

20 May 2020
Ref No.: 3351-1054

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Attention: Chris Sharpe

Dear Chris

Byron Bay Interchange – Addendum Review of Environmental Factors

Executive Summary

The Byron Bay Interchange (the Activity) was approved under Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). GeoLINK was engaged to prepare an Addendum Review of Environmental Factors (REF) for the Activity including:

- Assessment of the impacts of the Activity on the threatened Mitchell's Rainforest Snail (*Thersites mitchellae*) under the NSW *Biodiversity Conservation Act 2016* (BC Act) and Australian Government *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).
- An assessment of the presence of the Threatened Ecological Community (TEC) *Littoral Rainforest and Coastal Vine Thickets of Eastern Australia* as listed under the EPBC Act.
- Activity design revisions including:
 - Reducing impacts to MRS habitat through design changes at the southern end of the site; fence realignment to reduce vegetation removal and prevent human access into the MRS habitat; tree planting to reduce light penetration and edge effects; light design considerations to reduce light penetration; an MRS habitat clearing protocol; and pesticide/ herbicide provisions.
 - Removal of a mature Slash Pine (*Pinus elliottii*) tree that was originally shown as being retained on the design drawings and replacement with an appropriate semi-mature native rainforest tree.

Review of relevant literature and field surveys were undertaken to inform the assessments. The assessments concluded:

- The Activity is not likely to result in a significant impact on the MRS based on assessments under the BC Act and EPBC Act *Matters of National Environmental Significance - Significant Impact Guidelines 1.1* (DoFE 2013). Referral to the Australian Government Department of Agriculture, Water and the Environment is not required.
- The site and adjacent vegetation does not comprise the EPBC Act listed *Littoral Rainforest and Coastal Vine Thickets of Eastern Australia* TEC.

Environmental control measures detailed in the approved REF (SMEC 2019a) remain valid and would be undertaken as part of the revised Activity. The conclusions of the approved REF remain valid; that is, the environmental impacts of the Activity are not likely to be significant.

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1. Introduction

1.1 Background

The Byron Bay Interchange (the Activity or Action) was approved under Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The environmental assessment was undertaken in the form of a Review of Environmental Factors (REF) titled: *Review of Environmental Factors: Rural and Regional Interchange, Byron Bay Bus Interchange* (SMEC 2019a). The REF considered the NSW *Biodiversity Conservation Act 2016* (BC Act) and Australian Government *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) threatened listed Mitchell's Rainforest Snail (MRS; *Thersites mitchellae*) as a low potential occurrence on the Activity site and no statutory assessments were provided.

Mitchell's Rainforest Snail was confirmed in the southern end of the Activity site, south of the railway crossing walkway in the swamp sclerophyll forest habitat during surveys associated with the Byron Bay bypass (GeoLINK 2019a; 2020a; refer to **Illustration 1**). The following management measure of the REF was therefore triggered:

'Construction works must be stopped if any previously undiscovered threatened species or communities are discovered during works. An assessment of the impact and any required approvals must be obtained. Works must not recommence until Sydney Trains has provided written approval to do so' GeoLINK was engaged to prepare an Addendum REF for the Activity, including:

- Assessment of the impacts of the Activity on MRS under the BC Act in the form of a Five-part Test of Significance Assessment.
- Assessment of the impacts of the Activity (or Action) on MRS under the EPBC Act in accordance with the *Matters of National Environmental Significance - Significant Impact Guidelines 1.1* (DoE 2013).
- An assessment of the presence of the Threatened Ecological Community (TEC) *Littoral Rainforest and Coastal Vine Thickets of Eastern Australia* as listed under the EPBC Act.
- Activity revision to include the removal of a mature Slash Pine (*Pinus elliotii*) tree that was originally shown as being retained on the design drawings (refer to **Illustration 1**). A replacement planting with an appropriate semi-mature native rainforest tree would occur during landscaping.

1.2 Revised Activity

A detailed description of the Activity is provided in the approved REF (SMEC 2019a). Environmental safeguards and management measures detailed in the REF (SMEC 2019a) would be implemented during the construction phase of the project and form part of the Activity. Revisions to the Activity are discussed below.

1.2.1 Reduce Impacts on MRS Habitat

The following revisions to the activity have been made to reduce impacts to the southern swamp sclerophyll forest and associated MRS habitat:

- Vegetation clearing, earthworks (filling) and landscaping at the southern end of the site has been reduced.

- The sewerage pipes that connecting the amenities block with the local sewerage network along Butler Street has been re-aligned to reduce impacts to MRS habitat by using existing cleared areas where possible.
- The fence along the interface between the interchange and swamp sclerophyll forest (including the return along Butler Street) has been realigned to reduce habitat removal. The fence would reduce human access into the MRS habitat and become a permanent no-go zone during the operation phase of the project.
- The alignment of the stormwater drainage pipes, Gross Pollutant Trap (GPT) and rock scour protection at the outlet would be revised to minimise vegetation/ habitat removal where possible.
- A dense hedge planting (e.g. Lilly Pilly hedge with dense Lomandra plantings below) along the southern fence between the swamp sclerophyll forest and the interchange extending down Butler Street opposite the Burns Street intersection. The objective of this planting is to reduce light penetration from vehicles and infrastructure (e.g. street lighting, amenities block, etc) into the vegetation; reduce drying effects from wind; and minimise edge effects.
- Design and installation of street and infrastructure lighting to be directional, avoiding light spill into swamp sclerophyll forest (MRS habitat).
- Clearing and grubbing within MRS habitat would occur in accordance with the *MRS Habitat Clearing Protocol (Appendix A)*.
- Pesticide/herbicide provisions:
 - Construction phase: No use of pesticides/herbicides during construction stage of the project.
 - Operation phase: No use of pesticides/herbicides in the vicinity of the swamp sclerophyll forest.

The revised Activity would result in the extent of impacted MRS habitat being reduced from 0.09 ha to 0.05 ha. The original area of proposed impacted MRS habitat and an indicative area of the revised impacted MRS habitat is shown in **Illustration 1**.

1.2.2 Slash Pine Removal and Replacement

The Activity has been revised to include the removal of a mature Slash Pine (*Pinus elliottii*) tree approximately 0.5 m diameter at breast height (DBH) and 13 m tall. This tree is located at the southern end of the site (refer to **Illustration 1**) and was originally shown in the design drawings as being retained. It comprises an exotic weed species. A replacement planting with an appropriate semi-mature native rainforest tree (e.g. Tulipwood *Harpullia pendula*, Tuckeroo *Cupaniopsis anacardioides*, Cheese Tree *Glochidion ferdinandi*, Brush Box *Lophostemon confertus*) would occur during landscaping. The replacement tree is to be approved by the project manager prior to purchase and viewed prior to installation to ensure that the height, width and form of the proposed tree meet the requirements of the project.

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GDA 1994 MGA Zone 56

LEGEND

- Original Byron Bay interchange clearing limit
- Original impacted MRS habitat
- Revised (reduced) impacted MRS habitat

- Byron Bay bypass clearing limit
- Slash Pine to be removed and replaced with native tree species



MRS Habitat - Illustration 1



Byron Bay Interchange - Addendum REF
3351-1051

Information shown is for illustrative purposes only
Drawn by: DSA Checked by: AB Reviewed by: DSA
Source of base data: DFSI
Date: 12/05/2020
Revision: A



2. MRS Profile

Mitchell's Rainforest Snail occurs predominantly in swamp sclerophyll forest and lowland subtropical rainforest on the coastal plains between the Richmond River and Tweed Rivers. Surveys as part of Parkyn's (2014) PhD revealed broader habitat occupation, including:

- Littoral rainforest on hind dunes
- Vegetation beyond the coastal plain, including several locations in Mount Jerusalem National Park up to an elevation of approximately 600 m ASL and two sites near Byrriil Creek adjoining Mebbin National Park (Parkyn 2014).

Results from MRS surveys undertaken as part of the Byron Bay bypass (GeoLINK 2019a, 2019b, 2019c, 2020a, 2020b) suggest that the MRS is associated with broad habitat types (i.e. rainforest and swamp sclerophyll forest) within a restricted distribution, rather than specific floristic associations. Habitat subject to edge effects and with exotic species dominated understoreys were found to be occupied by MRS (GeoLINK 2020a; 2020b).

The NSW BioNet database (DoPIE, 2019) displays 267 MRS records in NSW. This includes records within the following national park estates:

- Cumbegin Swamp Nature Reserve
- Billinudgel Nature Reserve
- Stotts Island Nature Reserve
- Arakwal National Park.

The Atlas of Living Australia database (ALA, 2019) displays 367 MRS records, most of which duplicate the BioNet database records in NSW. This includes records within the following additional national parks estates:

- Mount Jerusalem National Park
- Nightcap National Park.

Parkyn (2014) found that the MRS's behaviour is largely nomadic and that coarse woody debris should be considered a key habitat component. The study suggested that the species restriction to rainforest and swamp forest indicates a dependence on high moisture levels, low fire frequency, and a well-developed leaf litter layer. Recorded preferred shelter/retreat sites include *Gahnia clarkei* stems and Bangalow Palm (*Archontophoenix cunninghamiana*) fronds (Parkyn 2014).

Mitchell's Rainforest Snail has been recorded breeding at various times of the year, depending on climate; and would achieve multiple breeding events throughout the year. It has been observed forming egg chambers in moist bark litter at the base of trees, with clutches of 50-80 eggs. Hatching has been recorded at approximately 28 days (Parkyn 2014).

3. Target MRS Surveys

3.1 Introduction and Methodology

Target MRS surveys were undertaken at the Activity site to verify the extent of impacted MRS habitat. Preliminary investigations found two areas of potential MRS habitat, comprising swamp sclerophyll forest in the north and south (refer to Figure 5-11 of the REF).

Surveys were undertaken on 27 and 28 April 2020 and comprised nocturnal surveys by two GeoLINK ecologists for two nights targeting the site and immediately adjoining potential habitat (refer to **Illustration 2**). Surveys were undertaken between 6:15 pm and 10:15 pm each night (4 hrs per person per night); totalling 16 hrs of survey effort. The surveys included:

- Verification that MRS were active in the known swamp sclerophyll forest at the southern end of the site
- Surveys across the remainder of the site with a focus in the swamp sclerophyll forest in the northern end of the site. The surveys extended offsite into the swamp sclerophyll forest to the north.

Weather conditions during the survey were fine and overcast on 27 April; and overcast with periodic rain on 28 April. Temperatures ranged from 18.4 to 21°C, while relative humidity varied between 74 and 99 % (BoM 2020).

3.2 Results

Three adult MRS were detected in the known swamp sclerophyll forest south of the railway walkway (refer to **Illustration 2** and **Table 1**). Individuals were detected within five minutes of surveying this area each night. No other MRS were detected.


Table 1 MRS Survey Results

MRS No.	Date	Easting	Northing	Shell Width (mm)	Age Class	Microhabitat
1	27/4/20	559759	6831106	23	Juvenile	Coarse woody debris
2	28/4/20	559751	6831109	33	Adult	Leaf litter at base of Broad-leaved Paperbark
3	28/4/20	559746	6831108	39	Adult	Coarse woody debris

3.3 Discussion and Extent of MRS Habitat On-site

These results are consistent with the findings of previous surveys undertaken as part of the Byron Bay bypass project (GeoLINK 2019a, 2019d), with:

- The swamp sclerophyll forest in the southern end of the Activity site being known MRS habitat.
- No MRS were detected in the swamp sclerophyll forest at the northern end of the site. Previous target MRS surveys in this area were undertaken on two occasions and included 4.7 hours nocturnal and two hours of diurnal surveys (excluding clearing phase surveys). In summary, MRS have not been detected in the swamp sclerophyll forest at the northern end of the site despite surveys on four occasions (three nocturnal and one diurnal survey).



Overall, the extent of actual MRS habitat on the Activity site is restricted to the swamp sclerophyll forest south of the railway crossing walkway (refer to **Illustration 2**) which has an area of 0.09 ha. It is located at the northern periphery of a larger area of contiguous known MRS habitat which extends to the south between the railway corridor (east) and the Byron Bay bypass/urban land (west and south). This habitat has a total area of 2.52 ha (refer to **Illustration 3**). The habitat to the immediate north of the railway walkway comprises banksia forest on sand and does not comprise potential MRS habitat.

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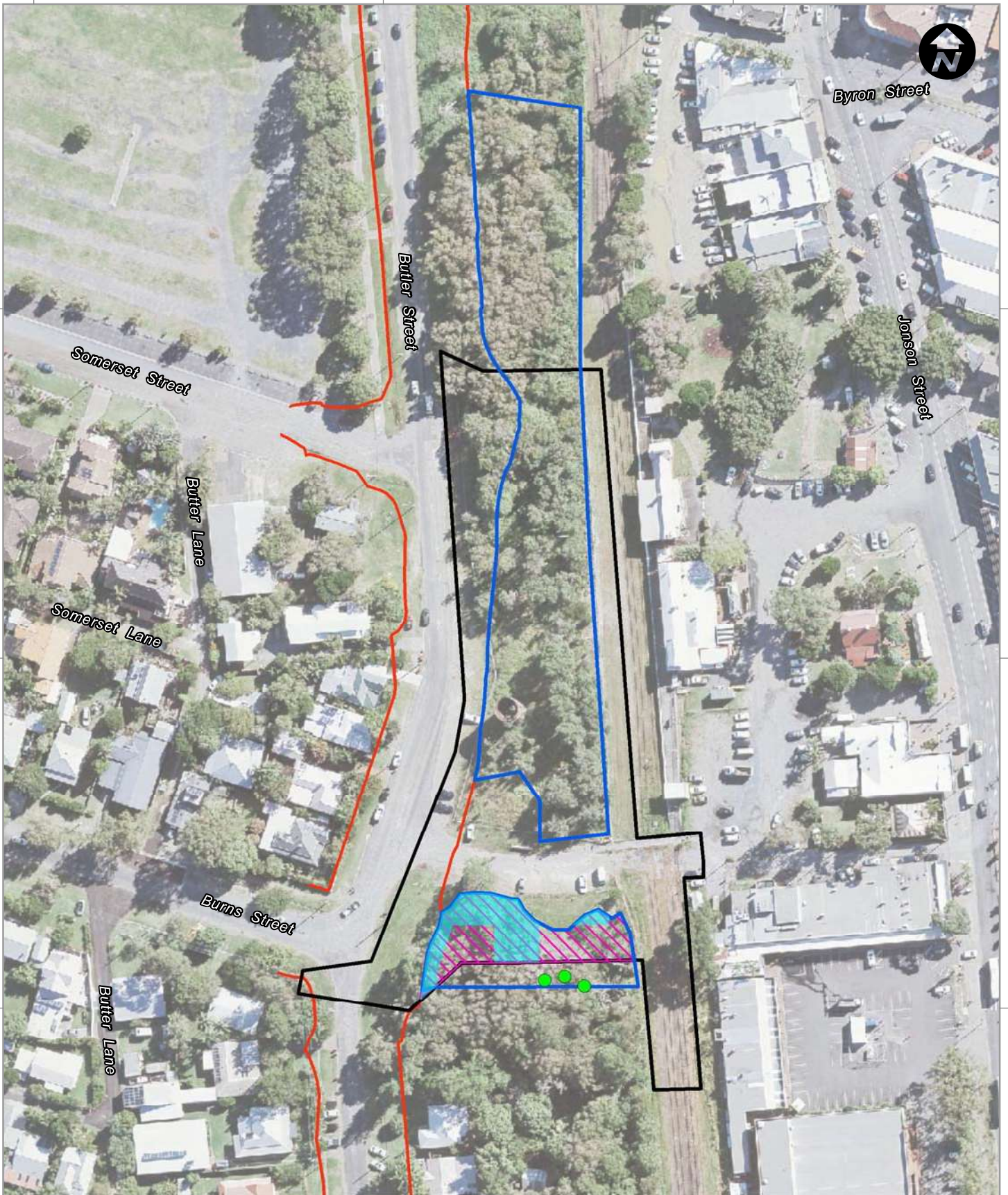
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GDA 1994 MGA Zone 56

LEGEND

 Original Byron Bay interchange clearing limit
 Revised (reduced) impacted MRS habitat

 Target MRS survey area
 Original impacted MRS habitat

 Byron Bay bypass clearing limit
 MRS survey record



MRS Survey Footprint and Results - Illustration 2



LEGEND

- Original Byron Bay interchange clearing limit
- Revised (reduced) impacted MRS habitat
- Indirectly impacted MRS habitat
- MRS local population habitat
- Byron Bay bypass clearing limit
- MRS survey record



Impacted MRS Habitat and Extent of Local Population Habitat - Illustration 3

4. Revised Activity Impacts

Environmental impacts associated with the Activity are detailed in the approved REF (SMEC 2019a). The revised Activity (refer to **Section 1.2**) would not result in additional impacts to the following environmental factors assessed in the approved REF:

- Non-Aboriginal heritage.
- Noise and vibration.
- Landforms, geology and soils.
- Water quality and hydrology.
- Contaminated land and hazardous materials.
- Visual aesthetics and urban design.
- Traffic and access.
- Demand on resources
- Cumulative environmental impacts.

Environmental control measures for these environmental factors are detailed in the approved REF and remain valid. No additional environmental control measures are required.

In relation to biodiversity, the revised Activity would result in reduced clearing of *PCT 1064 Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion* and associated fauna habitat. Specifically, approximately 0.04 ha of this vegetation/habitat originally assessed for removal at the southern end of the site would be retained. Biodiversity control measures detailed in the approved REF remain valid. Potential impacts of the revised Activity (as detailed in **Section 1.2**) specific to the MRS are provided below.

4.1 Direct Impacts

Potential direct impacts of the Activity on the MRS include:

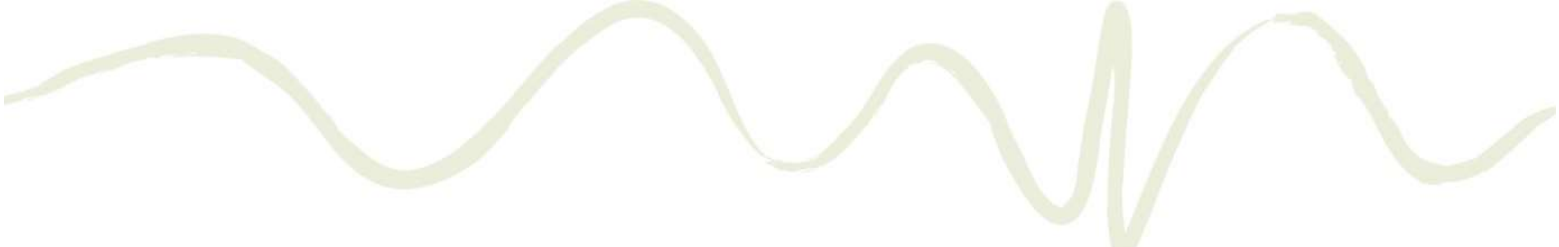
- Habitat removal. The Activity would require removal of approximately 0.05 ha of MRS habitat (swamp sclerophyll forest). This represents approximately 2 % of the area of contiguous habitat available to the local population. Approximately 2.47 ha (98 %) of the available contiguous MRS habitat would not be directly impacted by the Activity.
- Injury or mortality during clearing. To reduce this risk the *MRS Habitat Clearing Protocol* (refer to **Appendix A**) would be implemented prior to and during clearing.

4.2 Indirect Impacts

Potential indirect impacts of the Activity on the MRS or its habitat include:

- Habitat degradation through soil or water quality impacts
- Increased light spray penetration
- Habitat degradation in retained habitat through edge effects along the new vegetation edge (e.g. light penetration, weed invasion, etc).

For the purpose of this assessment, it is considered that indirect impacts could extend up to 15 m from the new clearing edge, which comprises 0.13 ha (5 %) of the remaining MRS habitat for the local population (refer to **Illustration 3**). It is unlikely that the indirect impacts would substantially reduce the current value of this habitat for the MRS considering:

- 
- The location of the site at an urban interface
 - Existing and retained vegetation is subject to existing edge effects and weed invasion
 - Construction activities would be undertaken in accordance with the REF (SMEC 2019a) safeguards
 - There are numerous MRS records in habitats at urban interfaces (Parkyn 2014; 2016; GeoLINK 2020a, 2020b; DoPIE 2019).

4.3 Cumulative Impacts

MRS surveys and habitat mapping by GeoLINK (2019c) identified approximately 216 ha of known/potential MRS habitat associated with the Cumbebin Swamp and the eastern side of the Belongil Creek floodplain (including the Activity site) prior to Byron Bay bypass construction. This habitat comprises swamp sclerophyll forest and rainforest vegetation types bound by:

- The Byron Bay township to the north and east
- Old Bangalow Road to the south (encompasses the Lilli Pilli estate area)
- Skinners Shoot Road/estuarine areas of Belongil Creek to the west.

Historic urban and agricultural development has impacted this population, defining its current distribution and the extent of potential. The impacts of the Activity on the population are cumulative to historic and recent development. This includes the Byron Bay bypass project which directly impacted the subject MRS population by:

- Removal of approximately 1.5 ha of MRS habitat
- Fragmenting approximately 2.52 ha of habitat located in the north/east of the bypass from the larger area of habitat to the south/west
- Indirect impacts (e.g. edge effects) to adjoining habitat.

The Byron Bypass project includes a number of environmental management measures, safeguards and offset provisions that aim to minimise impacts on the MRS and its habitat.

The Activity would contribute to cumulative impacts on the subject MRS and its habitat. Statutory assessments below take into consideration these cumulative impacts as appropriate.

5. MRS BC Act Assessment

5.1 Local MRS Population

The MRS is listed as Endangered under the BC Act. The OEH (2018) *Threatened Species Test of Significance Guidelines* defines the local population for resident fauna as:

'The population that occurs in the study area. The assessment of the local population may be extended to include individuals beyond the study area if it can be clearly demonstrated that contiguous or interconnecting parts of the population continue beyond the study area, according to the following definitions:

- *The local population of resident fauna species comprises those individuals known or likely to occur in the study area, as well as any individuals occurring in adjoining areas (contiguous or otherwise) that are known or likely to utilise habitats in the study area.'*

As discussed previously, GeoLINK (2019c) identified approximately 216 ha of known/potential MRS habitat associated with the Cumbebin Swamp and the eastern side of the Belongil Creek floodplain prior to Byron Bay bypass construction. Throughout this landscape, there would be varying MRS densities, habitat suitability and habitat quality; with the MRS typically occurring in low densities.

Construction of the Byron Bay bypass project has resulted in removal of approximately 1.5 ha of habitat and fragmentation of approximately 2.52 ha of habitat located in the north-eastern portion of the larger stand of local habitat (refer to **Illustration 3**). While a fauna underpass would be constructed as part of the Byron Bypass project and provide potential opportunities for MRS movement between habitat on each side of this road (based on previous records of MRS crossing Lilli Pilli Drive via a culvert – Parkyn 2016), the probability of frequent movement or the occurrence of MRS from habitat south/west of the bypass occurring within the study area (as defined in the OEH 2018 guidelines) is low.

For the purpose of this assessment, the local population of MRS is defined as the population within the 2.52 ha of known contiguous habitat associated with the swamp sclerophyll forest in the southern end of the site (north/east of the Byron Bay bypass; refer to **Section 3.3** and **Illustration 3**).

5.2 Test of Significance

(a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

The OEH (2019) MRS profile identifies the following threats to the MRS or its habitat:

- *Clearing of lowland rainforest, swamp forest and wetland margins for agriculture.*
- *Clearing of lowland rainforest, swamp forest and wetland margins for urban development.*
- *Damage to remnant areas of habitat from grazing by domestic stock.*
- *Damage to remnant areas of habitat by fire.*
- *Damage to remnant areas of habitat by weed invasion.*
- *Predation of snails by introduced rats.*
- *Habitat fragmentation increasing edge effects including increasing the severity of disturbance from fire, weeds and predation by introduced rats.*

- *Use of herbicides and pesticides in and near areas of habitat.*
- *Impacts on habitat as a result of dieback caused by root rot fungus (*Phytophthora cinnamomi*).*
- *Loss of coastal populations from sea level rise and climate change.*
- *Damage to habitat from changes in hydrology.*
- *Poor knowledge of species distribution.*
- *Lack of awareness of the species within the community.*

Potential impacts of the Activity on the local MRS population are detailed in **Section 4** and include:

- Direct impacts, including:
 - Removal of approximately 0.05 ha of MRS habitat (2 % of the habitat available to the local population)
 - Potential injury or mortality during clearing. This includes potential disturbance to breeding phases (e.g. mating or egg clutches) if present within the vegetation impacted by the proposal at the time of clearing.
- Indirect impacts leading to reduced habitat quality. Approximately 0.13 ha (5 %) of the remaining habitat available to the local population may be affected by indirect impacts.

While these are negative (cumulative and incremental) impacts, it is unlikely that the magnitude of these impacts would significantly affect the lifecycle of the MRS to the point of placing the local population at risk of extinction, considering:

- Approximately 2.47 ha (98 %) of known habitat that supports the local population would not be directly impacted by the Activity
- The existing value of the habitat subject to indirect impacts as a result of the Activity is unlikely to be significantly compromised given the existing environment and MRS records in urban interfaces
- Given the small proportion of habitat impacted, it is likely that only a small proportion of the local population would be impacted by the Activity
- The species behavioural and reproductive characteristics described in **Section 2.1**, particularly that it is largely nomadic, would achieve multiple breeding events throughout the year and has been recorded laying clutches of 50-80 eggs (Parkyn 2014)
- There are numerous MRS records in small remnants and/or urban interfaces (Parkyn 2014; DoPIE 2019; GeoLINK 2020a, 2020b).

Overall, the Activity is unlikely to have an adverse effect on the life cycle of the MRS such that the local population is likely to be placed at risk of extinction.

(b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

This part of the assessment is not applicable to threatened species.

(b) in relation to the habitat of a threatened species or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and



The extent to which habitat is likely to be removed or modified as a result of the Activity includes:

- **Directly Impacted Habitat:** Approximately 0.05 ha of swamp sclerophyll forest located in the northern periphery of the habitat available to the local population would be impacted. It represents approximately 2 % of the habitat available to the local MRS population.
- **Indirectly Impacted Habitat:** Approximately 0.13 ha (5 %) of the remaining 2.47 ha of habitat available to the local population. The value of this indirectly impacted habitat for the MRS is unlikely to be significantly compromised given the existing environment and MRS records at urban interfaces (DoPIE 2019; Parkyn 2014).

Approximately 2.47 ha (98 %) of the known habitat available to the local population would not be directly impacted by the Activity.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

The Activity directly affects habitat located in the northern periphery of the habitat available to the local MRS population. It is surrounded by cleared urban land to the east and west and unsuitable habitat to the north; creating a habitat 'cul-de-sac' (refer to **Illustration 3**). The subject site does not form part of any habitat corridors for the MRS. Overall an area of MRS habitat is unlikely to become fragmented or isolated from other areas of habitat as a result of the Activity.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality

The approximately 0.05 ha of MRS habitat directly impacted by the Activity is located in the northern periphery of the habitat available to the local population; representing 2 % of the available habitat. Approximately 2.47 ha (98 %) of the habitat available to the local population would not be directly or significantly indirectly impacted by the Activity. No MRS habitat would become fragmented or isolated as a result of the Activity. There are numerous MRS records in small remnant fragments and urban interfaces, suggesting that the long-term viability of the local population would not be compromised as a result of the Activity. Overall, habitat important to the long-term survival of the subject local MRS population would not be adversely impacted by the Activity.

(d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)

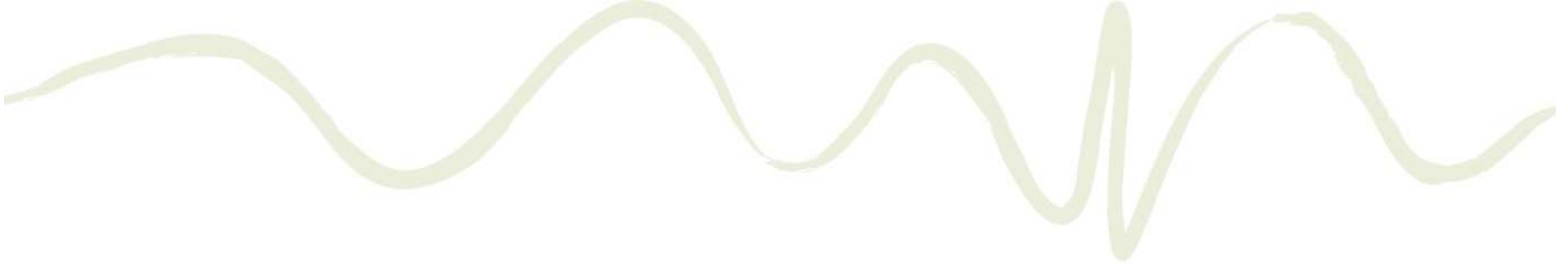
The Activity does not impact any declared area of outstanding biodiversity value.

(e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process

A key threatening process (KTP) is a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species or ecological communities. The current list of KTPs under the BC Act, and whether the Activity is recognised as a KTP is shown in **Table 2**.

Table 2 Key Threatening Processes

Key Threatening Process (as per Schedule 4 of the BC Act)	Is the development or activity proposed of a class of development or activity that is recognised as a threatening process?		
	Likely	Possible	Unlikely
Aggressive exclusion of birds by noisy miners (<i>Manorina melanocephala</i>)			✓
Alteration of habitat following subsidence due to longwall mining			✓
Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands			✓
Anthropogenic climate change		✓	
Bushrock removal			✓
Clearing of native vegetation	✓		
Competition and grazing by the feral European Rabbit (<i>Oryctolagus cuniculus</i>)			✓
Competition and habitat degradation by feral goats (<i>Capra hircus</i>)			✓
Competition from feral honeybees (<i>Apis mellifera</i>)			✓
Death or injury to marine species following capture in shark control programs on ocean beaches			✓
Entanglement in or ingestion of anthropogenic debris in marine and estuarine environments			✓
Forest eucalypt dieback associated with over-abundant psyllids and bell miners			✓
Habitat degradation by Feral Horses, <i>Equus caballus</i>			✓
Herbivory and environmental degradation caused by feral deer			✓
High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition			✓
Importation of red imported fire ants (<i>Solenopsis invicta</i>)			✓
Infection by <i>Psittacine circoviral</i> (beak and feather) disease affecting endangered psittacine species and populations			✓
Infection of frogs by amphibian chytrid causing the disease chytridiomycosis			✓
Infection of native plants by <i>Phytophthora cinnamomi</i>			✓
Introduction and Establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae			✓
Introduction of the large earth bumblebee (<i>Bombus terrestris</i>)			✓
Invasion and establishment of exotic vines and scramblers		✓	
Invasion and establishment of Scotch Broom (<i>Cytisus scoparius</i>)			✓
Invasion and establishment of the Cane Toad (<i>Bufo marinus</i>)			✓
Invasion, establishment and spread of Lantana (<i>Lantana camara</i>)		✓	
Invasion of native plant communities by African Olive (<i>Olea europaea L. subsp. cuspidata</i>)			✓
Invasion of native plant communities by <i>Chrysanthemoides monilifera</i> (bitou bush and boneseed)			✓
Invasion of native plant communities by exotic perennial grasses		✓	
Invasion of the Yellow Crazy Ant (<i>Anoplolepis gracilipes</i>) into NSW			✓
Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants			✓
Loss of hollow-bearing trees			✓
Loss or degradation (or both) of sites used for hill-topping by butterflies			✓
Predation and hybridisation by feral dogs (<i>Canis lupus familiaris</i>)			✓
Predation by the European Red Fox (<i>Vulpes vulpes</i>)			✓
Predation by the feral cat (<i>Felis catus</i>)			✓
Predation by <i>Gambusia holbrooki</i> (Plague Minnow or Mosquito Fish)			✓
Predation by the Ship Rat (<i>Rattus rattus</i>) on Lord Howe Island			✓
Predation, habitat degradation, competition and disease transmission by feral pigs (<i>Sus scrofa</i>)			✓
Removal of dead wood and dead trees	✓		



Clearing of native vegetation and removal of dead wood and dead trees are the two KTPs likely to be contributed to by the Activity.

Clearing of native vegetation: Clearing is defined as the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation so as to result in the loss, or long-term modification, of the structure, composition and ecological function of stand or stands. The Activity would have a relatively minor contribution to this KTP.

Removal of dead wood and dead trees: Minor fallen branches/logs may be removed from the site as a result of the Activity. This would only represent a minor contribution to this KTP.

Other potential KTP contributions from the Activity are minor and unlikely to place the local MRS population at significant risk of extinction.

5.2.1 Conclusion

This test of significance assessment undertaken in accordance with the requirements of the BC Act indicates that the local MRS population is unlikely to be significantly impacted by the Activity.

6. MRS EPBC Act Assessment

6.1 Population of a Species

The MRS is listed as Critically Endangered under the EPBC Act. In accordance with the EPBC Act *Matters of National Environmental Significance - Significant Impact Guidelines 1.1* (DoE 2013) a population of a species is defined as 'as an occurrence of the species in a particular area'. In relation to critically endangered species, occurrences include but are not limited to:

- a geographically distinct regional population, or collection of local populations, or
- population, or collection of local populations, that occurs within a particular bioregion" (DoEE 2013).

For the purpose of this assessment the subject 'population' of MRS is defined as per the 'local population' definition used in the BC Act assessment (refer to **Section 5.1**); which occupies an area of 2.52 ha. This is somewhat a conservative approach, as the EPBC Act definition would enable the larger eastern Belongil Creek floodplain population (which extends over an area of approximately 214.5 ha post Byron Bay bypass clearing) to be considered.

6.2 MRS Assessment

In accordance with the DoE (2013c) *an action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:*

- **lead to a long-term decrease in the size of a population**

Potential impacts of the Activity on the subject MRS population are detailed in **Section 4** and include:

- Direct impacts, including:
 - Removal of approximately 0.05 ha of MRS habitat (2 % of the habitat available to the local population)
 - Potential injury or mortality during clearing. This includes potential disturbance to breeding phases (e.g. mating or egg clutches) if present within the vegetation impacted by the proposal at the time of clearing.
- Indirect impacts leading to reduced habitat quality. Approximately 0.13 ha (5 %) of the remaining habitat available to the local population may be affected by indirect impacts.

While these are negative (cumulative and incremental) impacts, it is unlikely that the magnitude of these impacts would lead to a significant long-term decrease in the size of a population, considering:

- Approximately 2.47 ha (98 %) of known habitat that supports the subject population would not be directly impacted by the Activity.
- The existing value of the habitat subject to indirect impacts as a result of the proposal is unlikely to be significantly compromised given the existing environment and MRS records in urban interfaces.
- Given the small proportion of habitat impacted, it is likely that only a small proportion of the subject population would be impacted by the Activity.
- The species behavioural and reproductive characteristics described in **Section 2.1**, particularly that it is largely nomadic, would achieve multiple breeding events throughout the year and has been recorded laying clutches of 50-80 eggs (Parkyn 2014).

- There are numerous MRS records in small remnants and/or urban interfaces (Parkyn 2014; DoPIE 2019; GeoLINK 2020a, 2020b).
- Clearing and grubbing of MRS habitat would occur in accordance with the *MRS Habitat Clearing Protocol (Appendix A)*.

- ***reduce the area of occupancy of the species***

Approximately 0.05 ha of swamp sclerophyll forest located in the northern periphery of the habitat available to the subject population would be impacted. This represents approximately 2 % of the habitat available to the subject MRS population. The value of adjacent habitat is unlikely to be significantly compromised by indirect impacts given the existing environment and MRS records at urban interfaces (DoPIE 2019; Parkyn 2014; GeoLINK 2020a, 2020b).

Overall the Activity is unlikely to result in a significant reduction in the area of occupancy for the subject MRS population.

- ***fragment an existing population into two or more populations***

The Activity directly affects habitat located in the northern periphery of the habitat available to the subject MRS population. It is surrounded by cleared urban land to the east and west and unsuitable habitat to the north; creating a habitat 'cul-de-sac' (refer to **Illustration 3**). The subject site does not form part of any habitat corridors for the MRS. Overall the Activity would not fragment an existing population into two or more populations.

- ***adversely affect habitat critical to the survival of a species***

The MRS is known from a number of locations within the coastal plain between the Richmond and Tweed Rivers, it has also been recorded at several locations off the coastal floodplain (Parkyn 2014). The Activity directly affects a small area of habitat (0.05 ha) located in the northern periphery of the larger area of habitat available to the subject MRS population. Approximately 2.47 ha (98 %) of known habitat that supports the local population would not be directly impacted by the Activity and habitat fragmentation would not occur as a result of the Activity. The broader MRS population on the eastern Belongil Creek floodplain covers an area of approximately 214.5 ha (post Byron Bay bypass clearing). With consideration of the above and aforementioned points, the Activity would not adversely affect habitat critical to the survival of the MRS.

- ***disrupt the breeding cycle of a population***

The MRS's behavioural and reproductive characteristics are described in **Section 2.1**. While the Activity would result in negative (cumulative and incremental) impacts, the Activity would not disrupt the breeding cycle of the subject MRS population to the point of resulting in a significant impact, considering:

- The species is largely nomadic; would achieve multiple breeding events throughout the year; and has been recorded laying clutches of 50-80 eggs (Parkyn 2014).
- Approximately 2.47 ha (98 %) of known habitat that supports the local population would not be directly impacted by the Activity.
- The existing value of the habitat subject to indirect impacts as a result of the Activity is unlikely to be significantly compromised given the existing environment and MRS records in urban interfaces.
- Given the small proportion of habitat impacted, it is likely that only a small proportion of the local population would be impacted by the Activity.

- ***modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline***

The Activity would not modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline significantly, considering:

- Approximately 2.47 ha (98 %) of known habitat that supports the subject population would not be directly impacted by the Activity.
- The existing value of the habitat subject to indirect impacts as a result of the Activity is unlikely to be significantly compromised given the existing environment and MRS records in urban interfaces.
- Given the small proportion of habitat impacted, it is likely that only a small proportion of the subject population would be impacted by the Activity.
- The species behavioural and reproductive characteristics described in **Section 2.1**, particularly that it is largely nomadic, would achieve multiple breeding events throughout the year and has been recorded laying clutches of 50-80 eggs (Parkyn 2014).
- There are numerous MRS records in small remnants and/or urban interfaces (Parkyn 2014; DoPIE 2019; GeoLINK 2020a, 2020b).

- ***result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat***

The Activity would not result in invasive species that are harmful to the MRS becoming established in the species' habitat. Weeds are a common occurrence throughout the local landscape. Adjacent habitat is subject to existing edge effects and any increases in weed occurrence from the additional edge effects would be minimal in the local context. There are numerous MRS records in weed impacted urban interfaces (GeoLINK 2020a, 2020b).

- ***introduce disease that may cause the species to decline, or***

No diseases that may cause MRS decline are likely to be introduced as a result of the Activity.

- ***interfere with the recovery of the species.***

Habitat destruction (including clearing) is identified as a major threat for the MRS. The Activity therefore is not consistent with the overall objectives of the *Recovery Plan for Mitchell's Rainforest Snail* (NPWS 2001), as it would require removal of approximately 0.05 ha of known habitat. The removal of this small amount of habitat however is unlikely to substantially interfere with the recovery of the species (refer to aforementioned points) and the subject population is likely to remain viable.

6.2.1 Conclusion

This assessment has demonstrated that the Activity is not likely to result in a significant impact to the MRS. Therefore referral to the Australian Government Department of Agriculture, Water and the Environment is not required.

7. EPBC Act Littoral Rainforest Assessment

7.1 Introduction

The following tasks were undertaken to determine whether the TEC *Littoral Rainforest and Coastal Vine Thickets of Eastern Australia* (referred henceforth as Littoral Rainforests TEC) as listed under the EPBC Act occurs on or adjacent to the site:

- Review of the subject TEC's 'Key Diagnostic Characteristics and Condition Thresholds' described in the *Littoral Rainforest and Vine Thickets of Eastern Australia Listing Advice* (Threatened Species Scientific Committee, 2008).
- Review of the approved REF (SMEC 2019a) and the associated *Biodiversity Assessment Report, Byron Bay Bus Interchange* (SMEC 2019b).
- Aerial photograph interpretation and a site inspection to identify potential patches of woody vegetation characteristic of Littoral Rainforest TEC a minimum of 0.1 ha in size (as per the Threatened Species Scientific Committee [2008] minimum size condition criteria). The inspection extended into vegetation 50 m north and south of the site. If present, subsequent floristic and cover analysis would be undertaken to inform the assessment. A site inspection was undertaken on 8 May 2020 by GeoLINK senior ecologist David Andrighetto.

7.2 Analysis

7.2.1 Patch Identification and Floristic Composition

The Biodiversity Assessment (SMEC 2019b) included three 20 m x 50 m plots to record floristic composition and structure in accordance with the BioBanking Assessment Methodology (BBAM). Two Plant Community Types (PCTs) were identified at the site (refer to Fig No. 3 in SMEC 2019b):

- *PCT 1536 Tuckeroo - Lilly Pilly - Coast Banksia littoral rainforest*. This community was not found to comprise any TECs listed under the BC Act or EPBC Act.
- *PCT 1064 Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion*. This community was found to comprise the BC Act listed TEC *Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions*. No correlation to any EPBC Act TECs was identified.

It should be noted that the BBAM requires vegetation communities to be classified into specific PCTs based on the 'best fit' principle which does not necessarily align with BC Act or EPBC Act TEC determinations.

SMEC (2019b) recorded a total of 67 flora species at the site (31 native and 36 exotic species). This includes ten species characteristic of Littoral Rainforest TEC for the Southern South Eastern Queensland and NSW North Coast region listed in Appendix A of the Listing Advice. Five other rainforest species were also recorded.

The site inspection by GeoLINK on 8 May 2020 found that the vegetation descriptions and mapping provided in SMEC (2019a, 2019b) are representative of the vegetation on-site. No patches of vegetation of 0.1 ha in size characteristic of Littoral Rainforest TEC were recorded at or adjacent to the site.

7.2.2 Comparison to EPBC Act Littoral Rainforest and Vine Thickets of Eastern Australia Listing Advice

A comparison between the vegetation on-site and the Listing Advice 'Key Diagnostic Characteristics' and 'Condition Thresholds' is provided in **Table 3** and **Table 4** respectively. The condition criteria in **Table 4** represents the minimum level for patches to be included in the listed TEC.

Vegetation within the subject patch conforms to only some of the diagnostic characteristics provided in the Listing Advice (refer to **Table 3**) and does not meet the condition criteria listed in **Table 4** of the Listing Advice which represents the minimum requirements for patches to be included in the listed ecological community. Therefore the site and adjacent vegetation does not comprise the EPBC Act listed Littoral Rainforest TEC.

Table 3 TSSC Littoral Rainforest and Vine Thickets of Eastern Australia Key Diagnostic Characteristics Assessment

Key Diagnostic Characteristics (TSSC 2011)	Criteria Satisfied?
The ecological community occurs in the following IBRA bioregions: Cape York Peninsula, Wet Tropics, Central Mackay Coast, South Eastern Queensland, NSW North Coast, Sydney Basin and South East Corner.	Yes – The site is located within the IBRA South Eastern Queensland bioregion.
Patches of the ecological community occur within two kilometres of the east coast, including offshore islands, or adjacent to a large body of salt water, such as an estuary where they are subject to maritime influence.	Yes – The site occurs within two kilometres of the east coast.
The structure of the ecological community typically is a closed canopy of trees that can be interspersed with canopy gaps that are common in exposed situations or with storm events. Usually several vegetation strata may merge into a height continuum rather than occurring as distinct vegetation layers. The canopy forms a mosaic due to canopy regeneration, typically in the form of basal coppice following canopy decapitation due to prevailing salt laden winds and storm events. Wind sheared canopy can be present on the frontal section leading to closed secondary canopies. Emergents may be present, for example, species from the genera <i>Araucaria</i> (northern bioregions only), <i>Banksia</i> or <i>Eucalyptus</i> . The ground stratum of the vegetation typically is very sparse.	Only some criteria are met for PCT 1064 – the structure of the PCT 1064 Paperbark swamp forest mapped vegetation is closed in some areas. The southern patch and southern limit of the northern patch has a ground stratum that is locally sparse. The ground stratum of the northern patch becomes dense north of the site. The community is dominated by sclerophyll species and no obvious signs of wind shear was observed during the site inspection on 8 May 2020. No for PCT 1536 - The structure of the PCT 1536 Tuckeroo - Lilly Pilly - Coast Banksia littoral rainforest mapped vegetation is typically open with a dense ground stratum. The community is dominated by sclerophyll species and no obvious signs of wind shear was observed during the site inspection.
The ecological community contains a range of plant life forms including trees, shrubs, vines, herbs and epiphytes. To the north, most plant species diversity is in the tree and shrub (i.e. canopy) layers rather than in the lower strata. The converse generally occurs from the Sydney Basin Bioregion southwards. Feather palms, fan palms, large leaved vascular epiphytes and species that exhibit buttressing are generally rare. Ground ferns and vascular epiphytes are lower in diversity in littoral rainforest compared to most rainforest types.	Only some criteria are met – the subject vegetation includes a range of plant life forms including trees, shrubs, and herbs, however floristic diversity is low. Sclerophyll species (Coast Banksia and Broad-leaved Paperbark) are dominant. Vines are infrequent. Ground ferns and vascular epiphytes are generally sparse.
Plants with xeromorphic and succulent features are generally more common in littoral rainforest than in hinterland rainforest types. Canopy stem sizes also tend to be smaller compared to that in hinterland rainforest. Trunks rarely host mosses though lichens are usually common.	No - plants with xeromorphic and succulent features are uncommon. Canopy stem sizes are generally uniform. Mosses and lichens are rare.

Key Diagnostic Characteristics (TSSC 2011)	Criteria Satisfied?
Whilst species can be regionally predictable, there may be considerable variation in the composition of individual stands of the ecological community within any given bioregion. Attachment A provides a list of flora species for each relevant bioregion.	<p>The site contains 10 characteristic flora species listed for the Southern South Eastern Queensland and NSW North Coast region, plus five other rainforest species</p> <p>Key constituent species of Littoral Rainforest TEC locally such as Tuckeroo, Guioa, Three-veined Laurel and Beach Alectryon are either absent or occur uncommonly.</p>

Table 4 TSSC (2011) Littoral Rainforest and Vine Thickets of Eastern Australia Condition Thresholds

Criteria	Threshold Satisfied?
Small patches can be resilient and viable, but the minimum size of a patch needs to be 0.1 ha; AND	No – no patches a minimum of 0.1 ha in size characteristic of Littoral Rainforest TEC are present at or adjacent to the site.
The cover of transformer weed species (as identified in Attachment A) is 70% or less. Transformer weeds are highly invasive taxa with the potential to seriously alter the structure and function of the ecological community. This threshold recognises the relative resilience and recoverability of the ecological community to invasion by weed species; AND	Yes – transformer weeds at the site have less than 70% cover.
The patch must have:	
At least 25% of the native plant species diversity characteristic of this ecological community in that bioregion (Attachment A).	No - the subject patch contains 10 characteristic flora species listed for the Southern South Eastern Queensland and NSW North Coast region, plus five other rainforest species. This represents <25% of the native plant species diversity characteristic of littoral rainforest in the bioregion.
OR	
At least 30% canopy cover of one rainforest canopy (either tree or shrub) characteristic species (Attachment A), excluding Banksia and Eucalyptus species that may be part of the ecological community).	No – the canopy cover of all individual rainforest species (determined from canopy tree or subcanopy tree cover scores listed in Appendix B of SMEC 2019b) is <30%.

8. Conclusion

This Addendum REF has found:

- The Activity is not likely to result in a significant impact on the MRS based on assessment under the BC Act.
- The Activity is not likely to result in a significant impact on the MRS based on assessment under the EPBC Act *Matters of National Environmental Significance - Significant Impact Guidelines 1.1* (DoFE 2013). Therefore referral to the Australian Government Department of Agriculture, Water and the Environment is not required.
- The site and adjacent vegetation does not comprise the EPBC Act listed Littoral Rainforest and Coastal Vine Thickets of Eastern Australia TEC.

Environmental control measures detailed in the approved REF remain valid and would be undertaken as part of the revised Activity. The conclusions of the approved REF (SMEC 2019a) remain valid; that is, the environmental impacts of the Activity are not likely to be significant.

Please contact me on 02 6687 7666 or dandrighetto@geolink.net.au if you would like to discuss these results further.

Yours sincerely
GeoLINK



David Andrighetto
Senior Ecologist

UPR	Description	Date issued	Issued By
3351-1044	First issue	30/04/2020	David Andrighetto
3351-1049	Second issue	11/05/2020	David Andrighetto
3351-1050	Third issue	12/05/2020	David Andrighetto

Determining officer (Public Authority)–who Verifies this REF

"I declare that:

- This project determination modifies the original project determination within the *Review of Environmental Factors: Rural and Regional Interchange, Byron Bay Bus Interchange* dated 17 May 2019.
- The original project determination requires modification because of unexpected threatened species finds and revisions to the Activity designs.
- Having considered the scope of the project, the impacts and controls identified in the following REFs:
 - Review of Environmental Factors: Rural and Regional Interchange, Byron Bay Bus Interchange (SMEC 2019a).
 - *Byron Bay Interchange – Addendum Review of Environmental Factors* (this document, GeoLINK 2020).

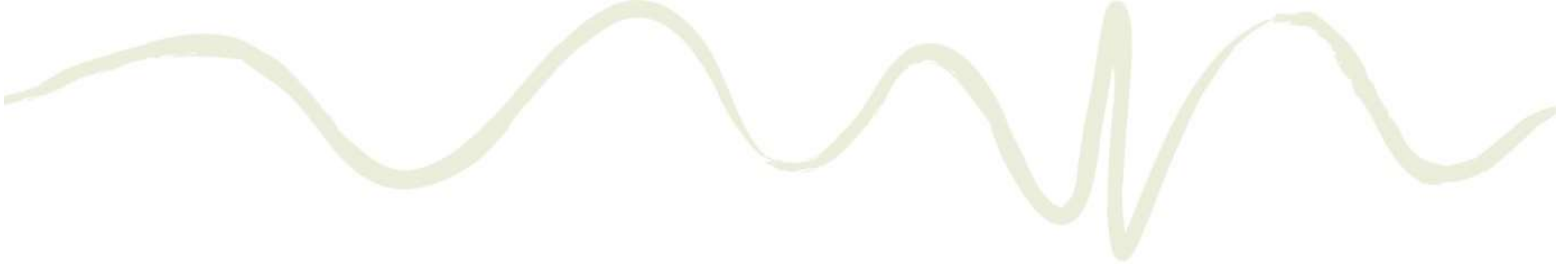
I approve the undertaking of the project as described by the REFs with the following conditions:

- This project determination will remain current for _____ until _____ at which time it shall lapse if works have not been physically commenced.
- I have complied with the EMS-09-WI-0124 Part 5 Review of Environmental Factors Process."

Signature:	David Cleary	Date:	28/05/20
Name (print):	David Cleary		
Position:	Environment Manager CSD, OPs & FND		
Agency:	Sydney Trains		

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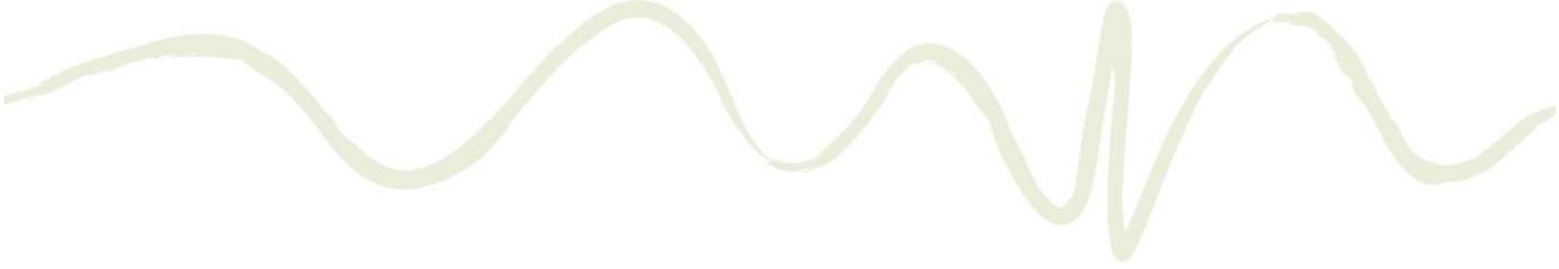
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Appendix A

Byron Bay Interchange - MRS Habitat Clearing Protocol



Foreword: The objective of this Mitchell's Rainforest Snail (MRS) habitat clearing protocol is to provide a framework for the detection, capture and relocation of MRS throughout the project prior to clearing and grubbing works in MRS habitat. The protocol is not a translocation strategy. It focuses on maintaining the welfare of any MRSs at the Byron Bay interchange site at the time of clearing through capture and relocation into adjacent known habitat.

This protocol is largely based on the protocol developed and implemented for the Byron Bay bypass project; where a total of 163 MRS individuals were captured and relocated (GeoLINK 2020a; 2020b). Parkyn (2014) *Studies on the ecology of the endangered camaenid land snail Thersites mitchellae* (Cox, 1864) was also reviewed to inform the survey methodology and suitability of relocation sites. On the basis of this review, it is likely that relocated snails would remain viable members of the local MRS population (and therefore be successfully relocated), given:

- The species displays nomadic behaviour and the ability to travel relatively large distances at night (>30m over 18 days; Parkyn 2014).
- Radio-tracking (18 nights) and capture-mark-recapture (> 60 days) studies by Parkyn (2014) did not record any adverse impacts to captured snails. One radio tracked snail was recorded breeding (laying eggs) during the radio tracking period.
- The proposed relocation areas:
 - Comprise known habitat that is contiguous with larger (>1 ha) of potential habitat
 - Contain preferred foraging and retreat site substrate.

It is worth noting that the Australian Government Department of the Environment and Energy (DoEE) has endorsed conservation translocation of another endangered land snail species (Boggomoss Snail *Adclarkia dawsonensis*) as a recovery action under an approved recovery plan (QDEHP 2017).

Land to which the protocol applies is shown in **Illustration A1** and comprises the swamp sclerophyll forest in the southern end of the site.



Byron Bay Interchange:

Mitchell's Rainforest Snail (MRS) Habitat Clearing Protocol

1. Site Induction

All construction personnel would be subject to a MRS induction that includes:

- A general description of the MRS (including photos and key identification features)
- Locations of MRS habitat on the project site (refer to **Illustration A1**)
- Provisions of this protocol.

This is in addition to the project Construction Environmental Management Plan (CEMP) induction which discusses standard project environmental provisions. Records of induction/toolbox training would be recorded.

2. Clearing Limit Delineation

No-go fencing (e.g. star picket and bunting flagging) and signage would be established along the works clearing limit prior to commencement of clearing. No works or plant access outside the clearing limits are permitted.

A qualified and experienced ecologist would be present during fence installation to undertake active searches for MRS along the fence alignment to ensure no MRS are impacted during fence installation. Any snails found would be captured and relocated into adjacent habitat in accordance with **Section 5**.

3. Pre-clearing Surveys and Phased MRS Microhabitat Reduction

Pre-clearing MRS surveys including phased MRS microhabitat reduction would be undertaken by at least two qualified and experienced ecologists on the two days and nights immediately prior to commencing clearing. Optimal nocturnal survey conditions are considered:

- >70 % relative humidity
- >14°C
- A moist ground layer.

An additional nocturnal survey would be undertaken during the week leading up to clearing should optimal survey conditions not be forecast during at least one of the two nights immediately prior to clearing (i.e. if optimal nocturnal survey conditions are forecast during at least one of the two required survey nights, a third nocturnal survey would not be required). If required, the additional nocturnal survey would occur on the night with the highest forecast humidity that week.



Pre-clearing surveys would include:

- **Diurnal searches for MRS at retreat (i.e. shelter) sites.** Active searches for MRS would occur across the area of potential habitat. Particular attention would be made to preferred retreat sites as identified in Parkyn (2014), that is: sedge (*Gahnia clarkei*) stems (or other species that provide a similar microclimate), dead palm fronds and coarse woody debris. Other potential shelter habitats would also be targeted including leaf litter, peeling bark vegetation and cavities at the base of trees; leaf litter and groundcover vegetation.
- **Diurnal phased MRS microhabitat reduction.** In association with diurnal searches for MRS, this would involve:
 - Removal of palm fronds and coarse wood debris (where it can be removed) into adjacent habitat outside the clearing limits
 - Removal of groundcover and leaf litter around the base of trees and large coarse wood debris
 - Removal of sedges.

The removed microhabitat features may be consolidated into cleared areas in the centre of the clearing limits (i.e. away from retained adjacent vegetation). Hand tools and assistance from labourers would be permitted to assist with the habitat removal.

The objectives of the phased MRS microhabitat reduction includes:

- Habitat salvage and relocation
- Reduce the habitat quality of the site for the MRS (particularly the retreat site habitat value)
- Improve visibility and potential MRS detection during nocturnal surveys.

Any day that microhabitat reduction is undertaken must be followed by a nocturnal survey.

- **Nocturnal MRS surveys.** Nocturnal MRS surveys would be undertaken by at least two ecologists to search for emerged MRS. The surveys would commence at dusk and continue for at least 4hrs, ensuring that the impact footprint is surveyed adequately.

4. Clearing and Grubbing Phase MRS Surveys

Each day of clearing and grubbing would include the following MRS surveys:

- Final diurnal MRS searches prior to commencing clearing. The duration of the surveys would depend on the extent of habitat being removed at that time.
- Intermittent searches during clearing, including:
 - The base of all felled trees
 - The ground stratum layer post clearing/disturbance (prior to grubbing or similar earthworks).
- A nocturnal survey each evening post clearing targeting the area cleared if all potential habitat is not cleared and grubbed.

Should clearing not occur on sequential days (e.g. due to the weekend) a nocturnal survey must be undertaken on the night prior to clearing re-commencing. Depending on the extent of clearing remaining, continuous or intermittent nocturnal surveys would be undertaken until at least 4hrs after last light.

The need for additional clearing and grubbing phase surveys would be determined by the project ecologist.

5. MRS Relocation

All MRS handling and relocation must be undertaken by ecologists licenced under Part 2 *Division 3 Biodiversity conservation licences* of NSW *Biodiversity Conservation Act 2016* (BC Act).

Any MRS found within the works clearing limit would be relocated into adjacent contiguous swamp sclerophyll forest habitat (similar to where it was found) on public land (refer to **Illustration A1**). The specific relocation site would be at least 20 m from the clearing limits. The upcoming clearing schedule and project site condition would be considered by the ecologist when determining the relocation distance/location. Any shelter habitat of relevance may also be relocated (e.g. palm fronds). Microhabitat site selection for MRS placement would include coarse woody debris (a preferred foraging resource) and preferred shelter/retreat site resources (i.e. *Gahnia clarkei* or palm fronds; Parkyn 2014), with each snail placed in a protected location with low risk of predation.

6. Detection During Construction Phase

Should any potential MRS be detected by construction personnel at any time during construction:

- Works within the vicinity of the snail would stop
- A temporary exclusion zone would be established
- The project ecologist would be notified to undertake identification, capture and relocation of the snail.

7. Reporting

All MRS surveys, and capture and relocations would be documented in the register provided in **Attachment A**. At completion of clearing, the results would be documented in a post clearing report summarising:

- MRS survey effort and results
- A discussion on the overall effectiveness of the protocol.



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LEGEND

- Byron Bay bypass clearing limit
- Directly impacted MRS habitat
- Potential MRS relocation habitat

GDA 1994 MGA Zone 56



MRS Habitat and Relocation Area - Illustration A1



Byron Bay Interchange - Addendum REF
3351-1047

Information shown is for illustrative purposes only
 Drawn by: DSA Checked by: AB Reviewed by: DSA
 Source of base data: DFSI
 Date: 30/04/2020



Attachment A MRS Register

