

Coomera Connector Stage One (1): Public Environmental Report

Queensland Department of Transport and Main Roads

Appendix Eight: Highest astronomical tide survey (FRC 2021)

Our Reference: 210609L

RE: Position of HAT in Road Corridor: Coombabah

Sections of the proposed road corridor for the Coomera Connector are in the vicinity of the Moreton Bay Marine Park, and specifically Marine National Park Zone, MNP34. The boundary of the Marine Park in this area is defined by the limit of tidal inundation on the highest astronomical tide (HAT). The boundary is ambulatory and varies as HAT varies.

HAT is defined as the highest level which can be predicted to occur under average meteorological conditions and any combination of astronomical conditions. In Australia HAT is calculated as the highest level from tide predictions over the tidal datum epoch, this is currently set to 1992 to 2011 (MSQ 2020¹). HAT is not reached every year.

The area is difficult to access, and consequently there is little survey data. Maps available on Qspatial, and more recent Lidar mapping indicate that HAT may be generally further to the east than indicated by the existing mapped boundary of the Marine Park (Map 1).

A meeting was held on 10 June 2021, with representatives from DTMR and DES (Table 1), to determine a method to establish HAT. It was suggested that field surveys of vegetation, supported by interpretation of aerial photos, available tidal data, and the assessment of tidal inundation on a tide close to HAT, would be an acceptable way forward

¹ Maritime Safety Queensland 2020 Notes and definitions. Queensland Government last updated 11 August 2020. <https://www.msg.qld.gov.au/Tides/Notes-and-definitions>. Accessed 06 September 2021.

Table 1 Attendees at HAT Investigation Meeting 10 June 2021

Person	Department / Company ¹	Section
Deborah Glassop	DTMR	South Coast Hinterland District
Julienne Blake	DES	Wetlands Unit Environmental Policy and Programs
Kurt Derbyshire	DES	Marine Protected Area Policy Protected Area Strategy and Policy
Ralph Dowling	DES	Queensland Herbarium
Arnon Accad	DES	Queensland Herbarium
Mike Ronan	DES	Wetlands Unit Environmental Policy and Programs
Darryl Metters	DES	Hydraulics Laboratory, Science Division
Steve Hoseck	DES, QPWS	Southern Marine Parks
Andrew Makinson	DTMR	Principal Environmental Officer
Amee Dodhia	DTMR	South Coast Hinterland District
Malcolm Tilgner	DTMR	South Coast Hinterland District
Carol Conacher	frc environmental	

¹DES Department of Environment and Science
DTMR Department of Transport and Main Roads

DTMR identified four areas of concern (Investigation Areas, Map 2):

- the area immediately south of Helensvale Road
- the proposed road corridor to the east of the existing rail corridor, from Helensvale Road to Whyalla Court
- the proposed road corridor to the east of the existing rail corridor, and south of Urangan Court, and
- a small area to the north-east of the Gold Coast Highway.

For each of the four areas of concern frc environmental:

- assessed vegetation using aerial images and previous mapping
- assessed tidal inundation on a tide close to HAT
- assessed vegetation in the field and staked the likely limit of inundation by HAT, and
- liaised with surveyors from DTMR, who established accurate position of the stakes.

From this information, and liaison with key staff from the Department of Environment and Science (DES), we then developed maps for each area, identifying the likely limit of inundation by HAT.

1. Observation of Tidal Inundation on a Tide Close to HAT

The Queensland Government Hydraulics Laboratory (QGHL) have 8 tide gauges in Coombabah Lake (Map 1), and another 1 at the entrance to Coombabah Creek. Three of these gauges are 'lite tide gauges' that transmit data in near to real time. Data from two lite tide gauges: Lake Coombabah north and Lake Coombabah south, were used in this exercise.

The other gauges are submerged pressure transducers that need to be retrieved for data to be downloaded. Data from the pressure gauges will not be retrieved until late September 2021, and consequently was not used in this exercise.

The official (and published) HAT levels for Queensland Standard Ports are likely to be updated in 2022 to align with a new Tidal Datum Epoch (2010-2029). QGHL provided estimates of the current and new HAT levels for Coombabah Lake north and Coombabah Lake south (Table 2), noting the new estimates may change once analysis is completed.

Table 2 Tidal height calculations¹ for highest tide on 27 June 2021 for Coombabah Lake north and south

Site	Current HAT	Approximate New HAT ²	Predicted Height	Actual Height	Height Below Current HAT	Height Below New HAT
Coombabah North	0.89	1.02	0.932	0.864	0.026	0.156
Coombabah South	0.89	0.98	0.816	0.855	0.035	0.125

¹ metres above LAT

² QGHL unofficial approximation based on predictions for 2010-2029 tidal datum epoch, that may change once data analysis is completed.

Predicted tide height data for Coombabah Lake north and Coombabah Lake south gauges was used to estimate the highest tides in June 2021, with highest tides around 00:05 on 26 June and 00:45 on 27 June 2021. The actual height of tidal inundation at Coombabah Lake north and south was combined with the current and new HAT predictions to calculate how far below HAT the high tide was on 27 June (Table 2).

Following the methods presented in Field 2013² and Queensland Surveyors 2004³, the extent of tidal inundation was staked at four sites near Whyalla Court and seven sites south of Helensvale Road (Map 2). The extent of inundation was staked during daylight, at, or close to, low tide on 26 June 2021 (16:00 to 17:30; Figure 1). At each site, the maximum extent of inundation was at the landward edge of the mangrove forest at this time. We returned to the staked sites before the predicted high tide and observed inundation until 1.5 hours after the predicted high tide. The maximum extent of inundation at each site at high tide was re-staked (Figure 2).



Figure 1 The maximum extent of inundation was staked at low tide.

² Field C. 2013. Local management and rehabilitation of mangroves: present and future. In: Workbook for managing urban wetlands in Australia. Ed: Paul, S. Sydney Olympic Park Authority.

³ Queensland Surveyors 2004. Operations manual: Technical Information 1.0 High Water Mark.



Figure 2 The maximum extent of inundation was re-staked at high tide.

At the sites near Whyalla Court, there was no tidal movement between low and high tide. Water appears to be ponded here, permanently inundating the mangroves. At the sites south of Helensvale Road there was less than 0.5 cm difference in inundation between low and high tide, again indicating ponding of the water.

Adhoc measurements of salinity at these sites indicated that salinity was also low: 3 PSU at the sites near Whyalla Court, and less than 1 PSU at the tidal inundation observation sites south of Helensvale Road. Seawater is approximately 35 PSU, and freshwater wetlands are less than 5 PSU (DERM 2011⁴).

⁴ Department of Environment and Resource Management (2011) Queensland Wetland Definition and Delineation Guideline, Queensland Government, Brisbane.

2 Vegetation Surveys

Methods

Preliminary estimates of tidal inundation were made from aerial images, and previous estimates of HAT (Lidar and Qspatial; Map 1). Vegetation was then surveyed in the field noting that:

- propagules of the dominant mangrove *Avicennia marina*, the grey mangrove are:
 - recalcitrant and do not have a dormant phase
 - float on, and are dispersed by water
 - are unlikely to be dispersed by fauna
- the grey mangrove has many physical and physiological adaptations to withstand growing in salt water, but also grows in freshwater
- the blind your eye mangrove (*Excoecaria agallocha*) commonly grows in areas that are not tidally inundated, and requires some freshwater input
- propagules (spores) of the mangrove fern *Acrostichum speciosum* are dispersed in the air
- the mangrove fern commonly grows in freshwater
- *Casuarina glauca*, the swamp she-oak can tolerate saline water of up to approximately 10 PSU, and
- the understory of swamp she-oak can be indicative of saline inundation if it dominated by plants such as marine couch (*Sporobolus virginicus*), and
- where the understory of swamp she-oak is dominated by weeds and species intolerant of saline inundation, it is unlikely to be inundated by brackish tidal water.

Flagged bamboo stakes were placed to mark the edge of vegetation communities that were likely to indicate the limit of tidal inundation by HAT. Surveyors tape was also placed on nearby trees to assist in finding the bamboo stakes. At each point the dominant vegetation was recorded and site conditions described. Ad hoc salinity measurement were also taken to aid in interpretation of tidal inundation.

The position of each stake was marked with a hand held GPS (Map 2), and then surveyed by surveyors from DTMR. DTMR surveyors used a Trimble R12 Global Navigation Satellite System (GNSS) equipment using Network Real Time Kinematic (NRTK) position corrections. Due to extensive tree cover, this often entailed positioning the GNSS antenna on a long pole to get it above the trees.

The tidal observation and vegetation survey data was combined with interpretation of aerial images and previous estimates of HAT to estimate the current extent of inundation by HAT.

South of Helensvale Road

The likely limit of inundation by HAT south of Helensvale Road is shown on Map 3.

The road verge to the south of Helensvale Road is fenced, and there is a relatively steep bank coming up to the fence (Figure 3). In places saltmarsh plants grow up to and on these banks. The likely extent of HAT inundation was marked along the upper edge of the saltmarsh (Figure 4). In places the saltmarsh was higher than the staked inundation (Figure 5).

To the west, swamp she-oak dominated the vegetation near Helensvale Road, with mangroves dominating further towards the lake. In this area there were many ponded areas, with water up to approximately 0.75 m deep. Ponded areas closer to the rail corridor and Helensvale Road had a salinity of < approximately 1 PSU, while those closer to the Lake had salinities over 2 PSU.

The freshwater ponded areas were surrounded by swamp she-oak with mangrove fern in the understory, and dense floating mats of the freshwater aquatic weeds, such as *Salvinia molesta* (Figure 6 and Figure 7). In these areas there were also some sparse scattered grey mangrove trees. It was considered unlikely that these freshwater areas were inundated by HAT. Discussions with staff from the Queensland Herbarium indicated that grey mangrove propagules can be driven by the wind and disperse into freshwater areas that are connected to tidally inundated areas.

Ponded areas with higher salinities were surrounded by grey mangrove trees, with mangrove fern in the understory.

The likely HAT position was staked at the interface between ponds dominated by swamp she-oak with < 5% cover of grey mangroves, and those with more than 5% cover of grey mangroves.



Figure 3 Fence to the south of Helensvale Road.



Figure 4 The upper edge of saltmarsh plants was used to indicate the likely extent of inundation by HAT.



Figure 5 Flagged bamboo stakes showing extent of inundation, with saltmarsh to landward.



Figure 6 Poned areas, surrounded by swamp she-oak and mangrove fern, with sparse grey mangroves.



Figure 7 The freshwater floating weed *Salvinia molesta* was often very dense in the ponded areas.

East of the Existing Rail Corridor from Helensvale Road to Whyalla Court

The likely limit of inundation by HAT east of the existing rail corridor from Helensvale Rd to Whyalla Court is shown on Map 3.

The northern section of this Investigation Area is contiguous with the Investigation Area south of Helensvale Road, and has a similar pattern of ponded areas. Closer to the Rail Corridor the ponded areas are surrounded by swamp she-oak, +/- a dense understory of mangrove fern, while towards the Lake the ponds are surrounded by grey mangroves. The likely HAT position was staked at the interface between ponds dominated by swamp she-oak with < 5% cover of grey mangroves, and those with more than 5% cover of grey mangroves.

Further to the south there were fewer freshwater ponds. The likely extent of inundation by HAT was marked as:

- the juncture between swamp she-oak with an understory dominated by salt tolerant plants such as marine couch (*Sporobolus virginicus*), and swamp she-oak with an understory dominated by plants that are not salt tolerant (Figure 8), or
- above the upper extent of pneumatophores of the grey mangrove (Figure 9 and Figure 10).



Figure 8 The likely extent of HAT marked at the boundary between salt tolerant and not salt tolerant vegetation in the understory of the swamp she-oak forest.



Figure 9 The likely extent of HAT marked above the upper extent of pneumatophores of the grey mangrove.



Figure 10 The likely extent of HAT marked above the upper extent of pneumatophores of the grey mangrove.

East of the Existing Rail Corridor, and South of Urangan Court

The likely limit of inundation by HAT east of the existing rail corridor, and south of Urangan Court is to the east of the proposed road corridor (Map 4), and consequently this area is not in Moreton Bay Marine Park. Vegetation along the eastern boundary of the proposed road corridor is not tolerant of tidal inundation by saline water (Figure 11).



Figure 11 Vegetation along the eastern boundary of the road corridor is not tidally inundated

North-east of the Gold Coast Highway

Aerial images indicate this area is dominated by a dense mangrove forest and is regularly tidally inundated, and consequently is within the Marine National Park Zone of Moreton Bay Marine Park (Map 5).

3 Conclusions

The two Investigation Areas east of the existing rail corridor are not within the Marine National Park Zone of Moreton Bay Marine.

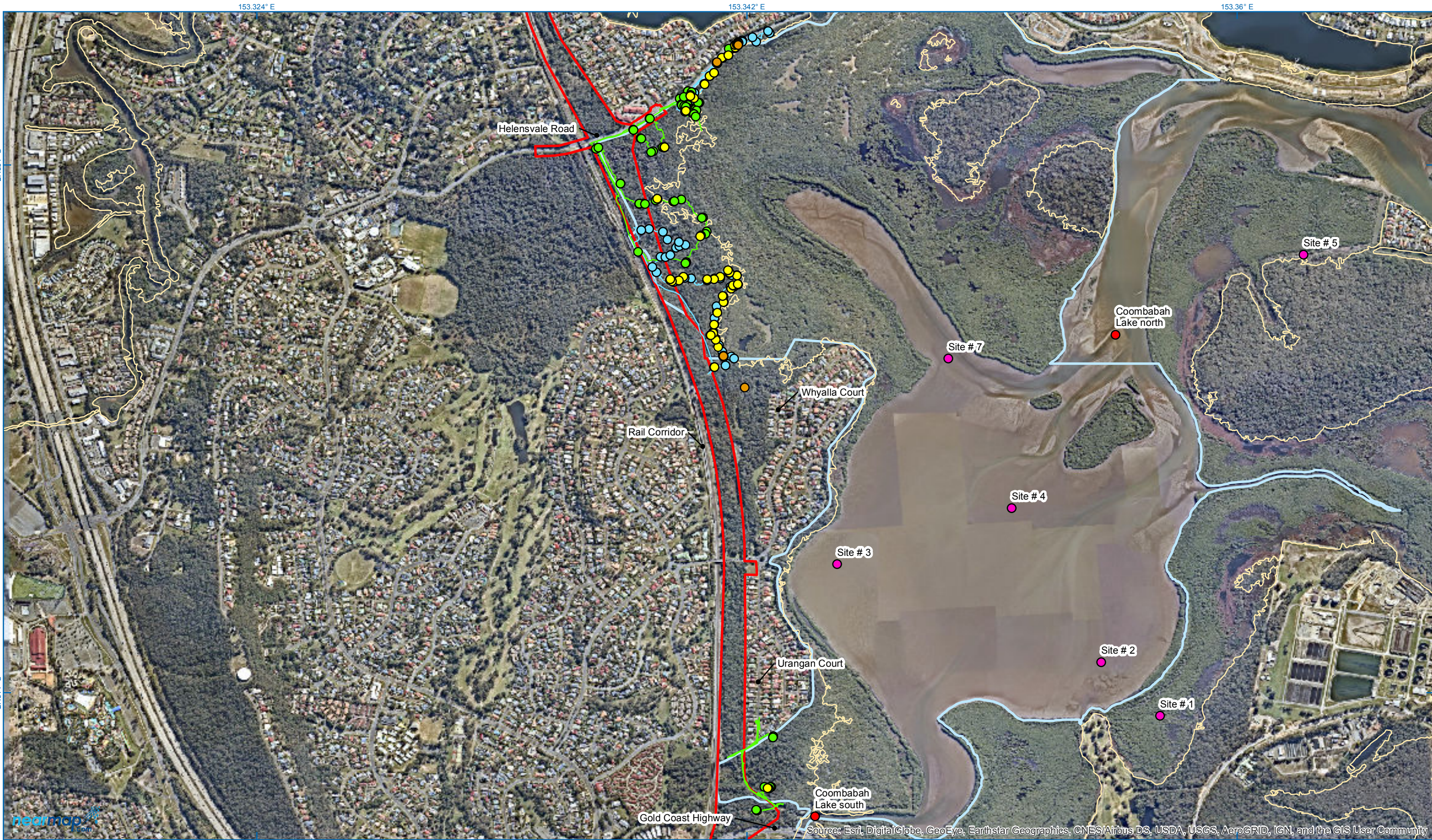
The Investigation Area south of Helensvale road is partially within the Marine National Park Zone of Moreton Bay Marine.

The Investigation Area north-east of the Gold Coast Highway is wholly within the Marine National Park Zone of Moreton Bay Marine.

Yours sincerely

Carol Conacher
on behalf of frc environmental

Maps



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



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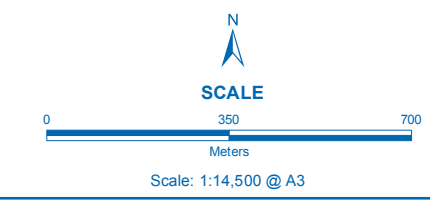
Coombabah HAT Mapping

Map 2: Waypoints, tracks and QGHL tidal monitoring sites

SOURCES
 © State of Queensland (Department of Resources) 2021
 © Queensland Government (Department of Transport and Main Roads) 2021
 © Queensland Government (Department of Environment and Science) 2013

LEGEND

- HAT QSpatial
- Proposed Road Corridor
- Previously mapped MNPZ Boundary
- QGHL Tidal Monitoring Sites**
- Lite Tide Gauge
- Pressure Transducer
- Track 2021/07/06
- Track 2021/08/06
- 6/07/2021
- 6/08/2021
- Tidal observation points
- DTMR surveyed position

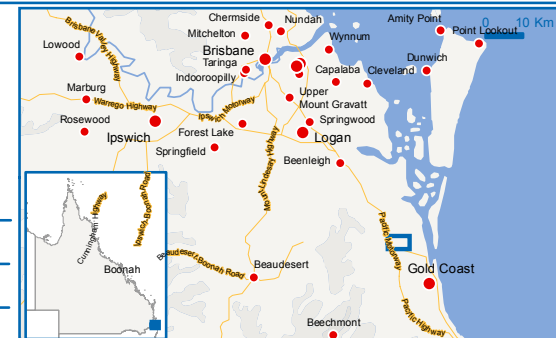


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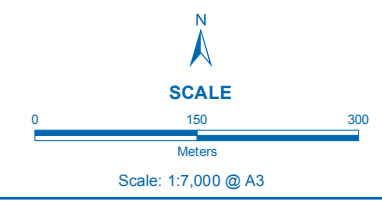
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Coombah HAT Mapping

Map 3: Estimated limit of inundation by HAT, south of Helensvale Rd

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 © Queensland Government (Department of Transport and Main Roads) 2021
 © Queensland Government (Department of Environment and Science) 2013

- LEGEND**
- Estimated HAT
 - HAT QSpatial
 - Proposed Road Corridor
 - Previously mapped MNPZ Boundary
 - DTMR surveyed position

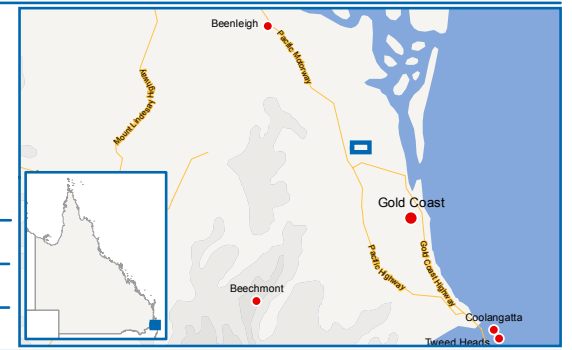


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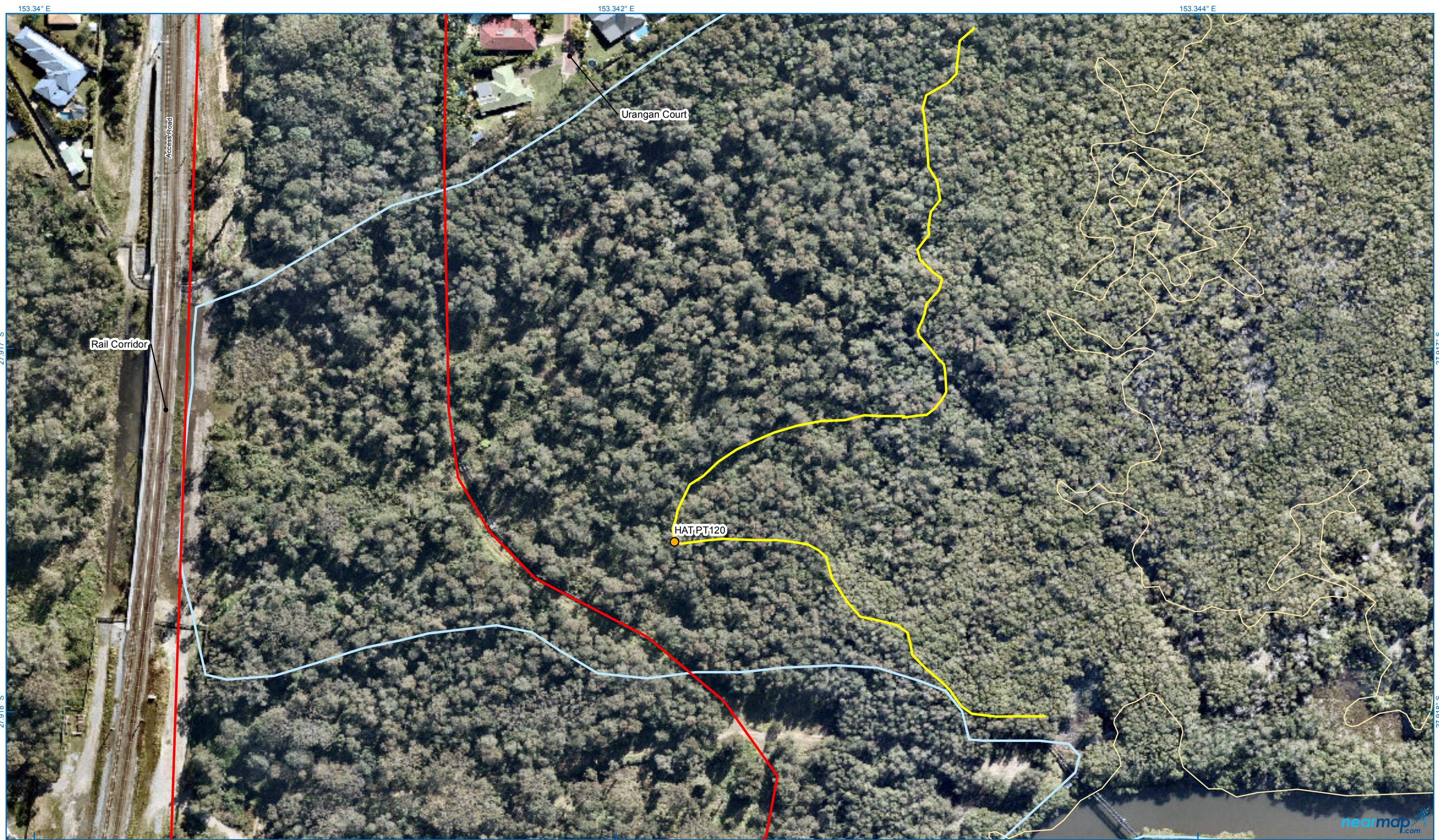
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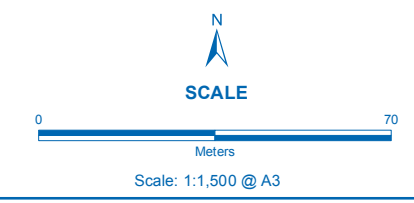
210609 Coombabah HAT Mapping

Map 4: Estimated limit of inundation by HAT, to the east of the rail corridor, and south of Urangan Court

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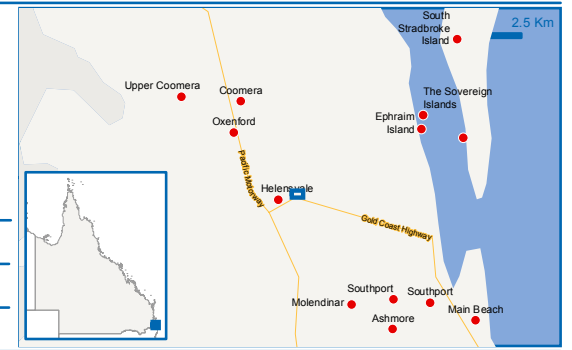
- LEGEND**
- Estimated HAT
 - HAT QSpatial
 - Proposed Road Corridor
 - Previously mapped MNPZ Boundary
 - DTMR surveyed position

- Road Network**
- Local Road
 - Rail Network



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210609 Coombabah HAT Mapping

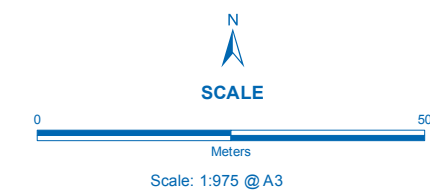
Map 5: Gold Coast Highway Investigation Area

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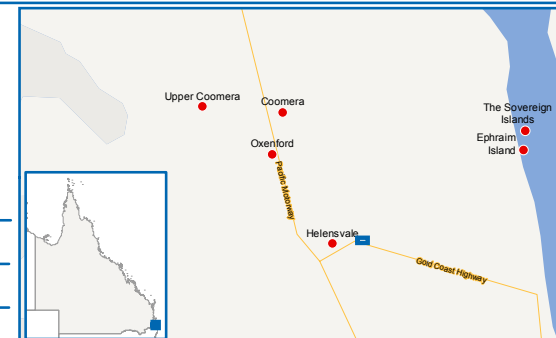
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-  Proposed Road Corridor
-  Investigation Area
-  Previously mapped MNPZ Boundary
-  Creek
-  Mangroves

-  Road Network
-  Highway



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Minutes

TMR / DES Coomera Connector meeting

Date	Thursday 30 th September 2021	Time	2-2.30pm
Place	MS Teams Meeting		
Chair	Deb Glassop		
Minute taker	Deb Glassop		

Attendees

Presence

Malcolm Tilgner - TMR	Present
Suman Joshi - TMR	Apologies
Deb Glassop - TMR	Present
Mat Davis - TMR	Present
Aaron Cassidy - TMR	Present
Anthony Lynden – TMR	Present
Kurt Derbyshire – DES	Present
Scott Mckinnon – DES	Present
Nicola Udy - DES	Present

Agenda item 1 Welcome and introductions.

All attendees introduced themselves and explained their respective roles.

Agenda item 2 FRC HAT remapping report – general discussion and way forward.

DG provided an outline of the HAT work FRC have recently completed and thanked KD for his prompt review of the draft report and confirmation that the Marine Park does not extend into the Coomera Connector corridor. Revocation or amendment of the Marine Park Boundary is therefore not required.

DG confirmed that TMR now proposes to formally send the report to DES with a cover letter to close out this matter and asked what the next steps would be after this occurs. KD explained that the only remaining task would be to amend the digital spatial mapping to reflect the revised HAT and MNP boundary.

Department of Transport and Main Roads

TMR / DES Coomera Connector meeting

- Minutes

MT asked what the expected timeframes might be to change the mapping. KD explained that there was an election commitment made to review the Marine Park Zoning Plan by the end of 2022, so the change to the mapping would likely take place in parallel with this review.

NU suggested that when TMR write formally to DES with the report, that the letter should include confirmation that Ralph Dowling from the Queensland Herbarium had also reviewed the report and was supportive of the revised HAT.

KD asked if TMR could provide their survey data to DES to assist with updating the Marine Park mapping. MT agreed to provide the data.

DG confirmed that she would also send of a copy of the report to the Coombabah Lake coordination group that DG and KD are current members of.

TMR	Send FRC HAT report to DES with formal cover letter. Letter to include commentary from Ralph Dowling at the Queensland Herbarium on his review of the report	30/9/21		
TMR	TMR to send HAT survey data to DES	30/9/21		
TMR (DG)	DG to send HAT report to the Coombabah Lake coordination group	30/9/21		

Agenda item 3 Coomera Connector / Coombabah FHA overlap - 904SP295987.

MT explained that the "kink" in the Coomera Connector corridor at this location had originally been as a result of sediment basins planned in this location. However, due to the impact on both the Ramsar wetland and the Coombabah FHA, these have now been relocated to an area outside of both protected areas.

KD noted that as this is a Management B FHA, there is scope for some permanent structures (such as culverts) to be approved if required.

Date of next meeting

N/A

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Queensland
Government

Our ref 450/03089
Enquiries Mathew Davis

Department of
Transport and Main Roads

27 October 2021

Ms Stacey Maddock Armstrong
Director, Protected Area Strategy and Policy
Department of Environment and Science
PO Box 15187
CITY EAST QLD 4002
Stacey.MaddockArmstrong@des.qld.gov.au

Dear Ms Maddock Armstrong

Re: Coomera Connector Marine Park Boundary at Coombabah Wetland

The Department of Transport and Main Roads (TMR) is progressing the design of the Coomera Connector (Stage 1) project, which intersects Careel Reserve, Helensvale. Current Marine Park mapping layers, specifically Moreton Bay Marine Park (MBMP) Marine National Park Zone, MNP34 intersect the Coomera Connector road corridor.

TMR engaged FRC Environmental (FRC) to undertake a site survey to determine the actual highest astronomical tide (HAT) boundary within Careel Reserve adjacent to the Coomera Connector corridor, and within the mapped Marine Park. The best method for determining HAT was established at a meeting between TMR, FRC, and the Department of Environment and Science (DES) on 10 June 2021 and was implemented by FRC in its field survey.

In FRC's report dated 20 September 2021 (Attachment 1), it reiterates the boundary of the MBMP is the area defined by the limit of tidal inundation at HAT, which is ambulatory and varies as HAT varies. FRC's report confirms the HAT boundary lies further to the east of current mapping layers and outside of the Coomera Connector road corridor. This new HAT boundary was agreed as the true MBMP boundary by representatives from DES at a subsequent meeting dated 30 September 2021 (Attachment 2). During this meeting, TMR agreed to forward the new mapped HAT boundaries to DES for updating MBMP boundary mapping, noting that DES was unlikely to complete this until the end of 2022. Notwithstanding this, the FRC surveyed HAT boundary is to be used as the true extent of the MBMP. Surveyed geospatial data, including mapped HAT boundaries, are provided for amending mapping layers accordingly (Attachment 3).

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Email CoomeraConnector@tmr.qld.gov.au
ABN 39 407 690 291

TMR understands that there is currently no obligation for Marine Parks Permits within this area with respect to the Coomera Connector project as the MBMP boundary lies outside the corridor and the matter has been resolved.

Your acknowledgment of the above by return letter by Friday 12 November 2021 would be appreciated.

I trust this information is of assistance.

Yours sincerely,

Paul Noonan
Regional Director, South Coast

Attachment 1 – FRC Position of HAT in Road Corridor: Coombabah report

Attachment 2 – Meeting minutes of 20 September 2021

Attachment 3 – Surveyed geospatial data

From: [Corro DES QPWS PASI](#)
To: [Mathew Z Davis](#)
Cc: [Kurt Derbyshire](#)
Subject: Letter to Paul Noonan from Stacey Maddock-Armstrong
Date: Wednesday, 10 November 2021 3:28:23 PM
Attachments: [image001.png](#)
[letter to Paul Noonan TMR Coombabah Lake HAT MBMP.pdf](#)
[image002.png](#)

Hello

Please see attached letter to Paul Noonan from Stacey Maddock-Armstrong.

Thank you

Dusty



Department of
Environment and Science

Our Ref: CTS 23444/21
Your Ref: 450/03089

9 November 2021

Mr Paul Noonan
Regional Director, South Coast
Department of Transport and Main Roads
PO Box 442
NERANG QLD 4211

Dear Mr Noonan

Thank you for your letter dated 27 October 2021 regarding the Coomera Connector and the boundary of the Moreton Bay Marine Park at Coombabah Lake wetlands.

I confirm that the Department of Environment and Science (DES) accepts the Highest Astronomical Tide (HAT) boundary surveyed by frc environmental and that this boundary constitutes the boundary of the marine park at this location. As shown by the mapping in the frc environmental report to the Department of Transport and Main Roads (TMR), the HAT/marine park boundary does not intersect with the Coomera Connector corridor. Therefore, there are no marine park approvals required for the works proposed to be conducted in the road corridor.

The spatial data provided for the HAT boundary provided by TMR will be used to update the spatial layer for the marine park boundary as part of the review of the marine park zoning plan, to be completed by the end of 2022.

Should your officers require any further information, they may contact Mr Kurt Derbyshire, Team Leader, Marine Protected Area Policy, Queensland Parks and Wildlife Service and Partnerships of the Department of Environment and Science on telephone (07) 3199 7630 or by email at kurt.derbyshire@des.qld.gov.au.

Yours sincerely

A handwritten signature in blue ink that reads "Stacey Maddock-Armstrong".

Stacey Maddock-Armstrong
Director, Protected Area Strategy and Policy