total of three stations had noise levels above the recommended baseline noise levels of 55-60 dB (Bentrup, 2008). With this, the fauna that presently inhabit these areas would have acclimated/habituated to the higher noise levels.

Physical Disturbance

For both Area A and Area B, presence of humans (workers) in and adjacent to habitats during the construction period can affect flora and fauna resulting in failed nesting attempts as well as an increased presence of stress hormones. In addition, the presence of equipment working near bird nests can affect survival rate of hatchlings.

For Area B, barges are planned to be deployed during the proposed construction works. Movement of vessels can be an issue for air breathing species such as cetaceans, dugongs, otters, and turtles. Of these marine megafaunas, only otters have been previously sighted in the area. These sightings are infrequent, and no otters were encountered during the baseline surveys. As otters are highly mobile and fast, it is expected that they will be able to avoid these vessels. Nevertheless, care should be taken during construction works and, where these otters are sighted, to ensure that they are outside the worksite before continuing with works that may pose a danger to them.

Ecological Light Pollution

The introduction of Artificial Lighting at Night (ALAN) can disrupt the natural patterns of light and dark in ecosystems. ALAN can be expected to influence various changes such as changes in habitat use as fauna may avoid illuminated areas, changes in activity such as reduced foraging, changes in behaviour such as delayed emergence time for nocturnal mammals, changes in reproductive behaviour that are reliant on light cues (references in Longcore and Rich, 2016).

For Area C, the flora and fauna within the seagrass patches and sandy intertidal areas will not be disturbed by the road enhancement work.

Impact to Environment Due to Water Quality

Environmental quality describes the conditions of the environment in terms of air quality, water quality and other aspects such as pollution from accidental spills.

For Area A, the inflow and exchange of fresh and saline water is paramount to the survival of the mangroves at Area A. Based on site observation, the mangrove area is currently fed by the seawater that was brought in from an existing drain opening. Thus, it would be critical that the works do not significantly disrupt water exchange.

For Area B, it is observed that the sediment plume is confined within the work area and is negligible. It is assessed that the piling works for the temporary platform for the bridge widening works will have no impact on water quality as the sediment plume is not predicted to reach the seagrass areas based

on the water quality modelling. The suspended sediments are not expected to affect the Changi Creek Mangroves as they are assessed to be tolerant to the levels of suspended sediment generated from piling activities of such scale.

Based on the modelling results, the high levels of sedimentation are confined to the area close to the piling location. The water quality modelling within Area B predicted that, during the construction stage, with the implementation of mitigation measures such as the installation of silt screen to stem the spread of suspended sediment, there will be no impact on seagrass and mangroves due to sediment plume and sedimentation.

In Area C, the seagrass patches and sandy intertidal areas surveyed will not be affected by the road enhancement work.

Changes to Environment Due to Other Sources

Dust Emissions – It is important to note that dust emissions from project activities are neither likely to hit the concentrations strong enough to affect the abundance and variability of birds, as observed by Saha and Padhy (2011), nor be a source of dust generated containing harmful heavy metals. Considering this, monitoring of air quality for the project should follow the IFC guideline of 25% average contribution and continue to monitor the fauna population during the project.

Run-offs – As the construction activities are within the immediate vicinity of marine ecological receptors, these runoffs will pick up sediments from these exposed surfaces of vegetation clearance and excavation, introducing sediments. Elevated levels of suspended sediments decrease light penetration through the water column and over time can cause sedimentation. As such the risk of these runoffs needs to be managed to reduce the chances of occurrence.

Spills and Leaks – Although the risk of oil spills is relatively low, the environmental consequences can be significant. As such, the risk of an accidental spill must be managed to reduce the likelihood of such an event.

PROPOSED MITIGATION MEASURES

Mitigation measures are recommended to reduce any potential impacts to as low as reasonably practicable and/or to avoid any potential impacts.

In Area A, with the implementation of the proposed mitigation measures below, the residual effects from the loss of environmental habitats, disturbance to flora and fauna, and changes to the quality of the water body have been reduced to be of slight negative impact (lowest category of negative impact in RIAM).

Area B is a mangrove environment, and mangroves are highly tolerable to some level of suspended sediment. Hence, it is expected that the proposed construction works, after mitigation, would result in no impact and no change to the water quality and mangrove environment.

Area C has sandy intertidal areas and seagrass patches. However, no impact from sediment plume and sedimentation from the road enhancement construction work are expected. No mitigation measure required.

Ecology and Biodiversity

To minimise the impact to the flora and fauna species, the following mitigation measures may be carried out at the pre-construction, construction, and post-construction phases.

Mitigation measures prior to the construction phase: -

- Carry out a pre-construction baseline if more updated information is required;
- Minimise vegetation clearance through project planning to curb habitat loss;
- Identify trees to be conserved and implement tree protection zones;
- Carry out flora relocation where feasible;

- Allow for conservation efforts such as collection of specimens; and
- Carry out wildlife shepherding to ensure no fauna is trapped within the project site.

Mitigation measures during the construction phase: -

- Restrict staff and subcontractor's movement as much as reasonably practicable to the project footprint.
- Soft start (ramp up) to gradually increase sound pressure levels produced from the working activities.
- Provide hoarding with noise reduction effect around construction site, if possible.
- Use of enclosures or shields for noisy equipment.
- Placing of vibrating units on isolators such as spring coils to reduce vibration.
- Limit vehicle speed to reduce noise.
- Only illuminate areas where necessary (e.g. security and safety reasons)
- Where feasible, lighting for night works should be installed facing downwards and away from nearby habitats e.g. forest
- Lights should be in orange colour and have a wildlife friendly wavelength of 590 nm (sodium vapour lamp or LED).

Mitigation measures at the post-construction phase: -

- Erect natural noise barriers (e.g. planting of hedges);
- Reduce the speed limit along the road; and
- Use alternative road paving materials that can reduce noise and vibration.

CONCLUSION

Through the EIS, DHI has identified the impacts within Area A and Area B and proposed mitigation measures to further reduce the potential impacts from the road improvement project. Nature Groups consulted have agreed with the mitigation measures recommended. LTA will follow-up by implementing these mitigation measures to reduce the potential residual impacts to as low as reasonably practicable. No impact to Area C is expected.

An Environmental Management and Monitoring Plan (EMMP) will be drafted and implemented during the construction stage to minimise any impacts due to the proposed works and to aid in monitoring the effectiveness of the mitigation measures.