

To: Bryce Taplin (Burbury Consulting)

Cc: Anahita Jungalwalla (ERA), Colin Terry (Entura)

Date: 11th November 2021

Project: New Bridgewater Bridge

From: Tim Alexander (Marine Solutions)

Subject: Comparison of 'Chosen Design' to Completed Assessment of 4.6 Dredging and Reclamation

Dear Bryce,

As requested, we have reviewed the 'chosen design' provided to us on 25 October 2021 and have completed an analysis comparing it to the assessment we undertook as detailed in our report, "New Bridgewater Bridge – Aquatic Risk Assessment".

Our assessment was based on the reference design and information provided by the Project Team by email.

The 'chosen design' provided refines the extent of works and enables us to make comment regarding any changes we believe may be required to the identified potential impacts, proposed mitigations or the findings generally.

1. Summary

We have provided a summary of our comparison in the table below.

Item	Current Assessment	'Chosen Design'
Potential Impacts	Loss of vegetation under reclamations. Altered sediment dynamics around reclamations. Water quality impacts of reclamation process.	Slightly lower area of seagrass covered by northern reclamation. No change for southern reclamation ¹ . Slightly lower than assessed effects of reclamations on water and sediment dynamics. Water quality impacts of reclamation process remain the same as long as the area being reclaimed is effectively isolated from the aquatic environment.
Proposed Mitigations	Minimise area of reclamations. Optimise shape of reclamations to reduce effects on hydrodynamics. Isolate area being reclaimed from aquatic environment during reclamation.	Minimise area of reclamations. Optimise shape of reclamations to reduce effects on hydrodynamics. Isolate area being reclaimed from aquatic environment during reclamation.

In summary, we believe that the assessment we have completed (as outlined in our report), generally covers the expected impacts of the 'chosen design', with respect to the reclamations.

There are no major differences from our assessment to the 'chosen design'. Given the extremely high levels of sediment disturbance expected to occur with "mass soil mixing", it will be critically important to verify the effectiveness and robustness of the structures used to isolate the area being reclaimed from the aquatic environment during the reclamation process.

¹ The area of impact of the 'chosen design' was used to generate revised figure for loss of seagrass within the assessment and the MPIS

2. Introduction

During the preparation of our report, the Early Contractor Involvement (ECI) process was either yet to begin or was underway but not concluded. As a result, a 'chosen design' was not available for us to assess the impacts of and so we undertook an assessment of [dredging and] reclamation based on reference design and information provided by the Project Team by email.

We understand that the reference design and the proposal description were developed to generally cover both of the tenderer design alignments and broadly the construction methods, and expected that the 'chosen design' will mostly accord with our assessment completed.

In particular, we expected to see a refinement of the alignment of the works (the size of intersections and the alignment over water were broader areas) and more detail on the construction methodology to be used.

This comparison has been completed to test these expectations and identify how well our assessment aligns with the 'chosen design'.

3. Background

The 'chosen design' was shared with us on 25 October 2021, and included selected plans, sections/elevations, renders and management plans.

In general, the 'chosen design' follows a design similar to the Reference Design. It:

- is a four-lane bridge crossing the River Derwent, with a posted speed limit of 80km/h
- includes changes to the intersections at the southern and northern extents of the bridge to allow for grade separation
- includes a shared path as part of the crossing, connecting into the local surrounding network
- involves the demolition of selected buildings and structures as originally proposed.

The following is where the 'chosen design' differs from what we assessed.

- The alignment of the bridge. The alignment is more refined than was previously advised. In comparison to the Reference Design, the alignment is further east at the southern extent but similar at the northern extent.
- The bridge type is confirmed. This includes the bridge pier spacing and number and type of piles.
- The extent of reclaim. A larger area of reclaimed land was proposed and assessed as part of the MPIS.

4. Potential Impacts

In our prior assessment, the potential impacts from the proposed development with respect to the reclamation were identified as per the below list.

- The placement of rock fill into the water to create the reclamation has the potential to displace and/or suspend a low-moderate amount of sediment. Levels of sediment suspended during infilling will depend on the rate of infill. This impact would extend for the duration of the infilling at each location which is estimated to be in the order of days to weeks. The use of a coffer dam or other type of barrier would help to contain the suspended sediment and reduce the impact on surrounding macrophytes, as well as mitigate any impacts related to the potential increased metal concentrations from sediment disturbance.
- Aquatic macrophytes will be lost beneath the area of the reclamation. The southern reclamation will result in a loss of up to 5,500 m² of aquatic vegetation, primarily *Ruppia megacarpa*. The northern reclamation will result in the loss of up to 2,000 m² of seagrass (primarily *Zostera muelleri*).
- The proposed southern reclamation will exert some influence on the flow of water around the southern corner of the causeway, deflecting it northward away from the shore. Depending on the

final shape of the reclamation, there is some potential for increased deposition and accumulation of sediment upstream and/or downstream of the reclamation. Considering that water velocities in this southern corner are already slow, effects are unlikely to be significant. Hydrodynamic modelling by Entura indicated that the reclamation will influence water movement velocities and water residence time in the area to the west of the structure, but changes to sediment deposition and accumulation were considered to be negligible (Entura 2021). Despite this, the high density of *Ruppia megacarpa* in this area means that strong consideration should be given to the scale of this reclamation and the shape of the structure designed to minimise disruption to water flows as much as possible.

- The northern reclamation may result in some deflection of river flow, causing localised scouring (Entura 2021). Particular attention should be given to the shape of the structure on the western, upriver end of the reclamation to ensure the structural integrity of the reclamation under high river flow and to minimise its effects on downstream currents.

In reviewing the ‘chosen design’ we have identified the following comparison of impacts.

Impacts	Change to impact
Loss of <i>Ruppia megacarpa</i> under the southern reclamation	No change. The size of the footprint of southern reclamation in the chosen design was provided to Marine Solutions and these numbers were used in the revisions of the Aquatic Risk Assessment.
Loss of seagrass (<i>Zostera</i>) under the northern reclamation	Slight improvement. As far as we can tell from the information provided, the in-water area of the northern reclamation appears to be smaller than the area discussed in the Aquatic Risk Assessment, resulting in a smaller area of seagrass lost than previously assessed.
Altered sediment dynamics – southern reclamation	Slight improvement. The shape of the southern reclamation in the chosen design is expected to result in a slightly better outcome for hydrodynamics, particularly on the eastern side i.e. slightly reduced disruption to flow than previously assessed.
Altered sediment dynamics – northern reclamation	Improvement. The northern reclamation in the chosen design is closer to the shore, i.e. shorter southward extension, than previously assessed. This is expected to result in a better outcome for hydrodynamics, i.e. reduced disruption to flow than previously assessed.
Water quality impacts of southern reclamation	No change. We were informed that the area to be reclaimed would be isolated from the estuary while the reclamation was taking place. This appears to still be the intention.

As can be seen from the above table, the impacts are expected to be similar to those assessed as part of the original assessment.

5. Proposed Mitigations

In our prior assessment, the proposed mitigations were identified as per the below list.

- Minimise surface area of the reclamations.
- Design the shape of the reclamations to minimise changes to hydrodynamics and resulting effects on scouring and deposition. Such a shape would have no hard angles or sharp corners on either the upstream or downstream margins, and would rather gently curve out and back in to the shoreline as much as possible. Development of the design would need to weigh any increase in the size of the footprint of the reclaim in order to create this shape against any corresponding increase in the loss of vegetation under the structure, most notably *Ruppia megacarpa* in the southern reclamation.
- The finalised design (scale, location and shape) of the reclaim should be compared against the design used in the hydrodynamic modelling by Entura (2021) to ensure that results of the modelling, in terms of effects on water flow velocities and sediment dynamics, are still relevant and applicable. A significant deviation from the modelled design may require additional/re- modelling.

- Isolate the area being reclaimed from the rest of the estuary i.e. use of impermeable barriers while the reclamation is being established.
- Source fill material from a certified quarry to ensure that it does not contain contaminants, and that it has been washed to remove fines, which will mean that no additional sediments enter the waterway.
- If isolation from the estuary is not feasible, establish reclamations on particularly low tides while the areas are dry (most relevant to the reclamation in the southern corner).
- If isolation from the estuary is not feasible, a slow rate of infill should be used in order to minimise sediment disturbance.

In reviewing the 'chosen design' we have identified that these mitigations have not changed. The mitigations are expected to be similar to those assessed as part of the original assessment.

It will however be important to verify the effectiveness and robustness of the structures used to isolate the area being reclaimed from the aquatic environment. With available information, it is unclear whether the proposed NoFlood barrier system would be effective given the softness of the sediment (i.e. potential for sinking) and the depth of the water in this area, compared to the height of the structures.

6. Findings and Conclusion

In summary, we believe that the assessment we have completed (as outlined in our report), generally covers the expected impacts of the 'chosen design', with respect to the reclamations.

Given the extremely high levels of sediment disturbance occurring with the "mass soil mixing", it will be critically important to verify the effectiveness and robustness of the structures used to isolate the area being reclaimed from the aquatic environment during the reclamation process.

Kind Regards,



Tim Alexander
Project Manager, Marine Solutions