

Peel Island Research Project Activity Statement

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1.0	8 May 2019
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1.5	25 July 2022

Project Contact

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1. Environmental history of Moreton Bay coral reefs

Over previous centuries Moreton Bay hosted large expanses of vibrant coral reefs. These reefs have largely disappeared as a result of three processes:

- Prior to European colonisation of what is now south-east Queensland many of the reefs failed to keep pace with rising sea levels and hence were slowly buried.
- The remaining viable reefs were then decimated as a result of targeted limestone extraction to construct the newly established European colony during the late 19th and early 20th centuries.
- This mining and dredging activity has ceased. However, ongoing impacts of reduced water clarity and increased sedimentation as a result of both episodic and ongoing resuspension of fine sediments deposited in the Bay from agricultural and urbanised catchment runoff has led to the demise of all but two main reefs in the system.

A report by the Queensland Museum (Wallace *et al.* 2009) identifies that the few remaining coral reefs in Moreton Bay are regarded as being close to environmental extinction.

The very small number of remaining reefs are located in places of high current flow or are exposed to the vigorous 'Moreton Bay Chop'. This means that these reefs are generally inaccessible for underwater viewing and hence their amenity value is severely constrained. Whilst this has benefits from a conservation perspective, non-extractive users are presently unable to experience and enjoy coral reefs in Moreton Bay.

2. Peel Island

Peel Island (Figure. 1) is an iconic place in Moreton Bay. Steeped in both indigenous and European colonisation history (including the host location for the lazarette – Leper Colony), Peel Island is now heavily used for recreational fishing (especially the western side), and the South-western side, known as Horseshoe Bay, is the premier anchorage for recreational vessels as a result of its shelter from the summer north-easterly sea breezes.

Surveys of the southern end of Horseshoe Bay undertaken by Reef Check Australia (RCA) reveal remnant corals skeletons and rubble beds, and sparse surviving coral colonies (see associated video file). This demonstrates that this location once hosted thriving corals reef community – as also identified by Slack-Smith (1959).

The demise of coral reefs, individuated through levels of coral cover, along the Queensland coast has been well documented (Wallace *et al.* 2009). It is also well-understood that this demise over the last century has primarily been a consequence of the increasing inputs of fine sediment runoff from catchments. It is also well recognised that the inputs of fine sediments into Moreton Bay have substantially increased since European colonisation, and large flood events over the recent decade have exacerbated this hazard.

In the case of Peel Island, the flood plume from the Logan River flow northwards past Peel Island (Douglas *et al.*, 2003) and represents an almost continuous supply of suspended fine sediments. In areas that have less flow, such as in the proposed location for this research project, these fine sediments can fall out of the water-column which act to smother benthic organisms such as coral colonies.

Logic therefore dictates that under these new environmental/water quality conditions, coral colonies can only survive and prosper if they are slightly elevated in the water-column so that they can receive more light; and are less vulnerable to smothering from fine sediments. The key research question then becomes, at what depth range will corals now prosper given the new environmental conditions?

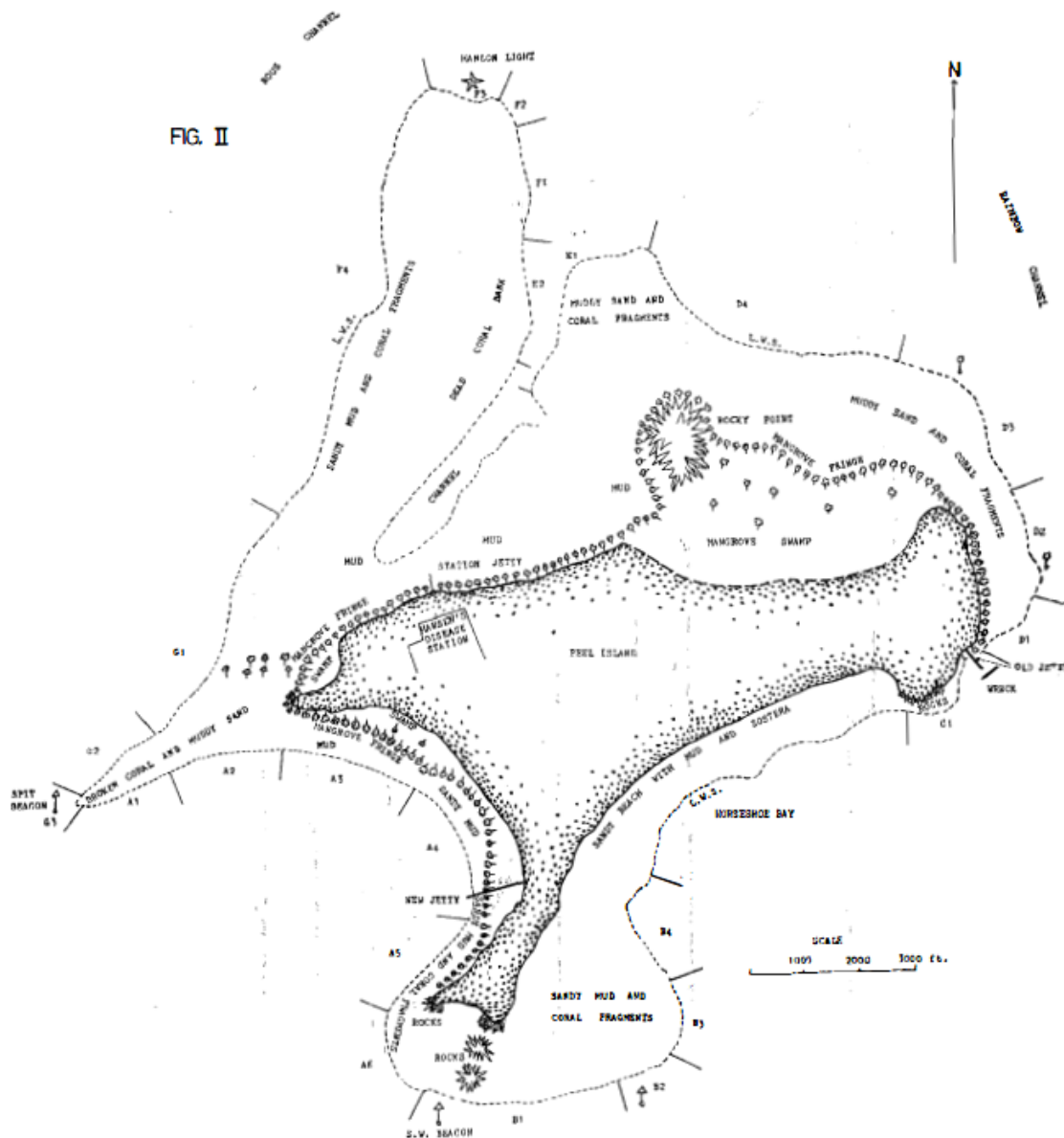


Figure 1. Peel Island. Image sourced from Slack-Smith (1959)

3. Project Purpose

In past decades a viable reef existed at the western end of Horseshoe Bay (Figures 1, 3). Horseshoe Bay is the premier anchorage in Moreton Bay and on a typical summer weekend over one hundred private vessels can be at anchor. The site is renowned as a prime anchorage location featuring a glorious sandy beach, sea grass meadows and an attractive vegetated and un-urbanised island.

Restoring the reef on the western side of Horseshoe Bay will re-create the coral reef habitat that will lead to demonstrable ecological and amenity values. However, what is not clear is whether corals will be able to survive at this site in the current water quality regime that features reduced light penetration and increased suspended sediment loads.

The overall **purpose** of this research project is therefore to ascertain whether this site can now support corals, and, at what depth range can corals now survive at.

4. Key project outcomes

This project would be considered successful if:

- Evidence that the chosen site will be suitable for restoration activities is generated. In particular, knowledge of the depth range that transplanted coral fragments survive and thrive is determined.
- Local personnel are trained in research reef restoration techniques, including installation, demobilisation and monitoring of transplanted corals and structures.
- Increased community awareness of Moreton Bay coral reefs and their importance is generated.

The additional benefits of this project will be:

- The creation of an amenity attraction close to a popular anchorage.
- The generation of knowledge of the general viability of reef restoration activities in Moreton Bay environments.

The degree of success will be determined by the number and growth of survival of transplanted coral fragments at particular depths.

5. The proposed research project

The project consists of three phases, as follows:

5.1 Phase I: Establishment

The establishment phase consists of gaining relevant approvals and institutional support, undertaking an initial site survey at the site (Figure. 3), installing instrumentation at the site and nearby Goat Island reefs, and sourcing and deploying the spider frames (Figure 4). Once the frames are in position fragments of corals can be secured onto the frames at different depths. The corals will be attached several months after the frames are deployed to allow the frames to be 'conditioned'.

Frame fabrication and deployment:

The frames will be fabricated on land from rebar (see Figure 4 for example). They will be constructed with oversight from a civil engineer using existing tested designs (a range are now available). The final design will be selected as close to the time of fabrication as designs are constantly being revised. The design will be of the general shape as shown in Figure 4.

The raw rebar frames are expected to be 1.5 m in height, with a base diameter of 3 m to ensure a low aspect-ratio (to minimise over-turning risk). Two frames are envisaged with 25 fragments, at a range of depths tied to each frame using stainless steel wire.

The frames will be small enough and light enough to be deployed from a 7 m vessel. The deployment operation will be undertaken as follows:

- The fabricated frames will be transported to the vessel and loaded aboard by hand by operators wearing the appropriate PPE.
- The vessel will transport the frames to the deployment location. Deployment will be undertaken at low tide to enable safer operations.

- Once at the deployment site, a visual survey will be undertaken by Reef Check Australia qualified snorkers so that the exact location can be determined that meets the benthic and depth range requirements (Figure 2).
- The frames will be weighted down with large dive weights (1-2 kg each, attached to multiple sections of the structures) to minimize the risk of being moved by wave action.
- The frames will be lowered over the side of the deployment vessel on the chosen site. The frames and instrumentation will be arranged over a substrate devoid of corals or any other benthic species that may be impacted. The site will be selected to allow for under keel clearance at spring low tides to minimise obstruction to vessels (although the site is not within the navigational area of the Bay).
- Yellow surface buoys that will be labelled will be installed at the four corners of the site. MSQ will be updated with a view that a Notice To Mariners will be issued.

Deployment operations will be overseen by an AMSA qualified Master, and a civil engineer.

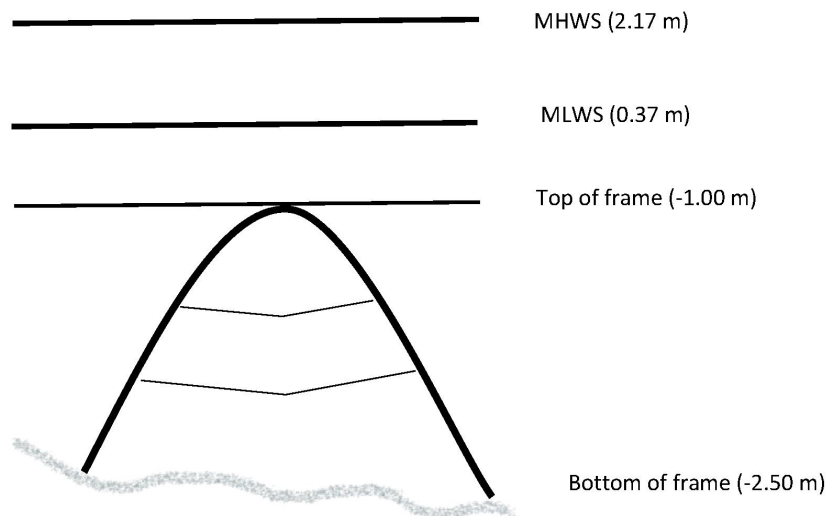


Figure 2. Relative depths of the frames (referenced to Chart Datum, MSQ)

Coral fragments:

Coral fragments will be collected on the basis of FoO (Fragments of Opportunity). Collection will come from a range of reefs including the North West side of Peel Island and nearly Goat Island. Broken coral fragments from existing damage (anchor, storm etc) will be collected. A maximum of 50 coral fragments will be collected over a staged three-month period (or longer if FoO are enough not found during the first period) in order to minimise impacts to intact coral reefs. Branching coral fragments will be collected as they form the most likely FoO and are a fast-growing sp. If not enough FoO can be found, QPWS will be notified and a possible request made to source non-FoO fragments.

Fragment size will be restricted to less than 10cm in length.

5.2 Phase II: Monitoring and maintenance

Once the fragments and instrumentation are established they will be routinely monitored to assess growth, condition and fouling (which will be removed as required). The plan is to conduct the monitoring over a three-year permit period. However, the frequency of the monitoring will be dependent upon weather, and the availability of logistical support.

Monitoring and maintenance will be conducted by qualified Reef Check Australia personnel, from appropriate vessels in survey.

In addition to scheduled monitoring and maintenance, reactive monitoring and maintenance trips will be undertaken when appropriate after large storm events.

Coral fragments that have not survived will be replaced on the reef from whence they were collected.

The monitoring equipment can include:

- Pliers and spare stainless wire,
- Collection bags (for any dead fragments)
- Hand-held camera equipment
- Spare temperature and water quality sensors

5.3 Phase III: Project Dis-establishment

At the end of the project a de-mobilisation phase will occur:

- The removal of the frames and instruments will be the reverse of the deployment process. The location moorings will be manually removed by trained Reef Check Australia personnel,
- The weights from the frames will be removed and manually lifted into the recovery vessels
- All coral fragments; dead or alive, will be returned to the location of collection
- The frames will be removed from the site of and disposed of in a landfill.

Removal operations will be overseen by an AMSA qualified Master, and a civil engineer. All operators will wear appropriate PPE. Snorkellers will be Reef Check Australia registered snorkellers.

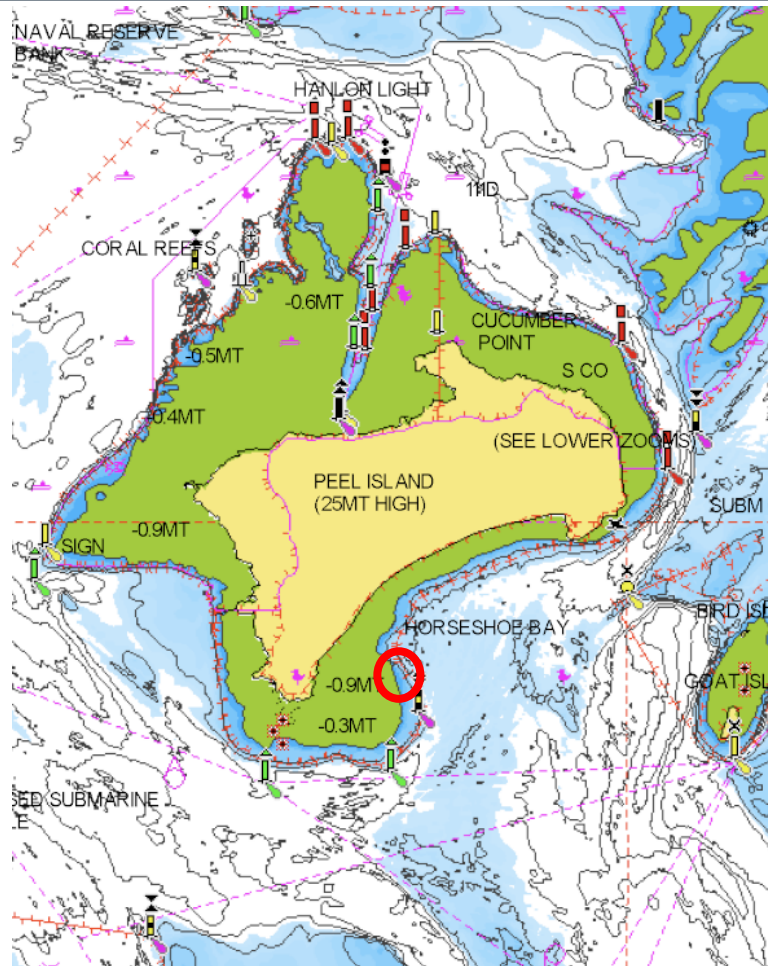


Figure 3. Navionics snapshot showing Peel Island, Goat Island, Horseshoe Bay and South-West Rocks reef research site (circled)



Figure 4. Reef spider type structures.

6. Potential conflicts with other marine park users and how they will be addressed

The study site is located to the west of the east cardinal mark (see Figure 3). Hence the site is located on the existing reef area which lies shoreward of the safe passage navigational area.

The frames will be clearly marked with surface floats in the event that vessels choose to pass through the non-Navigational area.

7. Potential conflicts with other marine park users and how they will be addressed

Safety risks can be either safety to project staff, or safety to protect the public, as described below:

- **Safety risks to project staff.** Staff actively participating will either be affiliated with the participating research organisations (AIMS, UQ, Griffith University, QUT) or with Reef Check Australia. Operations at the site will be undertaken under the Reef Check Australia safety management system.
- **Public safety risks:** There are two sources of risk: to boaters and swimmers/snorkellers. As highlighted above, the location is inside the main navigational channel. However, there is still the risk that for example PWC's (personal watercraft – jet skis) will pass over the site. Therefore, it is proposed that surface floats are placed at the site. The shallowest depth of the upper part of the frames is envisaged to be at least 1.0m under the surface at spring low tides (amended following consultation with MSQ). A bathymetric survey undertaken at the site (Figure 56) demonstrates that this site is suitable.

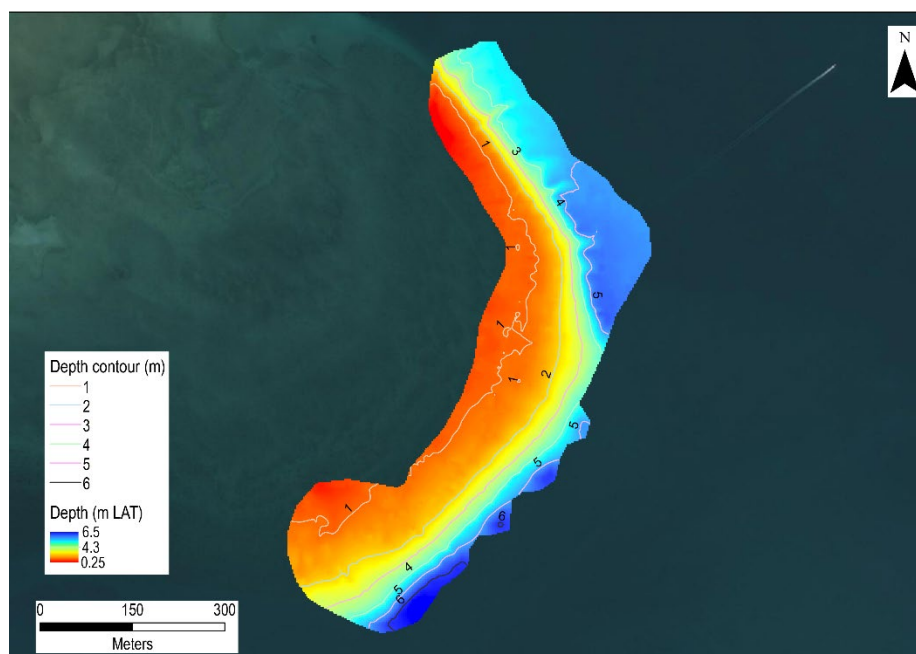


Figure 5. Bathymetric survey of the site taken in January 2021. The depths are referenced to Lowest Astronomical Tide

The design of the frames (Figure 4) will also ensure that snorkellers will be unable to fit between the gaps in the frames, and hence entrapment risks will be designed out of the structures under an engineering Safety in Design approach. The small size and weight bearing requirements do not require engineering certification, and tested designs will be used. However, the frames need to be anchored in such a way that wave action does not move them but does allow them to be removed.

8. Potential environmental impacts including processes undertaken to identify the impacts and steps taken to prevent, mitigate and monitor impacts

A recent survey (see video) demonstrates that the study site consists of rubble and bare substrate with infrequent remaining coral colonies. The footprint of the frames resting on the substrate will be of the order of less than 0.5 m²

As identified above, it may be required that some coral fragments will have to be sourced from live corals from Goat Island. However, given the high coral cover at this site the overall impacts are likely to be minor.

9. Equipment to be used in the marine park

The proposed equipment includes the following:

- Removable coral growout frames
- Oceanographic equipment (turbidity sensor and logger) to be deployed on-site for periods of months during the permit period. These could include fixed underwater cameras, temperature, and turbidity loggers.
- Vessels to transport researchers to and from the site.

10. Consultation undertaken (including State government agencies, public consultation or targeted consultation with community groups, traditional owners, conservation groups and other interested parties)

Consultation to date has been undertaken with:

- QPWS and Qld State Fisheries,
- QYAC
- The Moreton Bay Foundation, and its membership
- AMPOL Australia (who are interested in funding the project)

11. Other permits required for the activity, for example scientific purposes permits, ethics committee approvals, commercial activity permits

It is our understanding that no other permits will be required.

12. Key project risks

Risk	Descriptor	Mitigation Approach	Residual Risk
Loss of structures	Damage or loss of spider structures during adverse weather.	Ensure design, construction and installation fit for purpose.	low

Unintended damage to substrate of biota	Installation, monitoring and removal leads to unintended and unwanted impacts to existing reef environment.	Ensure all personnel are inducted and supervised. Operations are well-planned and supervised.	low
Damage to equipment by third parties	Deliberate or unintentional damage to the experiment from third parties.	The structures will be submerged and hence only able to be observed underwater.	low

13.Participating organisations

The following organisations are being contacted with a view to participation.

Organisation	Role
Reef Check Australia	Lead organisation, permit holder
QYAC	Partner organisation and participant
Moreton Bay Foundation	Partner organisation
University of Queensland	Supply of instruments, student assistance, research support
Science Under Sail Australia	Logistic support
QPWS	Regulator and logistics support

References

- Douglas G, Palmer M, Caitcheon G (2003) The provenance of sediments in Moreton Bay, Australia: a synthesis of major, trace element and Sr-Nd-Pb isotopic geochemistry, modelling and landscape analysis. *Hydrobiologia* 494:145-152
- Slack-Smith, RJ (1959) An investigation of coral deaths at Peel Island, Moreton Bay, in early 1956. *University of Queensland Papers*, I(7): 211-222.
- Wallace, C.C., Fellegara, I., Muir, P.R. & Harrison, P.L. 2009 10 05. The scleractinian corals of Moreton Bay, eastern Australia: high latitude, marginal assemblages with increasing species richness. In, Davie, P.J.F. & Phillips, J.A. (Eds), *Proceedings of the Thirteenth International Marine Biological Workshop, The Marine Fauna and Flora of Moreton Bay, Queensland*. *Memoirs of the Queensland Museum — Nature* 54(2): 1–118. Brisbane. ISSN 0079-8835.