SEAWALL HABITAT ENHANCEMENT PROJECT

MONITORING REPORT

YEAR 1

DATE: THURSDAY, 18 JANUARY 2024

PERMIT: DA2022/05/01

REFERENCE 2204-28537 SRA

CONTENTS

1. EXECUTIVE SUMMARY

The monitoring undertaken for this report has been conducted by CQUniversity PhD candidate Rory Mulloy. Rory is part of the Coastal Marine Ecosystem Reseach Centre (CMERC) which is led by Professor Emma Jackson. The monitoring has been undertaken in accordance with the Seawall Habitat Enhancement Project Monitoring Plan by suitably qualified and experienced people, namely, Rory Mulloy assisted by other researchers at CMERC, under Professor Jackson's guidance.

This report is provided to show compliance with Condition 3 of the Referral Agency conditions in the Development Application DA2022/05/01 and the following summarises the activities to date:

- Five (5) rock groynes were installed in December 2022 and January 2023, three (3) of which had sandy sediment banks placed on the upstream (southern) side.
- The total footprint disturbed was approximately 660 m^2 (based on the 'As constructed' drawings) and the total footprint approved was approximately 1290 m^2 (based on the approved 'For construction' drawings).
- With the smaller footprint and method used for placing the sediment the marine plant impact was also smaller than the approved 128 mangroves and 13 m^2 of saltmarsh.
- The sediment banks were shaped (flattened) in January 2023 and planted with mangrove saplings.
- 72 *Rhizophora stylosa* were planted across the three (3) sediment banks, with 68 surviving to date.
- Approximately 150 bamboo brush devices were installed in the sediment banks
- 23 *R. stylosa* and 27 *Avicennia marina* have succesfully recruited naturally.
- 200 *R. stylosa* propagules were planted in the natural mud near the two (2) groynes without sediment banks, with 178 surviving to date.
- Oyster baskets were not deployed at the start of the project due to the need to align deployment with oyster spawning times.
- 15 oyster baskets were deployed in early summer (October 2023) and 15 in mid summer (January 2024).
- This latter deployment completed the installation works.

2. CONSTRUCTION:

In December 2022, construction of Seawall Enhancement Project began at Fisherman's Landing in the northern portion of the Port of Gladstone.

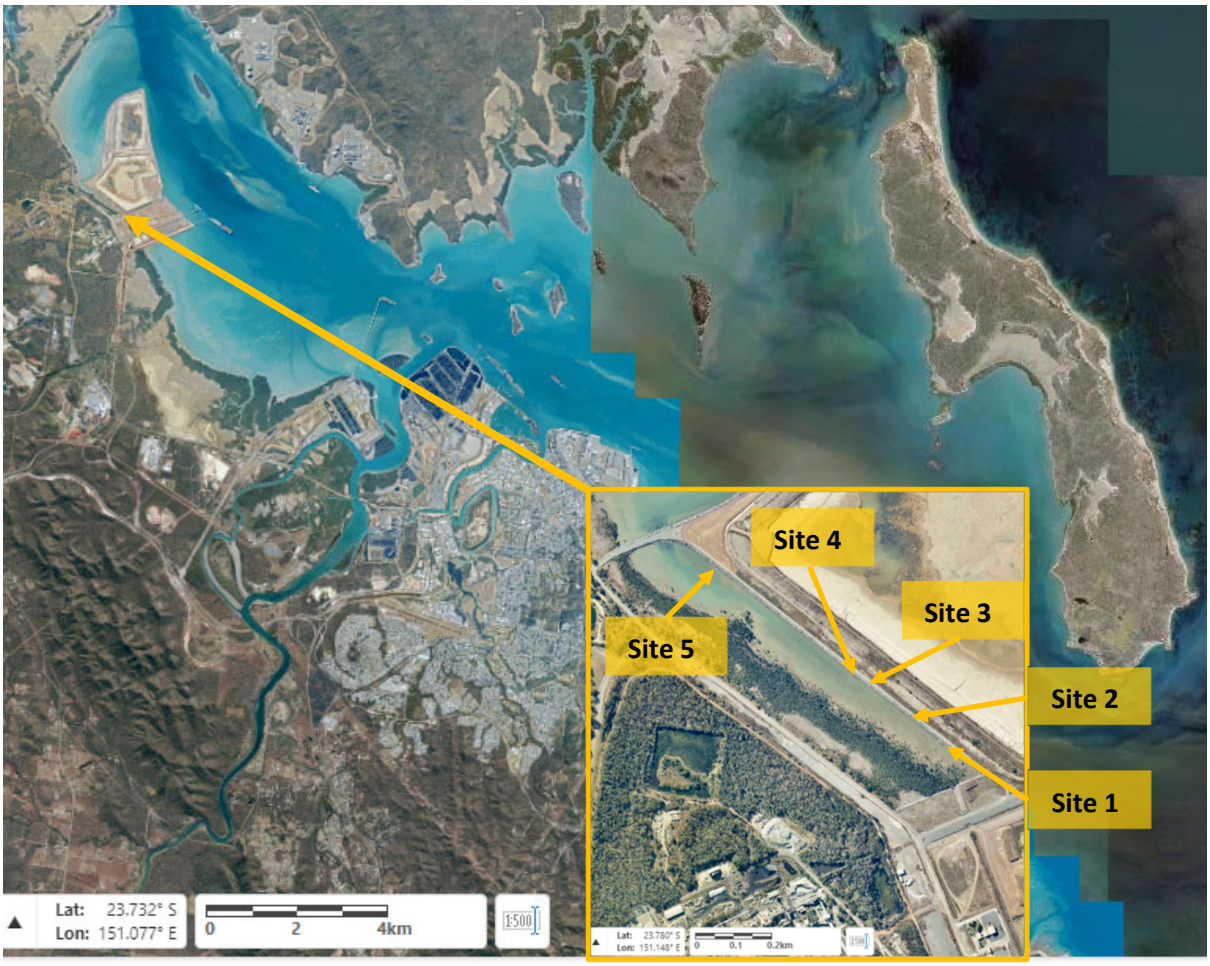


Figure 1: Locality Map showing Port of Gladstone and trial sites

DA2022/05/01 was approved for the construction of five (5) rock groynes (each approx. 8.5 m (base width) x 10 m long) perpendicular to the existing rock wall, at an elevation of 3.2 m relative to LAT. On the shoreward/ upstream side (in relation to the direction of the tide) three (3) of these groynes, sediment banks were approved that were approximately 25 m wide and 10 m long.

Construction was undertaken using anh excavator, with the first task at each location being the creation of e a rock bench / platform , that was off the haul road and above the groynes to allow the safe interaction between trucks and excavator. Rock delivered by trucks was placed at the GPS defined locations to a height of 3.1 m (100 mm below approved height). The sediment banks were placed by the excavator from the top of the existing seawall, which created less disturbance at both the top and bottom of the seawall. Rock platforms were removed after the groynes were installed.

The created sediment banks (each approx. 5 m x 18 m), were also placed at an approximate elevation of 3.1 m relative to LAT. These sediment banks were raked level in order to create more consistent surface to be able to compare the created habitat for mangroves or rock oyster.

The eventual disturbance to marine plants as a direct result of construction activities was less than initially estimated, as construction was able to occur in a way that minimised impact and was over a lesser total footprint. Based on the 'For construction' and 'As constructed' drawings the total footprint approved was approximately 1290 m^2 and the total footprint disturbed was approximately 660 m^2, which is just over 50%.

Figure 2: Photo of one of the completed sites, taken in January 2023. In the lower left of the image, along the base of the rock wall, there are some mangrove saplings visible – these and others similar were included in the disturbance estimate submitted as part of the original development application, but were left undisturbed during the construction process.

3. MONITORING:

As outlined in the Monitoring Plan submitted as part of the Development Application, project success would be measured in a number of ways. Site visits have occurred monthly as part of the research project and the way these metrics have been assessed over the last 12 months is outlined below.

3.1 Mangrove Habitat Establishment

In January 2023, the sediment banks were levelled and 1 m^2 plots marked out. Each sediment bank had 36 individual plots with one (1) of three (3) treatments applied to each, namely;

- Bamboo plugs – to help facilitate natural recruitment
- Mangrove seedlings planted – facilitated recruitment
- Blank – natural recruitment

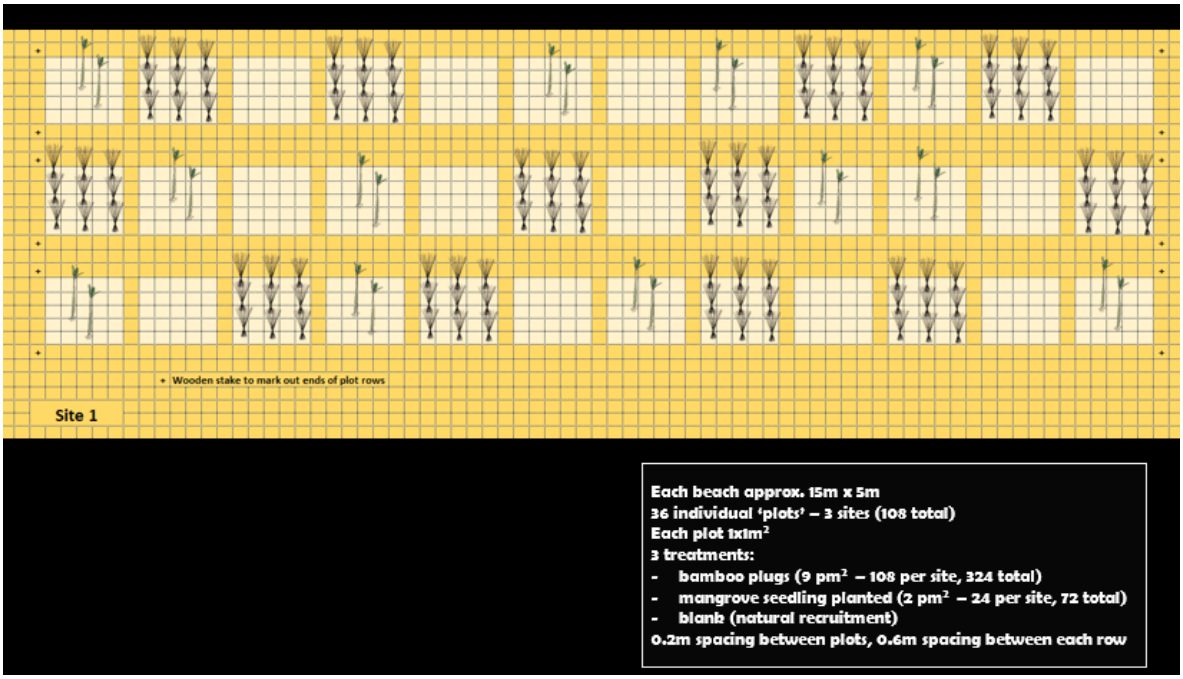


Figure 3: Example design of sediment bank plot layout

In March 2023, mangrove propagules, collected locally, were planted adjacent to the two (2) rock groynes without sediment banks. On the downstream side of Site 2, 100 propagules were planted and another 100 on the upstream side of Site 3.

Figure 4: Mangrove propagules planted adjacent to the two (2) sites without sediment banks. Planted within similar 1m^2 plots as above grouped as either single propagules, pairs or in high density

3.2 Oysters

The method chosen for the recruitment of oysters was using a 400 mm tall triangular Robust Oyster Basket (ROB 400). Due to the timing of the groyne construction, oyster specialists (OzFish) and scientists at CMERC advised that the deployment of ROBs should match the spawning season of oysters, which was thought to be sometime in the summer months. There is limited reference material regarding the spawning season of sub-tropical oysters, compared to the more temperate locations. To be able to monitor a full spawning season, the deployment of ROBs was accordingly delayed. The first deployment of 15 ROBs occurred in October 2023 (spring) and the second deployment of 15 ROBs took place in January 2024 (summer) (Figure 5).

The ROBs were placed at the leading edge of each groyne and their deployment marked the completion of project installation.

Figure 5: Site 1 showing ROBs deployed

3.3 Benthic inverterbrate colonisation

As a method of understanding the overall health of the newly created habitat, macrobenthic sampling has been undertaken to monitor the recolonisation of the new sediment.

Macrobenthic sampling was conducted on a monthly basis since creation of the 'living seawall' sites, across all sites (both with and without beaches) and at two (2) nearby reference sites. During sampling events, five (5) 100 mm diameter cores were collected at each site and sieved through a 1 mm sieve to count and identify invertebrates. Prior to construction of the sites, two (2) rounds of sampling took place (in October and December 2022) to help provide a baseline for the invertebrate community.

3.4 Sedimentation Analysis

A secondary method to monitor the new sediment was analysis of the composition and chemistry of the new sediment banks. Regular samples were taken at each sites (monthly for the first six (6) months, and then quarterly) to assess for changes to the sediment composition.

4. RESULTS:

4.1 Mangroves

As part of the Development Application submitted, we calculated an estimate of less than 13m^2 of saltmarsh that would be impacted by the development. However, this disturbance was minimised during the construction process so that not all of this saltmarsh area was impacted. Furthermore, we have observed establishment of saltmarsh on the newly created sediment beaches. The eventual disturbance to the mangroves was also less than estimated, as many of the saplings were not affected by the development.

Table 1 compares the disturbance to marine plants against mangrove habitat created at the end of year 1 of the project. This highlights that the total canopy cover is already more than double the approved maximum impact (noting actual disturbance was less than approved).

Table 1: Mangrove habitat created vs disturbance

	Total Plants	Ave. Canopy Cover	Total Canopy Cover
Pre-dev impact estimate	128*	7 cm x 6.5 cm	0.64 m^2
Planted seedlings	68**	13 cm x 9 cm	0.9 m^2
Recruited propagules	40	5 cm x 7 cm	0.1 m^2
Planted propagules	173***	5 cm x 5 cm	0.4 m^2

* Actual marine plant disturbance was less than estimated as many plants were left undisturbed during construction process

** Of 72 seedlings planted between January-March 2023

*** Of 200 *R. stylosa* propagules planted in March 2023

4.2 Oysters

No results are available for this report due to the recent deployment of the ROBs.

4.3 Macrobenthic

After construction of the sediment banks, no invertebrates were recorded at the three (3) sites (Sites 1, 4, and 5) until June 2023. However, crabs and crab holes were observed prior to this (in April 2023)(Figure 6). By October 2023, infaunal invertebrates have started to return including soft bodies polychaete worms (Figure 7). Samples are being identified and counted and will be reported in subsequent reports.

Figure 6: Crab holes observed at the created 'beach' sites in April 2023

Figure 7: Polychaete and crustacean collected during benthic sampling in October 2023

4.4 Sediment

Figure 8 shows the particle size distribution (<3 mm) for one (1) of the sites where a sediment bank was developed (Site 1), as an example. The data shows that prior to construction, the sediment was composed of clay, silt and fine sand (mostly particles less than 100 µm in size). The results from immediately after construction show that the sediment was comprised of mostly coarse sand and gravel. However, in the subsequent months after development, the proportion of sediment that was less than 100 µm in size increased, demonstrating that fine sediments are accumulating on these banks.

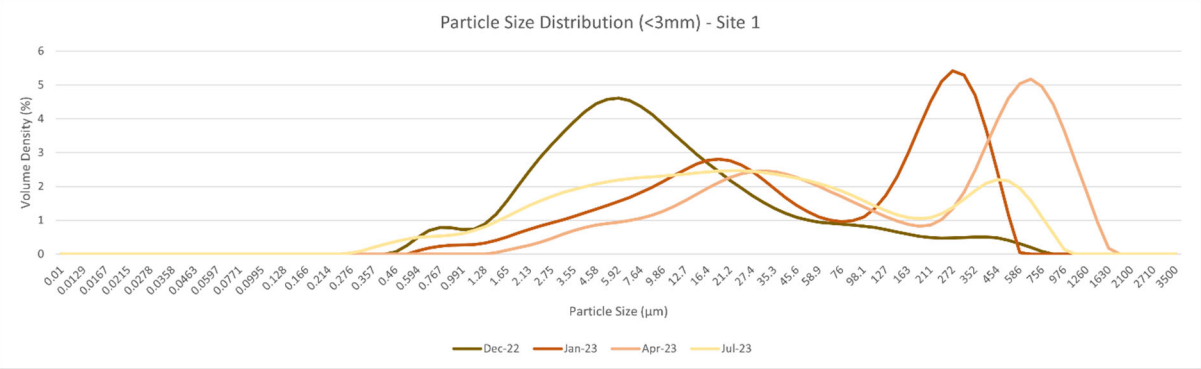


Figure 7: Sediment composition at Site 1

5. Future Activities / Outlook:

The monitoring and data collection will continue monthly until July 2024, after which point it will continue annually for the purposes of this report for DA2022/05/01.

Following the completion of the data collection for the PhD research project the proposed activities include scaling up the project. This will include broader scale planting of mangroves and oysters, and potentially an increase is the size of the sediment banks (subject to the required approvals).

Ongoing research of the area is likely to be a key part of this future work, investigating oysters, mangroves and potentiall marine flora. As above, this is subject to relevant internal and external approval processes.

6. APPENDICES

Appendix 1 – Time Series Images

Appendix 2 – Construction Drawings

Site 1 - Photographs

Year 0

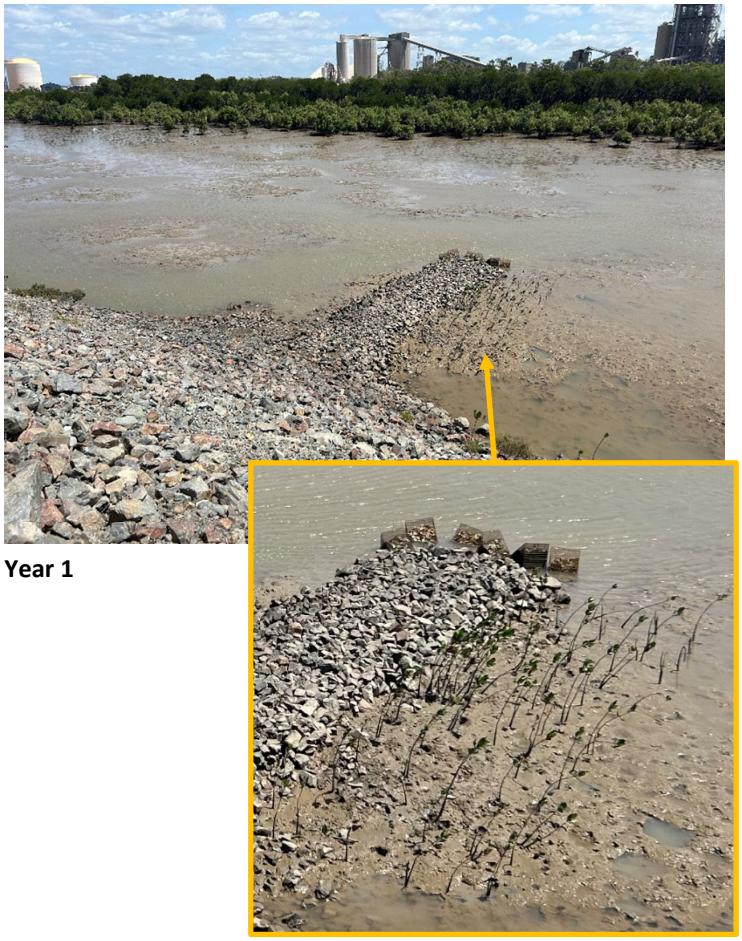
Year 1

Year 2

Year 5

Site 2 - Photographs

Year 0



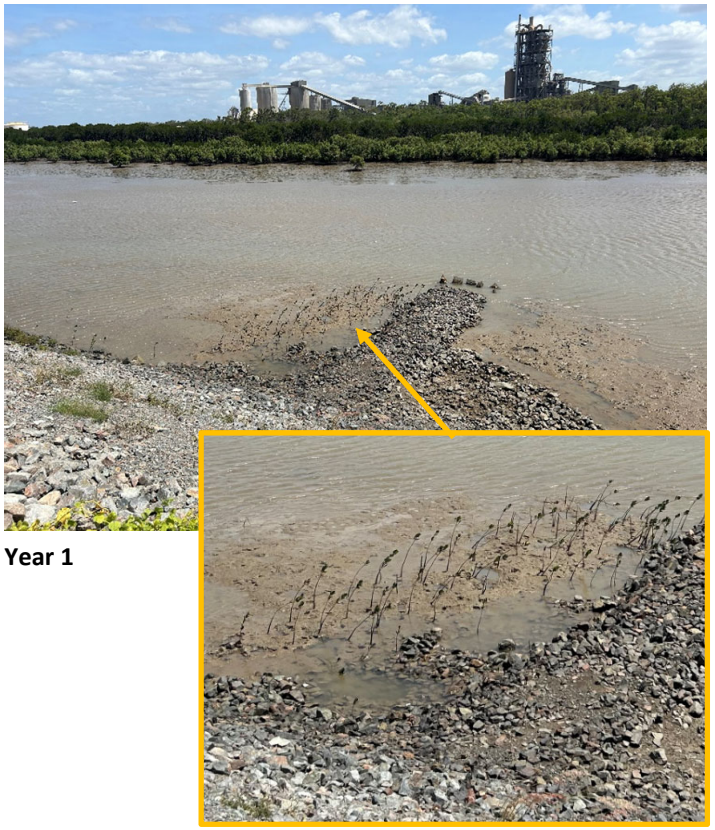
Year 1

Year 2

Year 5

Site 3 - Photographs

Year 0



Year 1

Year 2

Year 5

Site 4 - Photographs

Year 0

Year 1

Year 2

Year 5

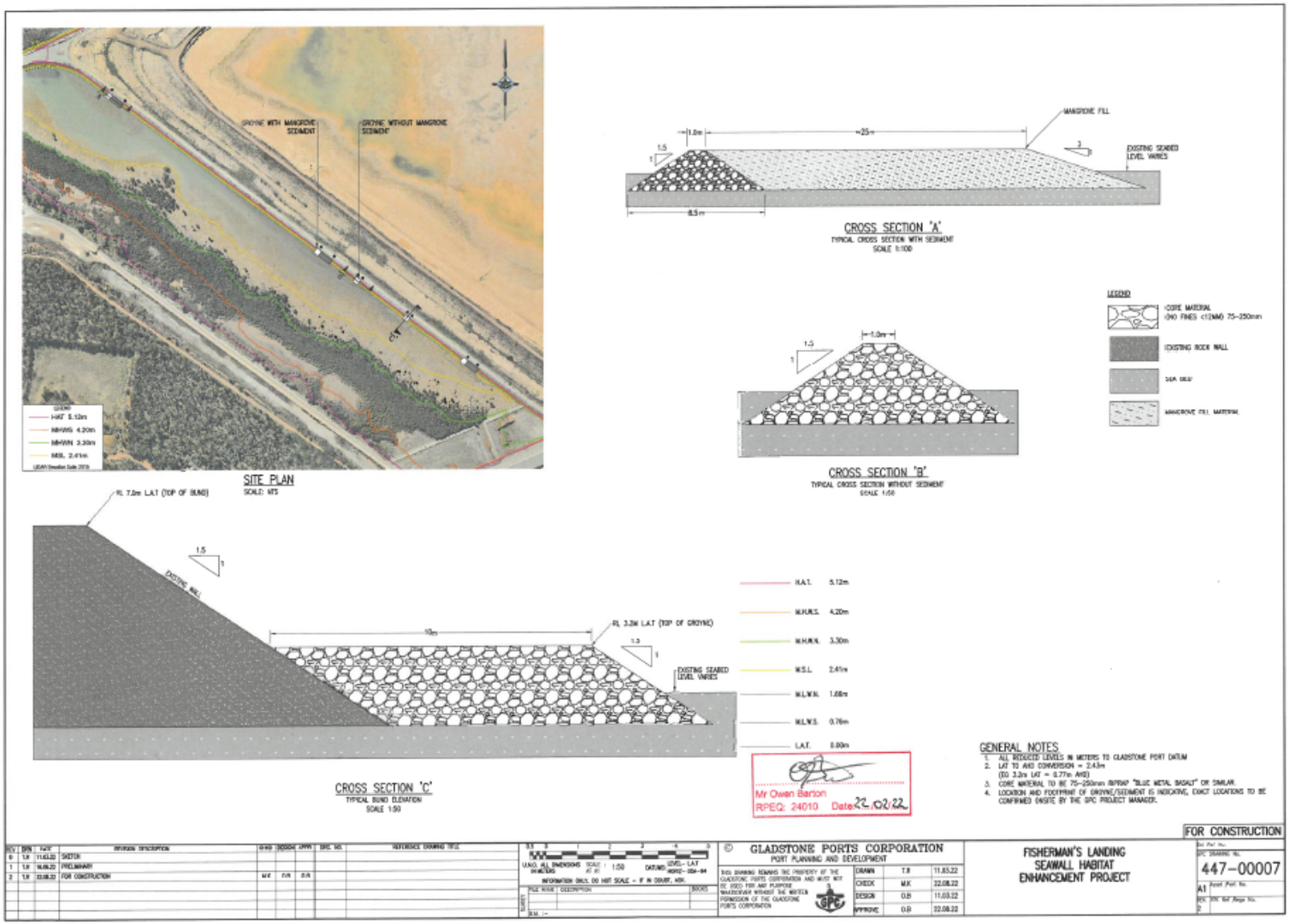
Site 5 - Photographs

Year 0

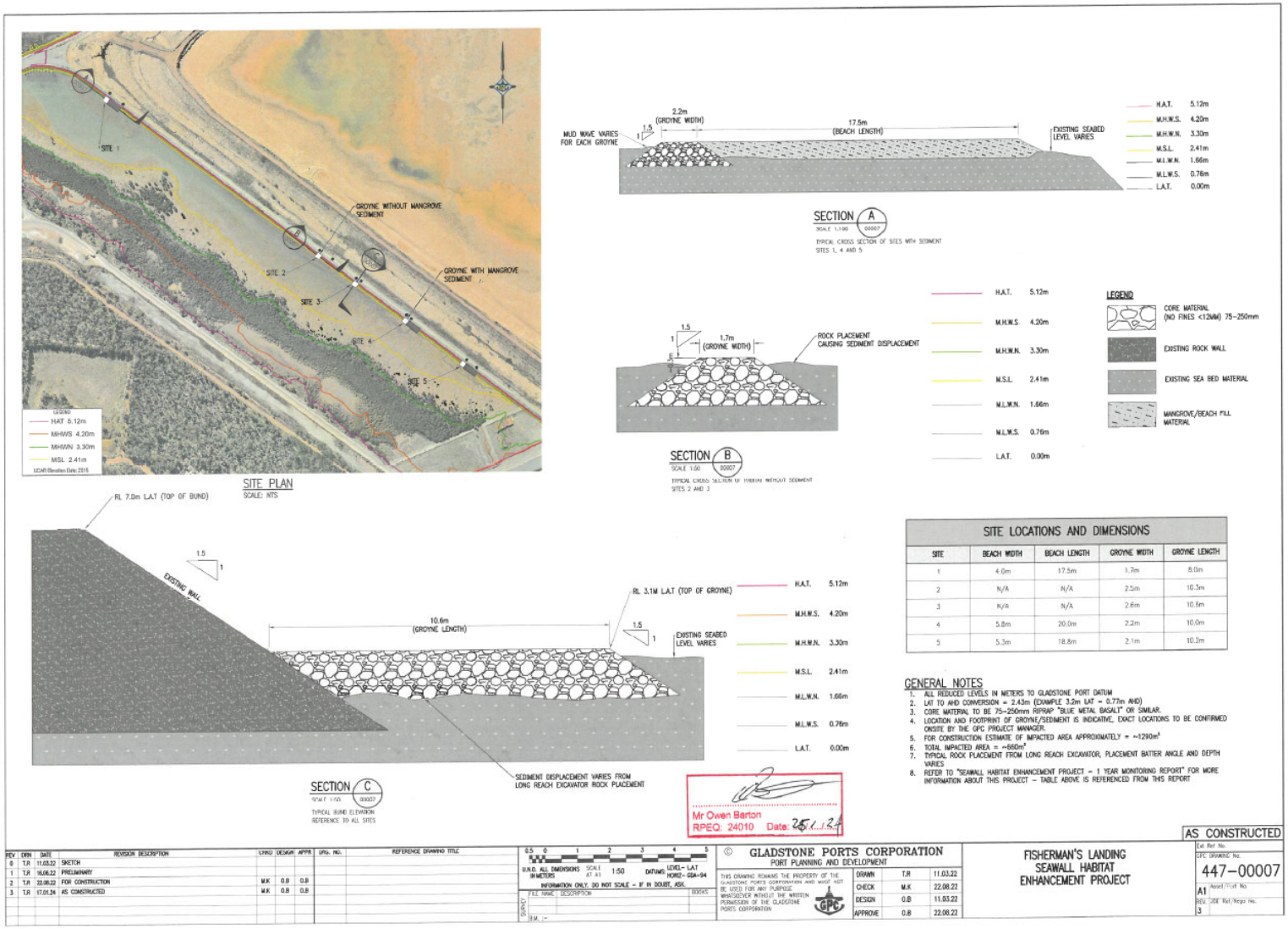
Year 1

Year 2

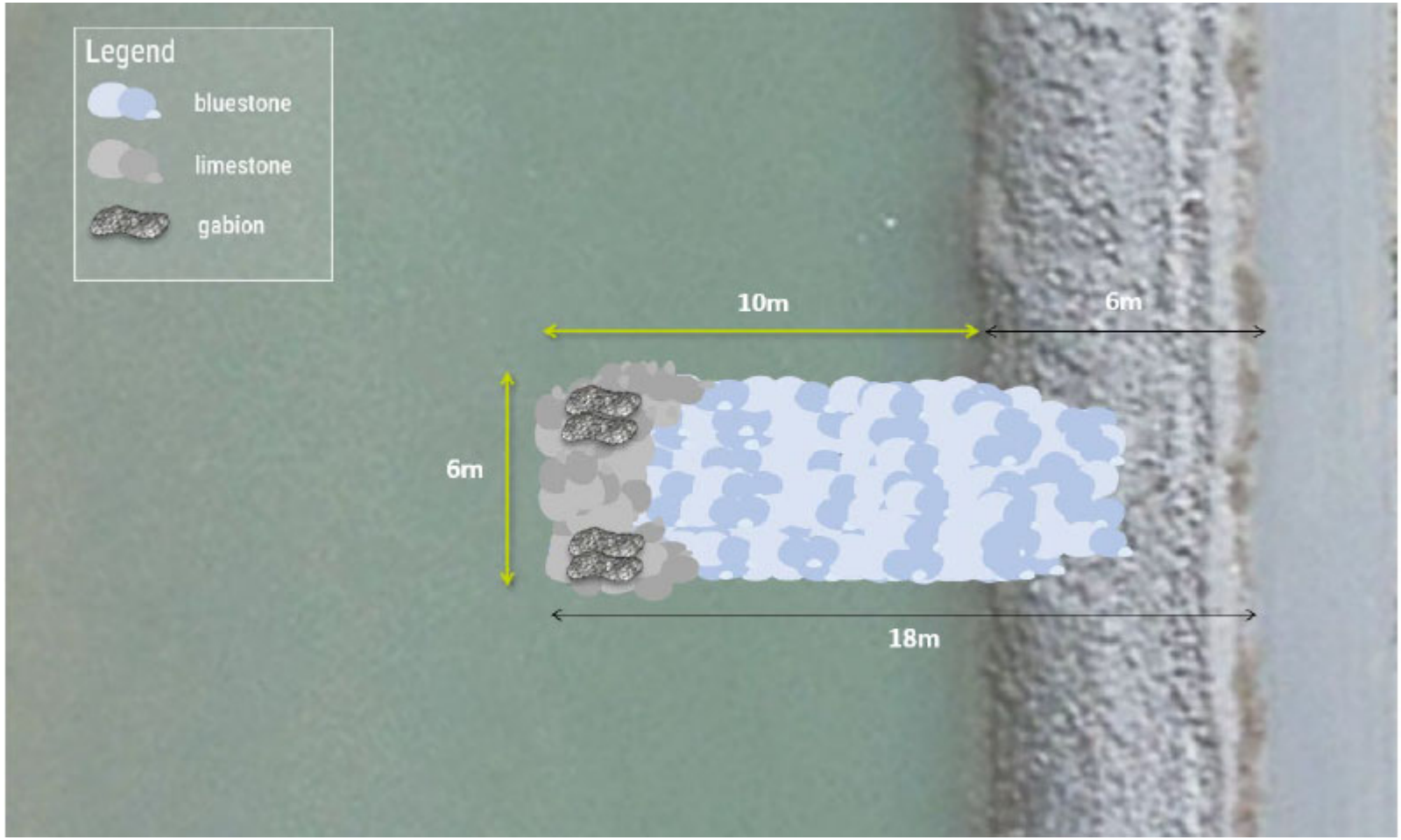
Year 5



For construction drawing



As Constructed drawing



Oyster placement design