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# **REPAIRS TO SEAWALLS AT 44-48 CHILDE STREET, BELONGIL URGENT WORKS**

Prepared By

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## Document Control Sheet

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## 1. OVERVIEW

The existing rock wall protecting 44-48 Childe Street (lots 18,19, 20, 21, 23, 57, 59, 60 and 61 Section 2 DP 1623) from erosion consists of large rocks along the seaward boundary of the subject properties and extending both to the NW and wrapping around the south-east boundary (Figure 1). The property to the NW is private property and the property to the SE is the old jetty site (State controlled public lands).



Figure 1 Subject properties

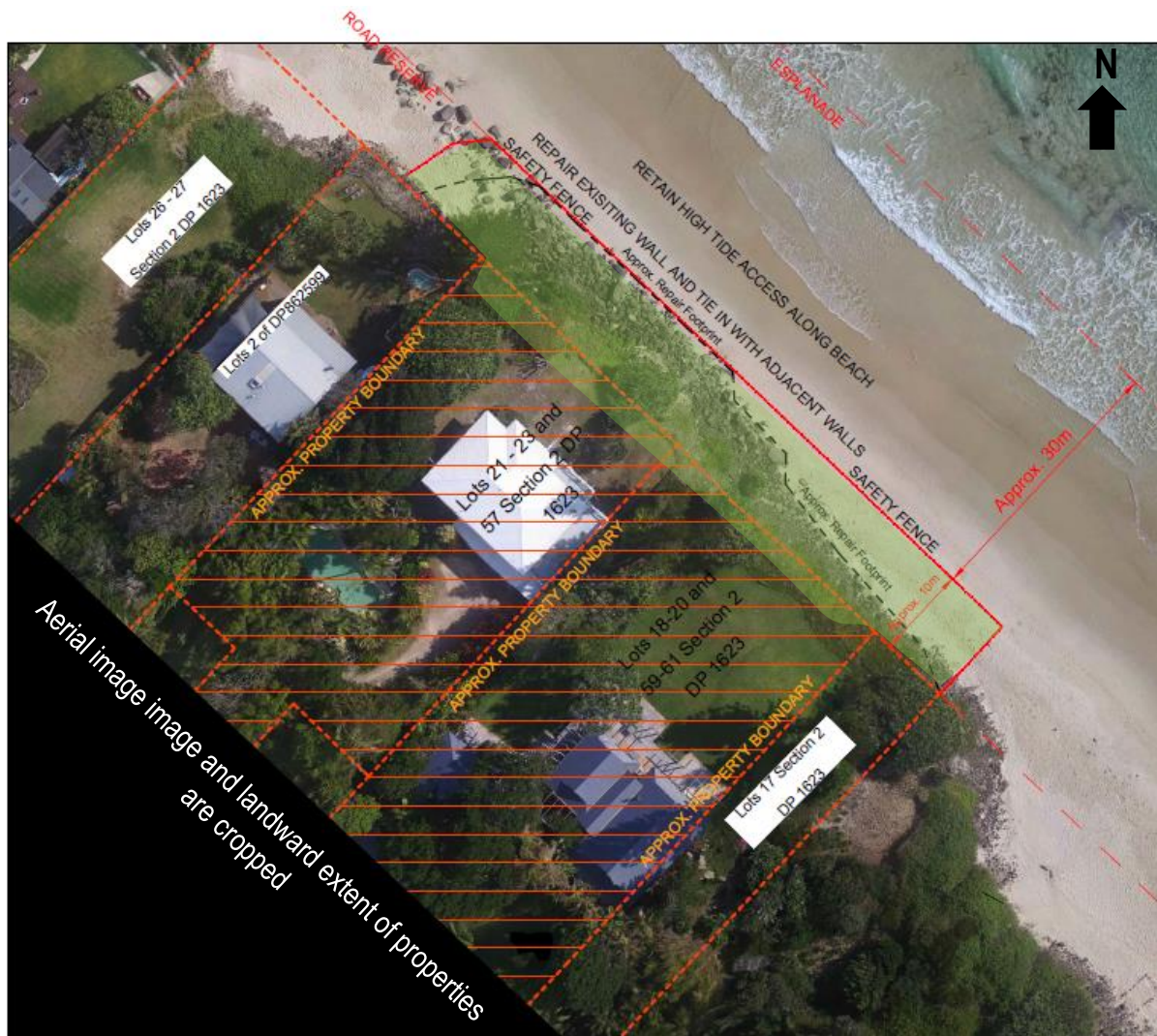
A DA for full repair of the existing rock wall has previously been lodged with the NSW Coastal Panel in January 2017.

As the January DA is still under consideration and as it is known that the seawall needs to be made safe, a second DA for more minor but necessary repair works to make safe the existing seawall is being prepared for lodgement in early August 2017. These works can be carried out from the private properties and the 10m wide road reserve under the control of Council without the need for any works, or equipment access, on the Esplanade that would require the approval of Department of Industry – Lands & Forestry. (



Figure 2). This will simplify the approval process and time to allow the works to be implemented asap.





**Figure 2 Extent of works – repairs and construction equipment access (footprint shaded in green)**

This technical report, with the attached technical drawings (Attachment A), has been prepared to support the second (August 2017) DA. The repair works are minor repairs to an existing seawall and the proposed repairs will not increase the footprint of the existing wall or have any adverse environmental impacts.

The second (August 2017) DA does not replace the first (January 2017) DA that provides for full repair of the existing seawall.

## 2. BACKGROUND

The existing structure at 44-48 Child Street is part of the rock seawall wall designed and constructed in about 1976 to protect the private properties to SE of Manfred Street between Manfred Street and

the rock wall at the Old Jetty site from intermittent storm erosion events (Figure 3). The existing erosion protection works at, and adjacent to, the subject properties have been damaged. These works have been in a state of disrepair for some time.

The 2015 BSC rock sea wall constructed to protect Manfred Street and the adjacent private wall to the NW connects into the 1976 wall. There is now a continuous rock seawall from the northern flank of the northern most private property on Belongil spit to the rock protection at the Old Jetty Site (State lands). With the natural sandstone outcrops at the southern end of the Old Jetty site and southward from Border Street with the BSC sandbag walls at Border Street and Don Street, there is now effectively a continuous protection structure (natural and artificial) between the SLSC to the south of Jonson Street and the northern most private property on Belongil Spit (WRL 2013).

The Belongil seawalls are generally landward of wave forces but the walls along Belongil, including the subject wall, have been subjected to wave impacts during a number of severe erosion events. Rock seawalls require maintenance and this is very much needed for this wall.

The subject wall has a well-documented history. Recently on 12/8/16, the Supreme Court of NSW issued orders made in proceedings brought by multiple plaintiffs including the owners of 44-48 Childe Street. These orders were based on the long-documented impact of the Jonson Street structure constructed and maintained by Byron Shire Council on the down-drift beaches and seawalls at Belongil. These orders require that the subject wall and the other walls protecting the multiple plaintiff's properties must remain in place and cannot be removed as per Schedule 1 of the Court Orders (Figure 4). BSC has consented to these orders.

In accordance with Supreme Court of NSW consent orders made 12/8/16, a development application to repair the existing seawall structure protecting this property was lodged with the NSW Coastal Panel in January 2017. The works were referred to NSW Department of Industry – Lands & Forestry. A response from NSW Department of Industry – Lands & Forestry for the part of these repair works on the Esplanade is still forthcoming. As there are safety issues, urgent repair works are needed and this report has been prepared to support the application for these urgent works.



Figure 3 Locality Plan





Figure 4 Schedule 1 from Court Orders (Subject properties circled in red by me)

### 3. CONDITION OF THE WALL

There is considerable data on the walls along the Byron Bay embayment. The urgent need for repairs was identified to Council in the 2013 report to BSC by Worley Parsons entitled “Byron Bay Erosion Protection Structures – Risk Assessment” (WP 2013). Without repairs the existing works could be further damaged, and become increasingly a threat to the public.

WP 2013 found that all of the structures along Belongil to be in a substandard condition as per Table 1 of WP 2013 (copied below as Table 1). Notes re Table 1:

- The Belongil walls are numbered 2.1 to 3.5.
- The walls along the subject property are part of Structure 3.1.
- Structures 3.2 and 3.3 have been upgraded by Byron Shire in 2015 from geotextile containers to an engineered rock wall.

WP 2013 provided a risk assessment only and no recommendations were made to repair and make safe any of the walls. Since the WP 2013 report:

- Structures 3.2 and 3.3 have been upgraded by BSC to a rock wall and, it is understood, a similar rock wall upgrading is being considered for 2.3.
- WP 2013 have prepared a report in 2014 for BSC investigating the options to upgrade at and adjacent to Jonson Street (Collectively referred to as Jonson Street Structure and structure numbers 1.1 – 1.7 in Table 1).
- Periods of beach erosion have occurred including erosion due to a major storm in early June 2016 that caused erosion along the NSW coastline and further damage to the walls.

**Table 1 Summary of risk Assessment (from WP2013, Table 1)**

Structure No.	Structure Description	Structure Resilience Rating	Coastal Processes Rating	Coastal Ecology Rating	Public Use and Amenity Rating
1.1	Interim coastal protection works at Byron SLSC	HIGH	LOW	LOW	LOW
1.2	Rock protection at Byron SLSC	MODERATE	MODERATE	MODERATE	LOW
1.3	Rock protection in front of the main reserve area adjacent to the surf club, separated from adjacent protection by concrete ramp	MODERATE	MODERATE	MODERATE	MODERATE
1.4	Rock protection in front of main reserve	EXTREME	MODERATE	MODERATE	MODERATE
1.5	Rock protection in front of Jonson Street carpark and east of groyne marking location of original jetty	MODERATE	MODERATE	MODERATE	MODERATE
1.6	Rock protection in front of Jonson Street carpark and west of groyne marking location of original jetty	HIGH	MODERATE	MODERATE	MODERATE
1.7	Rock toe protection in front of First Sun Caravan Park	HIGH	MODERATE	LOW	MODERATE
2.1	Border Street geotextile container interim protection works	LOW	LOW	LOW	MODERATE
2.2	Rock protection adjacent to Border Street works	MODERATE	MODERATE	EXTREME	EXTREME
2.3	Don Street geotextile container interim protection works	LOW	MODERATE	MODERATE	MODERATE
2.4	Concrete cube and rubble protection works adjacent to Don Street works	MODERATE	MODERATE	EXTREME	EXTREME
2.5	Geotextile container revetment adjacent to ad-hoc rubble works	MODERATE	MODERATE	MODERATE	MODERATE
3.1	Rock revetment north of old jetty site	EXTREME	HIGH	EXTREME	EXTREME
3.2	Manfred Street geotextile container interim protection works	MODERATE	MODERATE	MODERATE	MODERATE
3.3	Geotextile container revetment fronting private land adjacent to the Manfred protection works	MODERATE	HIGH	MODERATE	MODERATE
3.4	Rock protection north of the geotextile container revetment	EXTREME	HIGH	EXTREME	EXTREME
3.5	Geotextile container revetment works at northern flank of the rock protection at Belongil Spit.	MODERATE	MODERATE	MODERATE	MODERATE

Looking at the detailed hydraulic stability evaluation for 44 and 48 Child St (part of structure 3.1) by WP 2013:



Structure No.	Structure Description	Design standard 30 – 40% damage (from Table 3); initial damage for geotextile revetments	Rating	Comments
3.1	Rock revetment north of old wharf site	<1yr ARI	Poor	Rock armour is too small to withstand estimated wave heights at this structure for events greater than the 1 year ARI

The public use and amenity rating by WP 2013 for the private structures along Belongil is between moderate and extreme. The public use and amenity rating for the subject property was extreme. These ratings were in 2013 and the public use and amenity rating may now be worse and the structure should be repaired and made safe.

ICM engineers have made regular inspections of the walls along Belongil Spit since 1999 and a condition survey of the walls along Belongil, with particular attention to the walls covered under the consent orders (Figure 4), was carried out by ICM engineers on 13/10/16 using high precision photogrammetry with RTK survey positioning to ascertain and record the condition the walls. This condition survey was more detailed than the 2013 inspections by Worley Parsons (WP 2013).

During the 2016 condition survey it was observed that:

- the subject wall was partially covered by sand and was landward of high tides and wave action (Figure 5 & Figure 6).
- some loose rocks are exposed on the exposed seaward face that are of a lesser size than required for stability (Figure 5).
- The repairs needed are restacking and replacement of displaced rocks so that the wall face is stable.

The WP 2013 findings re risk and hydraulic stability reflected the small rocks on the seaward face of the wall. The proposed repair works will improve the public use, amenity, risk and hydraulic stability ratings.





Figure 5 44 Childe Street (ICM 13/10/16)



Figure 6 48 Childe Street (ICM 13/10/16)

Many of the inspections by ICM engineers since 1999 were during erosion events when the lower section of the wall was uncovered. The historical ICM photos along with publicly available aerial photos from Google Earth and Nearmap provide good details of the condition of the wall below present sand level.

From the data available, the Belongil walls have generally been constructed with primary armour rocks with a grading of 1.5-5t with a smaller secondary armour layer and clay filter layers under the primary armour. The walls were located along the seaward face of the historical storm erosion scarps that are landward of normal high water. The continuous wall acts as a terminal seawall that not only protects public and private beachfront properties and infrastructure during major erosion events but also provides environmental benefits as it mitigates the risk of a breakthrough of Belongil Spit that, if allowed to occur, would have large adverse impacts on Belongil Creek and the Belongil wetlands (Figure 3).

The existing structure has proven to be structurally adequate over the life, to date, of about 40 years.

The wall has performed its function satisfactorily to date and the proposed works are repair of the existing structure, not redesign and rebuild.

The typical cross-section of the wall is shown in Figure 7.

Some of the rocks now exposed on the seaward face are smaller than 1.5-5t. These rocks will generally not be hydraulically stable in conditions when the wall is exposed to storm wave impacts.

The need for maintenance is to be expected after this time as rock seawalls are flexible structures that can accommodate some rock movements ("damage") and should be maintained after major storm impacts. Present engineering rock seawall design formulas and guidelines incorporates the notion that a level of damage is acceptable and maintenance is required to limit the extent of damage.

The existing works have been damaged to an extent that they are now in need of repair to restore them to their original condition and safety.

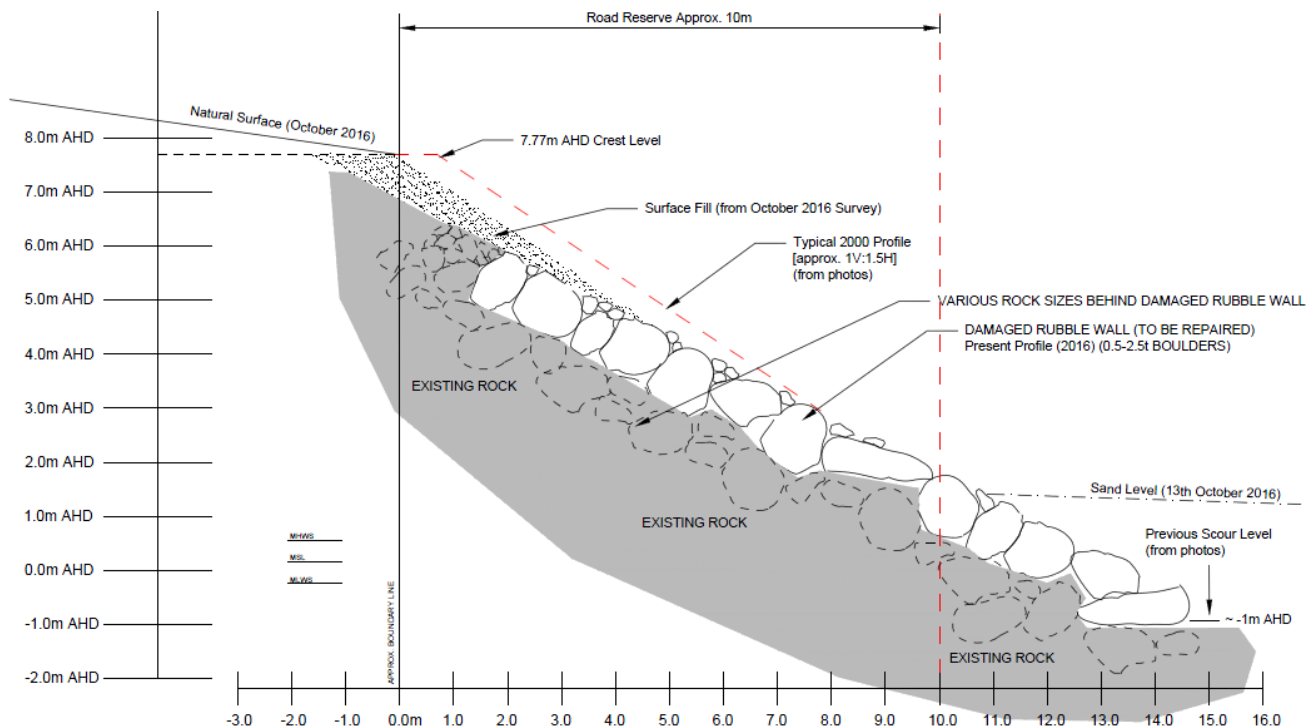


Figure 7 Existing profile

#### 4. REPAIR DESIGN

The most urgent works are to restack any unstable rocks on the exposed (above beach level) seaward face of the wall in a stable configuration. To achieve this, some additional rocks may be required. This will not change any characteristics, such as void ratio and energy dissipation.

For the initial urgent repairs and subsequent full repairs of the existing wall structure, all appropriate engineering principles, codes and standards will be applied. These include:

- Coastal Engineering Guidelines (Institution of Engineers, Australia, 2012)
- Guidelines for the design of maritime structures (Australian Standard AS 4997-2005)
- The Rock Manual (CIRIA, 2007)
- Actions from Waves and Currents on Coastal Structures (International Standard ISO 21650:2007)
- Eurotop (2016)

The works proposed in the August 2017 DA are for minor repairs to make safe the exposed sections of the seaward face of the existing wall above beach level. These works can be carried out without the need for any works, or equipment access, on the Esplanade.

Technical drawings for the urgent repair works (August 2017 DA) have been prepared (See Attachment A). As per the technical drawings, the repairs will restack existing unstable rocks on the exposed seaward face above beach level (about 2m high) to a stable slope and configuration (Drawings 004 and 006 in Attachment A). This work will be adequate to increase the structural stability of the wall and restack unstable, or potentially, unstable rocks above the present sand level in a safe and stable configuration.

The rocks displaced below beach level or onto the Esplanade will not be retrieved and restacked as part of the extent of works proposed in the August 2017 DA. Thus, some additional rock, in the 1.5 - 5t size grading rock similar to the existing primary armour rock size may need to be imported to fill any gaps in the primary armour layer. This size armour rock has proven to be hydraulically stable under wave forces, in practice and theory, for the walls constructed along the back beach along Belongil - it is the primary armour size that has been generally used and was specified for the primary armour layer for the rock seawall recently designed and constructed at Manfred Street for BSC (Umwelt 2013, WRL 2013).

It is important to note that the proposed works are not design and construction of new works. The proposed works are for repair of an existing structure that has been in place for about 40 years and has performed satisfactorily. We have not determined theoretical design criteria such as waves, winds, water levels and overtopping. This is not necessary for repair works as the works are minor repair of existing works that have provided a full-scale model that has proved to be more than adequate. The NSW Coastal Panel has queried design criteria for the January DA. In our responses, we advised that the works were repairs and also referred the Panel to the previous comprehensive design studies for this area. The most relevant is the design studies for the Manfred Street seawall (WRL 2013). We refer the Panel to all information and reports of this nature provided with the January application for this reference if relevant.

WRL 2013 provided a detailed hydraulic stability assessment of the Manfred Street seawall and ICM have reviewed the assessment calculations and concurred with them. As a check only, during the repair design, ICM recalculated the theoretical design rock sizes on the wall using Van der Meer formulae and CIRCA (2007). For these calculations, the design data developed by WRL 2013 for the recently designed and constructed rock seawall at Manfred Street for Byron Shire was used with some minor modifications for the subject site and a design life of about 30 years with maintenance as required; estimated at 10 yearly intervals. The future conditions will depend on the coastal management plan and mitigation of impacts caused by the Jonson Street structures. Repair, using similar size rock to existing, is a practical approach for an existing structure that has proven to be adequate in service over 40 years. The adopted design conditions, including waves and ocean water levels, are based on the extensive theoretical calculations by WRL (2013) at the structure for the design check were as follows:



Adopted Design Conditions at Structure			
Design Event		50	year ARI
Design interval between maintenance		10	year
Wave height at structure	$H_S$	2.50	m
	$H_{2\%}$	3.50	m
Critical wave period	$T_{cr}$	13.0	sec

The design check indicates the following theoretical rock sizes:

Adopted Boulder Weight & Grade (t)			
		Primary	Secondary
$M_{15}$		1.62	0.16
<b>Adopted <math>M_{50}</math></b>		<b>3.00</b>	<b>0.30</b>
$M_{85}$		4.37	0.44

This compares well with the typical rock sizes in the existing structure and other structures along Belongil. Seawall design is not exact and there are uncertainties in the various inputs and, as a design check, it has been previously noted that these armour sizes are similar to the Manfred St wall rock design sizes (WRL 2013).

The estimated additional rock required is not more than about 8 – 10 rocks (24t / 2 trucks) or about 0.3% of original estimated volume. This is very minor works. Any imported rock will be of at least similar quality to the existing rock that is primarily basalt and greywacke, both of which are hard dense rocks with SG > 2.6 as per the Rock Manual (CIRIA 2007). Potentially suitable quarries include:

- Ballina (NSW, 30 km from Belongil);
- Corndale (NSW, 35 km);
- Tumbulgum (NSW, 60 km);
- Piggabeen (NSW, 75 km); and
- West Burleigh (Qld, 80 km).

## 5. REPAIR CONSTRUCTION METHODOLOGY

Works to repair the existing seawall structures protecting this property are to be carried out as anticipated by the recent Supreme Court of NSW consent orders made 12/8/16. BSC has agreed to and signed the consent orders.

The proposed method of carrying out the works is as follows:

- Pre-Construction
  - All consents from adjacent landowners impacted by the works are to be formalised.
  - All statutory approvals to be obtained and notifications made.
  - A programme of works to be prepared that coordinates all of the private repair works such that the individual works proceed in an orderly manner, one property at a time, with the repair for each property completed and that section of beach opened before commencing on the next repair.
  - Safety fencing and signage is to be erected as per the construction drawing (Attachment A) to restrict public access to the work area. This fencing will be erected on the subject property and within the road reserve under Council control. The fence and construction works and activities will not intrude on the Esplanade. Access will be through the subject private properties as per the traffic plan. (Attachment A).
  - The traffic management plan which includes pedestrian access to and along the beach to be approved by BSC (attached in Attachment A). Truck traffic will be limited to a low loader to deliver and remove the excavator and two 12t truck movements to deliver rocks over the repair time (estimated at 2-5 days).
- Construction (Estimated repair time 2 -5 days on weekdays, 7am to 6pm.)
  - Access for equipment and materials to be through the subject properties.
  - Work areas as per the construction plan (Attachment A) will be kept as small as practical and fenced with safety signage and barricades to restrict public access to work and stockpile areas. Safe public accesses to and along the beach will be maintained.
  - The works will be carried out with a long reach excavator using a rock bucket and rock grab to position face rocks above beach level in a stable and safe configuration.
  - The works shall be carried out working from private property and Council road reserve and progressively starting from the SE end.
  - Rocks, temporarily removed or new, are to be stockpiled within the fenced work areas.
  - Noise will be kept to acceptable limits as per similar projects
- Post-Construction
  - The beach is to be groomed and left in a clean condition free from rock or rubble from the repair works.
  - The access track is to be removed and the area impacted by the track revegetated and restored to the original condition.
  - The safety fencing is to be removed.
  - Maintenance by owners as required after major storms – estimated every 10 years.

## 6. NO IMPACTS

The proposed repair works to make safe the existing wall above beach level are minor and limited. Due to the nature and scope, the proposed repair works will not change the size, location or key physical characteristics (such as reflection coefficient) of the existing wall. As a result, there will be no change to the present interactions between the wall, when intermittently exposed to waves, and the coastal processes. In particular, there will be no adverse impacts on adjacent properties or down-drift impacts caused by the repair works.

The proposed repairs will improve the stability of the wall and will have positive impacts on safety and the protection of adjacent private and public properties.

Furthermore, the repairs are to a wall that is generally inactive with respect to coastal processes. The alignment of the walls along Belong Spit, including the subject wall, is landward of normal high water (Figure 3) and these walls act as a terminal seawall that not only protects public and private beachfront properties and infrastructure during major erosion events but also provides environmental benefits as it mitigates the risk of a breakthrough of Belongil Spit that, if allowed to occur, would have large adverse impacts on Council and Crown Lands.

The potential effect of specific coastal hazards and processes on the proposed repair works can be summarized as follows:



Processes and Hazards [from NSW Coastal Protection Act 1979]		Impact on repaired wall
a)	beach erosion	The works are repair of an existing structure.
b)	shoreline recession	
c)	coastal lake or watercourse entrance instability	The coastal hazards and processes on the repair works will be the same as the status quo.
d)	coastal inundation	
e)	coastal cliff or slope instability	However, the repaired wall will be better able to resist the present and future coastal processes and hazards.  In particular, the repairs will reduce the hazards of: - coastal and tidal inundation of low areas due to a breakthrough of the existing wall - slope instability along the subject properties. - erosion of Belongil Creek and wetlands due to breakthrough of Belongil spit
f)	tidal inundation	
g)	erosion caused by tidal waters, including the interaction of those waters with catchment floodwaters	
h)	Sea level rise and associated climate change impacts	

The impacts of the proposed repair works on the coastal processes and hazards will be similar to the status quo as the works are repair of an existing structure.

The impacts of the repair of the existing coastal protection works on coastal processes and hazards can be summarized as follows:





Processes and Hazards [from NSW Coastal Protection Act 1979]		Impact by repaired wall
a)	beach erosion	<p>The works are repair of an existing structure.</p> <p>The impact of the repair works on the coastal hazards and processes will be the same as the status quo - no change</p>
b)	shoreline recession	
c)	coastal lake or watercourse entrance instability	
d)	coastal inundation	
e)	coastal cliff or slope instability	
f)	tidal inundation	
g)	erosion caused by tidal waters, including the interaction of those waters with catchment floodwaters	
h)	Sea level rise and associated climate change impacts	

In the design of the repair works, Section 55M of the Coastal Protection Act has been considered. Section 55M requires that:

- (a) *the works will not over the life of the works:*
  - (i) *unreasonably limit or be likely to unreasonably limit public access to or the use of a beach or headland, or*
  - (ii) *pose or be likely to pose a threat to public safety, and*
- (b) *satisfactory arrangements have been made (by conditions imposed on the consent) for the following for the life of the works:*
  - (i) *the restoration of a beach, or land adjacent to the beach, if any increased erosion of the beach or adjacent land is caused by the presence of the works,*
  - (ii) *the maintenance of the works.*

With reference to the above Section 55M conditions:

Re (a) (i); *the works will not over the life of the works unreasonably limit or be likely to unreasonably limit public access to or the use of a beach or headland*

- The proposed works are to make safe existing works by restacking of the wall to restore a stable slope without loose rocks that could be dislodged during erosion events.
- The completed repair works will improve safety of public access along the beach.

Re(a) (ii); *the works will not over the life of the works pose or be likely to pose a threat to public safety*

- The proposed repair works will improve public safety by restacking loose rocks. Thus, the repair works will not “pose a threat to public safety”.

Re (b) (i); *satisfactory arrangements have been made (by conditions imposed on the consent) for the following for the life of the works: (i) the restoration of a beach, or land adjacent to the beach, if any increased erosion of the beach or adjacent land is caused by the presence of the works.*

- The proposed repair works will restore a stable slope above present sand level. Impacts on the beach and adjacent land will be unchanged from present. Thus, any repairs will not cause “any increased erosion of the beach or adjacent land”.
- The proposed repair works will also reduce the risk of erosion and a breakthrough of the Belongil Spit at this site. A breakthrough would result in:
  - Damage to Childe Street and the associated public infrastructure to westward of the subject property.
  - Inundation and erosion of the Belongil Creek, wetlands and littoral rainforest to westward of the subject property.

Re (b) (ii); *satisfactory arrangements have been made (by conditions imposed on the consent) for the following for the life of the works: (ii) the maintenance of the works.*

- The proposed repair works can and should be maintained by the landowners after each erosion event that impacts the wall.
- The wall should be inspected after each erosion event that exposes the seaward face of the wall to wave action. This inspection should compare the condition of the wall to the “as repaired” condition after the proposed repairs. Specifically, the inspection should:
  - Identify any loose, broken or displaced rocks.
    - Any loose rocks should be repositioned to be in a well interlocked and stable orientation.
    - Any broken rocks shall be replaced by a sound unbroken rock of similar size as the broken rock and placed in a well interlocked and stable orientation.

- Any displaced rocks should be removed and replaced in a similar position to the original position in a well interlocked and stable orientation.
- Check the crest level and seaward slope angle. Any subsidence or slope adjustment should be repaired to the original “as repaired” condition.

### Other potential impacts

#### End effects:

A common concern re seawalls, particularly those like the Jonson Street Structure that generally extend into the surf zone, is that they have long term end effects. As the proposed works are repair of an existing wall that is landward of the general influence of the waves and tides, this is not an issue.

Despite that the NSW Supreme Court has ordered that the walls stay in place, the NSW Coastal Panel requested a review for the full repairs in the January 2017 DA. The lack of down drift impact beyond the status quo will again be confirmed.

Previous studies for BSC of existing and proposed upgrading of existing walls along the Byron embayment found that the only structure that had significant end effects was the Jonson Street structures. Near to the subject site, a geobag wall has been upgraded to a much larger rock seawall recently by BSC. In the consideration of the potential for end effects of this rock seawall with a length of 100m, WRL (2013) considered the McDougal et al 1987 diagramme as well as more recent work by NSW researchers (see WRL 2013 Section 8.7.2). WRL 2013 concluded that there would be no incremental end effects beyond the status quo ie referring to the McDougal et al 1987 diagramme (Figure 8):

- L (length of hard / protective structures) = 1,727m
- r (increased end effect recession) = 0m
- S (extent of increased end effect recession) = 0m

This assessment by WRL 2013 was supported by Umwelt 2013 (see Section 5.2.1):

“They are a replacement for an existing protection structure, so they would have no incremental (additional) impact beyond the status quo.”

ICM concluded, similarly, that there will be no incremental end effects from repairing the existing wall with a length of 90m at the subject site. That is,  $r = 0\text{m}$  and  $S = 0\text{m}$  as per the McDougal et al 1987 diagramme overlaid on Belongil (Figure 8) with dimensions.

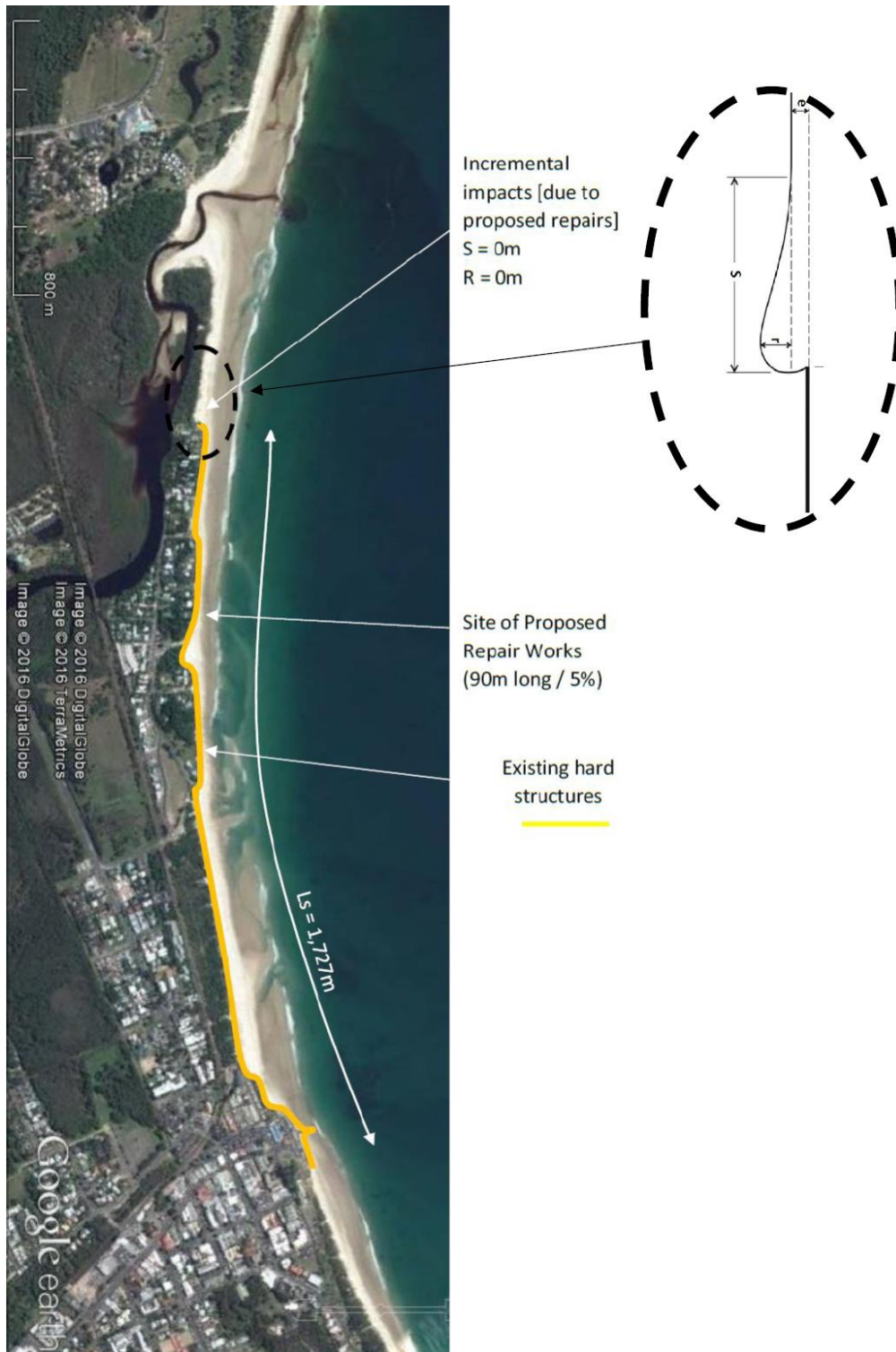


Figure 8 McDougal et al 1987 diagram applied to Belongil curved coastline



Summarising, there is now a continuous rock seawall from the northern flank of the northern most private property on Belongil spit to the existing rock protection at the NW section of the Old Jetty Site (State crown lands). With the natural sandstone outcrops at the southern end of the Old Jetty site and southward from Border Street with the BSC sandbag walls at Border Street and Don Street, there is now almost continuous protection (natural and artificial) of varying standards between the SLSC to the south of Jonson Street and the northern most private property on Belongil Spit. (WRL 2013). This repair is to a wall that is part of this continuous protection.

#### **Habitat impacts:**

A detailed environmental impact assessment was done for the new rock seawall recently constructed nearby to the subject site at Manfred St for BSC. This rock wall was found have minimal environmental impacts (Umwelt 2013 Table 2.1) The impacts of the proposed repairs will be much smaller and there will be no impacts on shore bird and turtle nesting.

#### **Extreme weather events:**

The repair time is only about 3 -5 days so works can be timed to avoid extreme weather events. Before commencement of the works the short and long-range weather forecasts will be checked and works will not be commenced unless weather is suitable. Should extreme weather events be predicted during the course of the works that could affect the works, then the works will be suspended and made sound for the predicted weather impacts

The cost estimate for the maintenance repairs is \$15,000 over a thirty year period.

## **7. SUMMARY**

Urgent works are necessary to make safe the existing wall.

The present application is for minor urgent works above beach level. The additional rock to be imported will be limited to 24t. No excavation on the beach or works on crown lands will be required.

These repairs will:

- make safe the existing wall
- have positive benefits to the safety of beach users
- improve protection to private and public property and infrastructure

These repairs will not:

- increase the footprint of the existing wall
- move the existing wall seaward.
- change the characteristics of the existing wall with respect to to the status quo of impacts on or by coastal processes
- cause environmental impacts

## 8. REFERENCES

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## **ATTACHMENT A**

## **TECHNICAL DRAWINGS**