# REPAIRS TO SEAWALL AT 6B CHILDE STREET

## RESPONSES TO RFI BY NSW COASTAL PANEL

**RE: NO 6B CHILDE ST, BELONGIL**
**REF DOC 17/8231**

**Q1. Advise if it is intended to import new rock material for the works (or will the works solely comprise "re-stacking" of loose rock armour retrieved from the beach margins).**

**Response:** It is proposed to repair the wall by re-stacking of loose rock armour retrieved from the beach margins. If the accessible displaced rock is inadequate to properly repair the wall, then additional rock will be imported from local quarries. It is estimated that about 10% of the original seaward face may need to be imported. This is only an estimate at this stage. Their legal status is, therefore, unimpugnable.

**Q2. Details of any existing consents or approvals relevant to the existing works.**

**Response**: The Supreme Court of NSW has issued an injunction in August 2016 that the walls must remain in place and cannot be removed. These Orders were made in proceedings brought by multiple plaintiffs based on the long-documented impact of the Jonson Street structure on the downdrift beaches at Belongil.

**Q3. a copy of the International Coastal Management, 2000 report referenced in the SEE.**

**Response**: Copy attached as Attachment B.

**Q4. A detailed engineering design report for the structure including a description of the proposed design and materials to be used in the structure. The design report should detail how each of the relevant criteria have been selected including (where relevant):**

**a. A detailed survey plan depicting the cadastre, proposed footprint of the structure, existing property boundaries (including the crown road reserve) and specifying all relevant dimensions of the proposed structure.**

**b. Sufficiently accurate cross sections of the proposed structure (including its proposed points of termination and/or method or tie if there are existing approved works on either side) and its location relative to the existing property boundaries (including the crown road reserve). Such cross sections to clearly specify all relevant dimensions (including crest, toe and existing beach levels)**

**Response: Response:** Additional survey and cross section details requested in a and b have been added to the existing drawings on the technical drawing set that was previously provided. The revised drawings are attached as Attachment A.

International Coastal Management PTY LTD (ICM)
OFFICE 50 / G Arm, SYC Marina. Main Beach. Qld. 4217. Australia
POST PO Box 306. Main Beach LPO. Main Beach. Qld. 4217. Australia
TELEPHONE +61 7 5564 0564 FAX +61 7 5532 9147
WEBSITE www.coastalmanagement.com.au

**c. Adopted engineering principles, codes or standards applied to the design of the structure;**

**Response:** For the repair of the 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)

**d. Adopted design probability and risk used in the design;**

**Response:** The works are "repair" not "design" and your question is inappropriate. To date the wall structure has been adequate to protect the properties and risk of failure will be reduced by the repairs. There is low risk to the safety of humans and assets located landward of the structure. For the recent wall approved and constructed for BSC at the seaward end of Manfred St and adjacent to Manfred Street (see Umwelt, 2013. Review of Environmental Factors for Interim Beach Access Stabilisation Works at Belongil, Byron Bay. Report 3209/RO1/Final ("Umwelt 2013"; see also University of NSW Water Research Laboratory, 2013. "Design of Interim Beach Access Stabilisation Works – Belongil, Byron Bay" WRL Technical Report TR 2013/08. Report for BSC ("WRL 2013"))., WRL 2013 stated at Page 20:

*"ISO 21650:2007 provides the following commentary: "Temporary and small coastal structures would belong to the very low safety class. Larger coastal structures such as … exposed seawalls protecting infrastructure would belong to the low safety class. Breakwaters protecting an LNG terminal or a power station would belong to the normal safety class whereas a sea dyke protecting populated low land would belong to the high safety class." Based on the above guidance, WRL considers the proposed interim works at the Belongil site as being either Very Low or Low safety class according to ISO 21650:2007."*

The above applies equally to the subject site – *"the site can be classified as being either Very Low or Low safety class according to ISO 21650:2007*. "

Any damage should be repaired as per "Urgent Repairs to Seawalls at 6 Childe Street, Belongil" (**ICM 2016)** (see page 9) and ICM Jan 2017 "Urgent Repairs to Seawalls at 6 Childe Street, Belongil - Offsite Erosion Management Plan" (**ICM 2017)** at page 4 previously provided to the Panel with the Application:

- *"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.*

**International Coastal Management** PTY LTD **(ICM)**
OFFICE 50 / G Arm, SYC Marina. Main Beach. Qld. 4217. Australia
POST PO Box 306. Main Beach LPO. Main Beach. Qld. 4217. Australia
TELEPHONE +61 7 5564 0564 FAX +61 7 5532 9147
WEBSITE www.coastalmanagement.com.au

- *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."*

**e. Ocean water levels;**

**Response:** The works are "repair" not "design". Your question is inapplicable and not relevant to this application. Ocean levels and predicted sea level changes for the Byron Bay embayment have been documented in recent reports, including for the Council in the BSC rock seawall at the seaward end of Manfred St and along the seaward boundary of the private property to the NW of Manfred Streel (Umwelt 2013, WRL 2013).

We ask for clarification of the relevance to a repair application and reserve the right to respond further if clarification is provided. We do not adopt these reports on this issue.

**f. Wave heights;**

**Response:** The works are "repair" not "design". Wave heights for the Byron Bay embayment have been documented in recent reports and specifically for the BSC rock seawall at the seaward end of Manfred St and along the seaward boundary of the private property to the NW of Manfred Streel (Umwelt 2013, WRL 2013). Again, we query the relevance to an application to repair a wall which the Supreme Court has ordered must stay in place. We do not adopt these reports on this issue.

.

**g. Toe scour levels;**

**Response:** As per x-sections in drawings – Attachment A.

**h. Crest levels;**

**Response:** As per x-sections in drawings – Attachment A.

**i. The type of hydraulic stability assessment used to underpin the proposed design and parameters adopted;**

**Response:** The works are "repair" not "design". However, the boulders used to construct the present wall were designed for the site and are of a similar size, and hydraulic stability as the rock seawall constructed recently for BSC at the seaward end of Manfred St and along the seaward boundary of the private property to the NW of Manfred Streel (Umwelt 2015, WRL 2013).

International Coastal Management PTY LTD (ICM)
OFFICE 50 / G Arm, SYC Marina. Main Beach. Qld. 4217. Australia
POST PO Box 306. Main Beach LPO. Main Beach. Qld. 4217. Australia
TELEPHONE +61 7 5564 0564 FAX +61 7 5532 9147
WEBSITE www.coastalmanagement.com.au

In proceedings in 2015, the Land and Environment Court permitted the construction of this wall to proceed.

**j. Any movement (or spread/migration) of the structure that could be anticipated over the proposed life of the works.**

**Response:** The wall is now well founded with the toe below -1m AHD. Careful stacking during repairs will minimise any future movement of the structure. Once repaired, some rocks on the seaward face may move and be displaced during major erosion events > 1 in 10yr ARI and may need to be restored to as part of a maintenance programme by owners as per the previous report provided by ICM 2017 (see page 4) and in particular:

- *"Once repaired the walls will be able to resist damage from minor erosion events and wave impacts. Based on my observations of the behaviour of the walls and records of erosion cycles over the past 25 years, the repaired walls should be able to cope with about a 1 in 10 year ARI storm without needing any significant maintenance."*

The walls are more vulnerable to movement in their current state of repair. The Coastal Panel should expedite its consideration of this application to avoid the present dangers. An unprotected sand dune escarpment would also pose a greater danger. The repair of the existing wall provides the best option for safety. See also the response to 4(d) which describes the classification as low risk.

**The engineering report should also detail how the proposed structure will tie in to existing structures to the north and south of the proposed development, and how the expected differences in engineering standards will be managed with respect to the considerations outlined in s55M of the *Coastal Protection Act* 1979.**

**Response:** The structure will tie in to adjacent structures by 10m as shown on the drawings (Attachment A). This transition will minimize differences between adjacent structures.

ICM 2017 (see pages 3 – 4) and ICM 2016 (see page 9) previously provided to the Panel has detailed how impacts on adjacent structures will be avoided:

- *"The repair works will not cause any increased erosion of the beach or adjacent land as:*
    - *The footprint of the repaired wall will be smaller and will not extend as far seaward.*
    - *The repaired wall face will be less reflective during erosion events.*
    - *The proposed repair works will also reduce the risk of erosion and a breakthrough of the Belongil Spit at this site that would result in damage to adjacent lands as well as Childe Street with the associated public infrastructure to westward of the subject property.*
    - *As a result, any impacts on the beach and adjacent land will be the same, or less, than at present."*

International Coastal Management PTY LTD (ICM)
OFFICE 50 / G Arm, SYC Marina. Main Beach. Qld. 4217. Australia
POST PO Box 306. Main Beach LPO. Main Beach. Qld. 4217. Australia
TELEPHONE +61 7 5564 0564 FAX +61 7 5532 9147
WEBSITE www.coastalmanagement.com.au

**Q5.A description of coastal processes and hazards (within the meaning of the *Coastal Protection Act* 1979), including sea level rise (being projected sea levels which have been peer-reviewed and widely accepted by scientific opinion) and other associated climate change impacts (as relevant) predicted to affect the beach in the vicinity of the proposed works.**

**Response:** The works are repair of an existing structure. The impact of the repair works on coastal hazards, as defined in the Coastal Protection Act 1979, will be:

a) beach erosion – no change
b) shoreline recession - no change
c) coastal lake or watercourse entrance instability – no change
d) coastal inundation – reduced risk of inundation of low coastal lands to landward of the wall due to breach of the wall.
e) coastal cliff or slope instability – reduced slope instability
f) tidal inundation – reduced risk of tidal inundation and damage to Belongil Creek and wetlands
g) erosion caused by tidal waters, including the interaction of those waters with catchment floodwaters - reduced risk of erosion by tidal waters and damage to Belongil Creek and wetlands

Sea level rise and other associated climate change impacts (as relevant) predicted to affect the beach in the vicinity of the proposed works have been documented in recent reports and specifically for the BSC rock seawall at the seaward end of Manfred St and along the seaward boundary of the private property to the NW of Manfred Streel (Umwelt 2013, WRL 2013). Council has other reports. We query the relevance to an application to repair an existing rock wall which the Supreme Court has ordered to stay in place. We do not adopt these reports on this issue

**Q6. A description of the:**

**a. potential effect of such coastal processes and hazards on the proposed structure; and**

**b. the likely impacts of the proposed structure on these coastal processes and hazards.**

**The description should:**

**c. include details of the extent to which the proposed structure will be exposed from lowered beach conditions over the course of its proposed life and how this will affect public access and beach usage.**

**d. provide estimates of the impacts of the proposed structure on the beach's sediment budget, including through storm erosion, underlying recession and projected sea level rise over the design life.**

**Response:** Your question appears to be addressed to a new structure – this is an application to repair an existing structure. To date, the wall has provided protection from the

coastal processes and hazards and its ability to resist these in the future will be improved by the proposed repairs and maintenance.

WRL 2013 (Section 8.7.2) and Umwelt 2013 (Section 5.2.1) noted that as the Manfred Street wall (and other walls included in the appraisal) *"are a replacement for an existing protection structure, so they would have no additional (incremental) impact beyond the status quo."* The same applies to the proposed works that are repairs to an existing structure and there will be additional (incremental) impact beyond the status quo on the coastal processes or increased additional (incremental) hazards to or from the wall. As per response to Q6 above there will be some reduction in hazards after the wall is repaired.

The wall is well founded with the toe below -1m AHD to accommodate any beach lowering if this occurs from time to time. The repairs will not result in any additional (incremental) impact on beach levels or beach sediment budget. As repairs entail restacking of rocks displaced seaward, the repaired wall will provide improved public access and beach usage now and into the future.

**Q7. An assessment of wave overtopping of the proposed structure and how this will be managed to ensure the safety of humans and assets located landward of the structure and the structural integrity of the protection works themselves. This assessment should include all relevant calculations to estimate the wave overtopping rates.**

**Response:** To date the wall crest height and structure has been adequate to resist failure by overtopping and its ability to resist overtopping will be improved by the repairs and maintenance.

There is low risk to the safety of humans and assets located landward of the structure. For the recent wall constructed at and adjacent to Manfred Street, WRL 2013 stated: *"ISO 21650:2007 provides the following commentary: "Temporary and small coastal structures would belong to the very low safety class. Larger coastal structures such as … exposed seawalls protecting infrastructure would belong to the low safety class. Breakwaters protecting an LNG terminal or a power station would belong to the normal safety class whereas a sea dyke protecting populated low land would belong to the high safety class."*

*Based on the above guidance, WRL considers the proposed interim works at the Belongil site as being either Very Low or Low safety class according to ISO 21650:2007."*

This applies equally to the subject site –*"the site can be classified as being either Very Low or Low safety class according to ISO 21650:2007*." (see WRL 2013 Page 20)

The Land and Environment Court allowed the building of this wall to proceed.

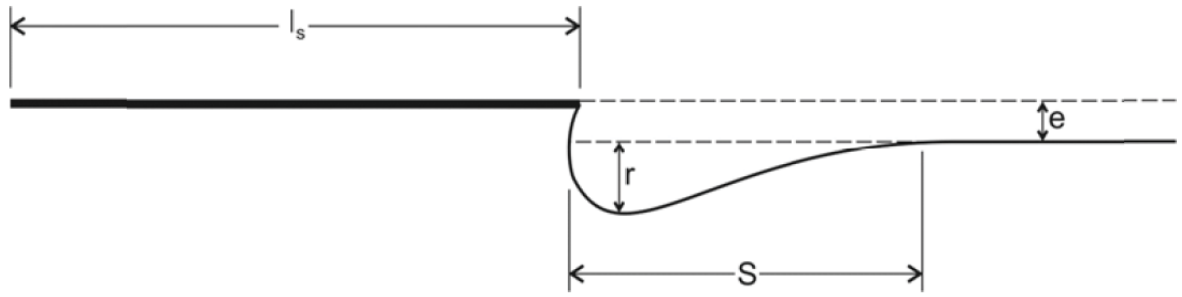
Any damage due to overtopping should be repaired during the life of the structure as set out in the original application.

**Q8. An assessment of end effects to both the north and south of the structure, or if contiguous with another structure, the impact on that structure, including but not limited to any 'tie-in' arrangements. This assessment should include a diagram illustrating the potential end effects of the structure.**

**a. Such diagram to be prepared in accordance with the methodology in *McDougal et al 1987* or other reputable methods or modifications and is to include a specification of the (S), (r), (e) and ($l_s$) values used and how they were determined. If the shape of the end effects calculated does not conform to the shape in *McDougal et al 1987* or other reputable methods, an explanation of the variation is to be provided.**

**b. Such assessment to include consideration of the cumulative impact of the structure, having regard to its proposed connection or interaction with end effect impacts of other existing structure within the active beach margins around the embayment**

**Response:** An assessment of such effects was provided in the original application. McDougal et al 1987provided the following diagram for end effects of seawalls on a straight beach:




(Source: McDougal *et al*, 1987)

*Figure 1*

The proposed works are part of a near continuous seawall on a **curved** beach that stretches from the northernmost private property on Belongil Spit to Border Street. Southward of border Street and along the old Jetty site, natural coffee rock forms a limiting structure as does the Jonson Street structure (WRL 2013). WRL (2013) calculated that the total length ($l_s$) is 1,727m. The subject wall is about 40m long (about 3%) including the 10m tie ins at each end..

WRL 2013 (Section 8.7.2 - Off Site Impacts of Proposed Interim Beach Access Stabilisation Works) found that:

*"The following statements regarding off site impacts apply to the proposed interim beach access stabilisation works:*

- *They make up only a small proportion (< 10%) of hard structures on the beach;*
- *They are a replacement for an existing protection structure, so they would have no incremental (additional) impact beyond the status quo; and*
- *They would reduce the likelihood of flanking failure to surrounding protection works."*

Similarly, as the proposed repairs are to an existing section of the seawalls and is only about 3% of the length of hard structures on the beach, the proposed repair works will have "*no additional (incremental) impact beyond the status quo"* on the magnitude of variables r

and S in the formula even if it were applicable and the proposed repair works will "*reduce the likelihood of flanking failure to surrounding protection works"*.

The proposed repair works will NOT result in failure of works on adjoining properties. The Supreme Court of NSW Orders show the extent of the current protection for the subject properties to be repaired as extending to either side of the subject properties – see drawing following extracted from Court Orders. This overlap was included in the current protection to be repaired as the adjacent walls provide protection to the subject properties. The repaired walls will be smoothly transitioned into the adjacent walls to avoid a weak area at the boundaries or adverse impacts on the adjacent walls during repairs. This was already explained in the original application.

**International Coastal Management** PTY LTD **(ICM)**
OFFICE 50 / G Arm, SYC Marina. Main Beach. Qld. 4217. Australia
POST PO Box 306. Main Beach LPO. Main Beach. Qld. 4217. Australia
TELEPHONE +61 7 5564 0564 FAX +61 7 5532 9147
WEBSITE www.coastalmanagement.com.au

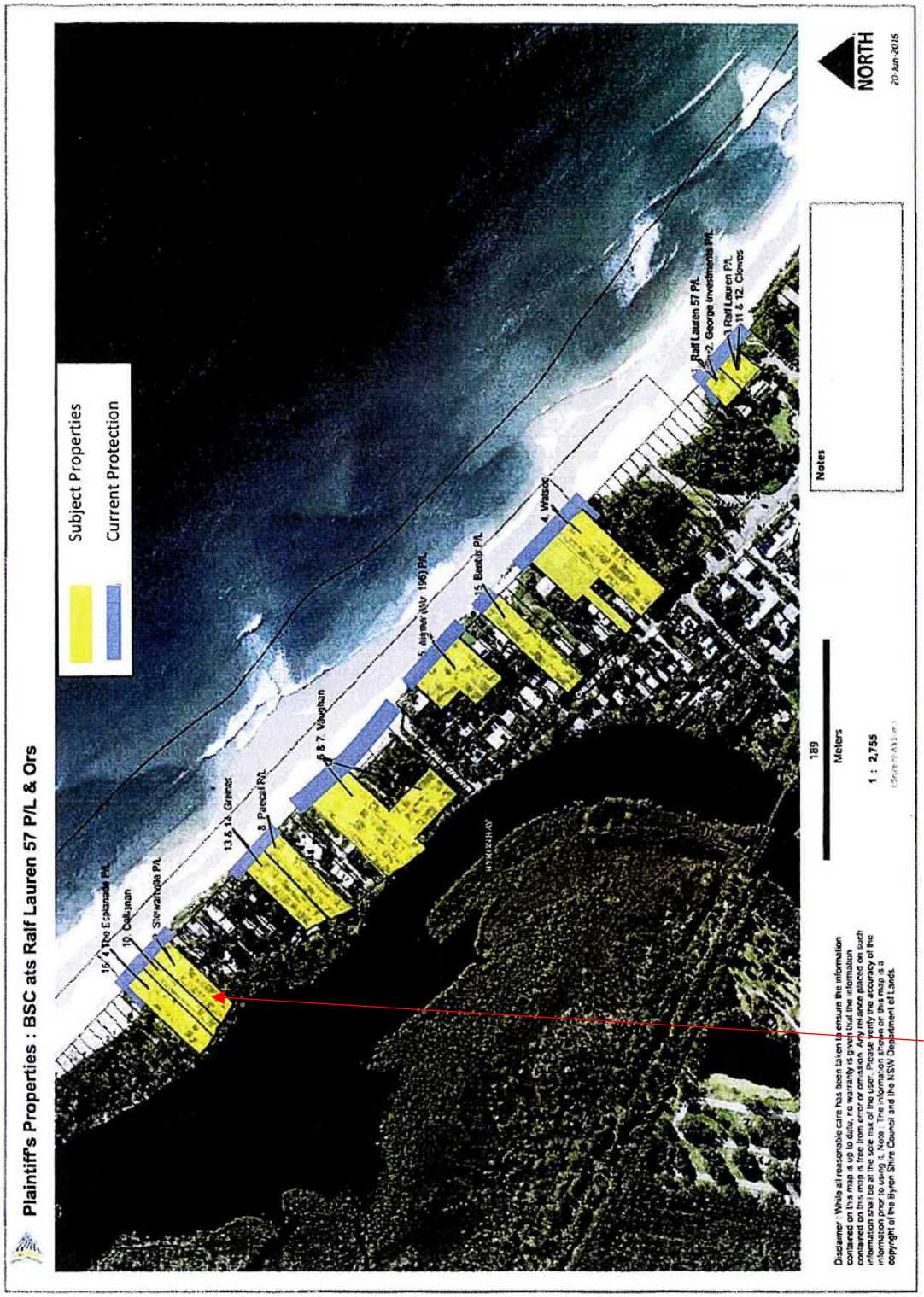



*Figure 2 Schedule 1 from Court Orders*

**International Coastal Management** PTY LTD **(ICM)**
OFFICE 50 / G Arm, SYC Marina. Main Beach. Qld. 4217. Australia
POST PO Box 306. Main Beach LPO. Main Beach. Qld. 4217. Australia
TELEPHONE +61 7 5564 0564 FAX +61 7 5532 9147
WEBSITE www.coastalmanagement.com.au

**Q9. Details of the proposed long term inspection, monitoring, management and maintenance regime both for the structure itself, as well as the monitoring and mitigation of impacts of the structure, over the life of the structure, on the adjoining beach and surrounding areas. Include details of who is proposed to be responsible to implement each regime element as well as proposed conditions offered to ensure implementation.**

**Response:** These matters have already been dealt with in the documents lodged with the application. As there stated, the proposed repair works should be maintained by the owner of the land that the wall protects. During the life of the wall, the wall should be inspected after each erosion event that exposes the seaward face of the wall to below MHWS (presently 0.66m AHD). 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.

As the repair works will have no incremental (additional) impact beyond the status quo, monitoring and mitigation of impacts of the structure, over the life of the structure, on the adjoining beach and surrounding areas is not necessary.

The urgent need for repairs was identified to Council in the 2013 report to BSC by Worley Parsons and in more recently with this application in ICM 2016 (see page 10) and ICM Jan 2017 (see page 4) .

**International Coastal Management** PTY LTD **(ICM)**
OFFICE 50 / G Arm, SYC Marina. Main Beach. Qld. 4217. Australia
POST PO Box 306. Main Beach LPO. Main Beach. Qld. 4217. Australia
TELEPHONE +61 7 5564 0564 FAX +61 7 5532 9147
WEBSITE www.coastalmanagement.com.au

## REFERENCED REPORTS USED IN RESPONSES

ICM Dec 2016 Urgent Repairs to Seawalls at 6 Childe Street, Belongil

ICM Jan 2017 Urgent Repairs to Seawalls at 6 Childe Street, Belongil - Offsite Erosion Management Plan

McDougall WG, Sturtevant MA and Komar PD 1987. 'Laboratory and field investigations of the impact of shoreline stabilization structures and adjacent properties', Proceedings of Coastal Sediments '87, ASCE, pp 962–973.

Umwelt, 2013. Review of Environmental Factors for Interim Beach Access Stabilisation Works at Belongil, Byron Bay. Report 3209/RO1/Final.

University of NSW Water Research Laboratory, 2013. "Design of Interim Beach Access Stabilisation Works – Belongil, Byron Bay" WRL Technical Report TR 2013/08. Report for BSC

Worley Parsons 2013. "Byron Bay Erosion Protection Structures – Risk Assessment" Report for BSC

The last 3 of these reports are attached.

Signed

[redacted]

Leslie Angus Jackson
BE, CPEng, RPEQ

14/3/17

**International Coastal Management** PTY LTD **(ICM)**
OFFICE 50 / G Arm, SYC Marina. Main Beach. Qld. 4217. Australia
POST PO Box 306. Main Beach LPO. Main Beach. Qld. 4217. Australia
TELEPHONE +61 7 5564 0564 FAX +61 7 5532 9147
WEBSITE www.coastalmanagement.com.au

## ATTACHMENT A

## DRAWINGS REVISED 14/3/17

International Coastal Management PTY LTD (ICM)
OFFICE 50 / G Arm, SYC Marina. Main Beach. Qld. 4217. Australia
POST PO Box 306. Main Beach LPO. Main Beach. Qld. 4217. Australia
TELEPHONE +61 7 5564 0564 FAX +61 7 5532 9147
WEBSITE www.coastalmanagement.com.au

International
Coastal
Management

OFFICE 50G 1 MacArthur Parade, Main Beach, 4217, QLD, Australia
POST PO Box 306, Main Beach LPO, Main Beach QLD, 4217, Australia
TELEPHONE +61 7 55640564 FAX +61 7 55329147
WEBSITE www.coastalmanagement.com.au

# Belongil Seawall Repairs

## 6B CHILDE STREET
## (Lots 32 and 33 in Section 3 of DP1623)

## DRAWING REGISTER

28.02.17

BSR - CS5 - 001 A COVER PAGE
BSR - CS5 - 002 A PLAN VIEW (PRESENT)
BSR - CS5 - 003 A X-SECTION (PRESENT)
BSR - CS5 - 004 A REPAIR WORKS
BSR - CS5 - 005 A CONSTRUCTION PLAN


# SITE PLAN

LOCALITY PLAN

NOTES

- Cadastral Data from NSW Globe KML for Google Earth, NSW Land & Property Information

LEGEND

- Approximate Property Boundary
- X-Section

VERTICAL DATUM: AHD | HORIZONTAL DATUM: -

REVISION REGISTER

| REV.NO. | DATE | DESCRIPTION | BY | ENG. | APP. |
|---|---|---|---|---|---|
| - | - | - | - | - | - |
| - | - | - | - | - | - |
| - | - | - | - | - | - |
| - | - | - | - | - | - |
| - | - | - | - | - | - |
| A | 24/02/17 | Updated Drawing | SK | AJ | AJ |

International Coastal Management
OFFICE 50G 1 MacArthur Parade, Main Beach, 4217, QLD, Australia
POST PO Box 306, Main Beach LPO, Main Beach QLD, 4217, Australia
TELEPHONE +61 7 55640564 FAX +61 7 55329147
WEBSITE www.coastalmanagement.com.au

PROJECT NAME
BELONGIL SEAWALL REPAIRS

DRAWING TITLE
PLAN VIEW (PRESENT)

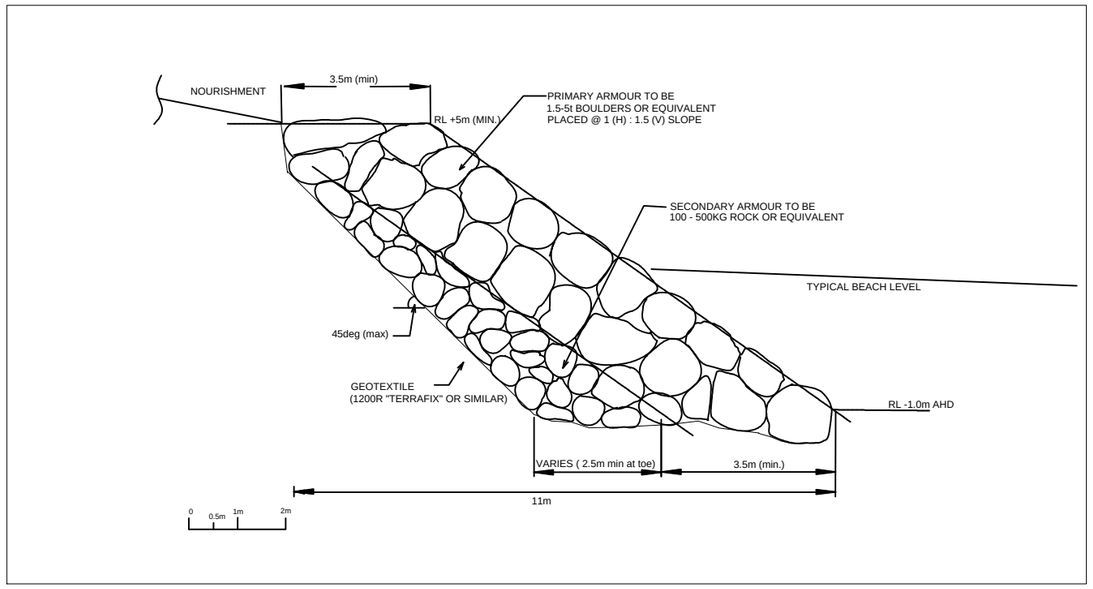
DRAWING No. BSR - CS5 - 002

REVISION: A

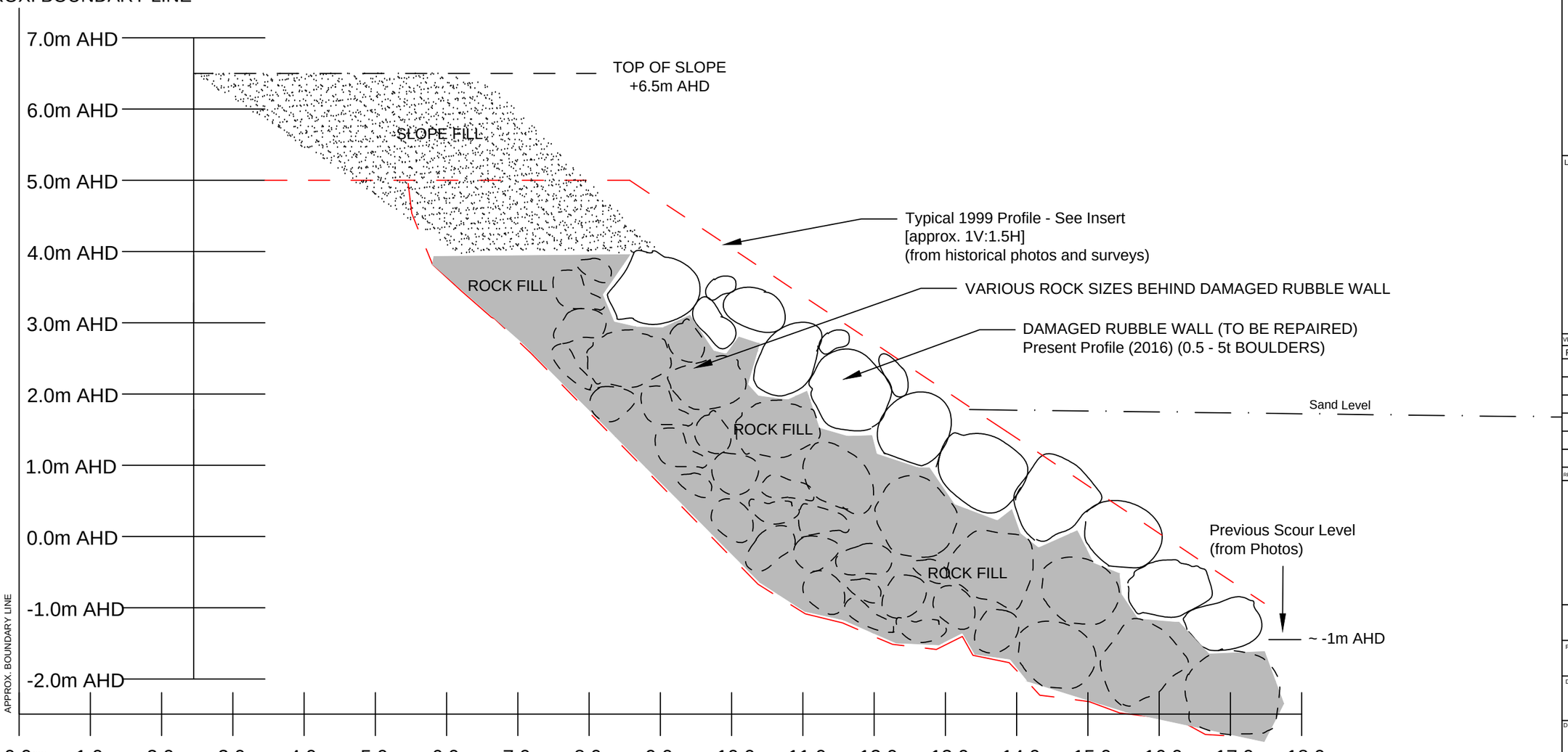
DRAWN : SK | CHECKED : AJ | APPROVED : AJ RPEQ 2876

SIZE: A3 | SCALE : A3 | DATE : 28 Feb, 2017

PHOTO




From ICM BELONGIL EROSION PROTECTION WORKS (1999)




# X-SECTION (PRESENT)

LOCALITY PLAN

NOTES

- Present profile
- Grey shaded area shows estimated location of rocks based on wall slump and volume displacement

LEGEND

VERTICAL DATUM: AHD | HORIZONTAL DATUM: -

REVISION REGISTER

| REV.NO. | DATE | DESCRIPTION | BY | ENG. | APP. |
|---|---|---|---|---|---|
| A | 24/02/17 | Updated Drawing | SK | AJ | AJ |


International Coastal Management

OFFICE 50G 1 MacArthur Parade, Main Beach, 4217, QLD, Australia
POST PO Box 306, Main Beach LPO, Main Beach QLD, 4217, Australia
TELEPHONE +61 7 55640564 FAX +61 7 55329147
WEBSITE www.coastalmanagement.com.au

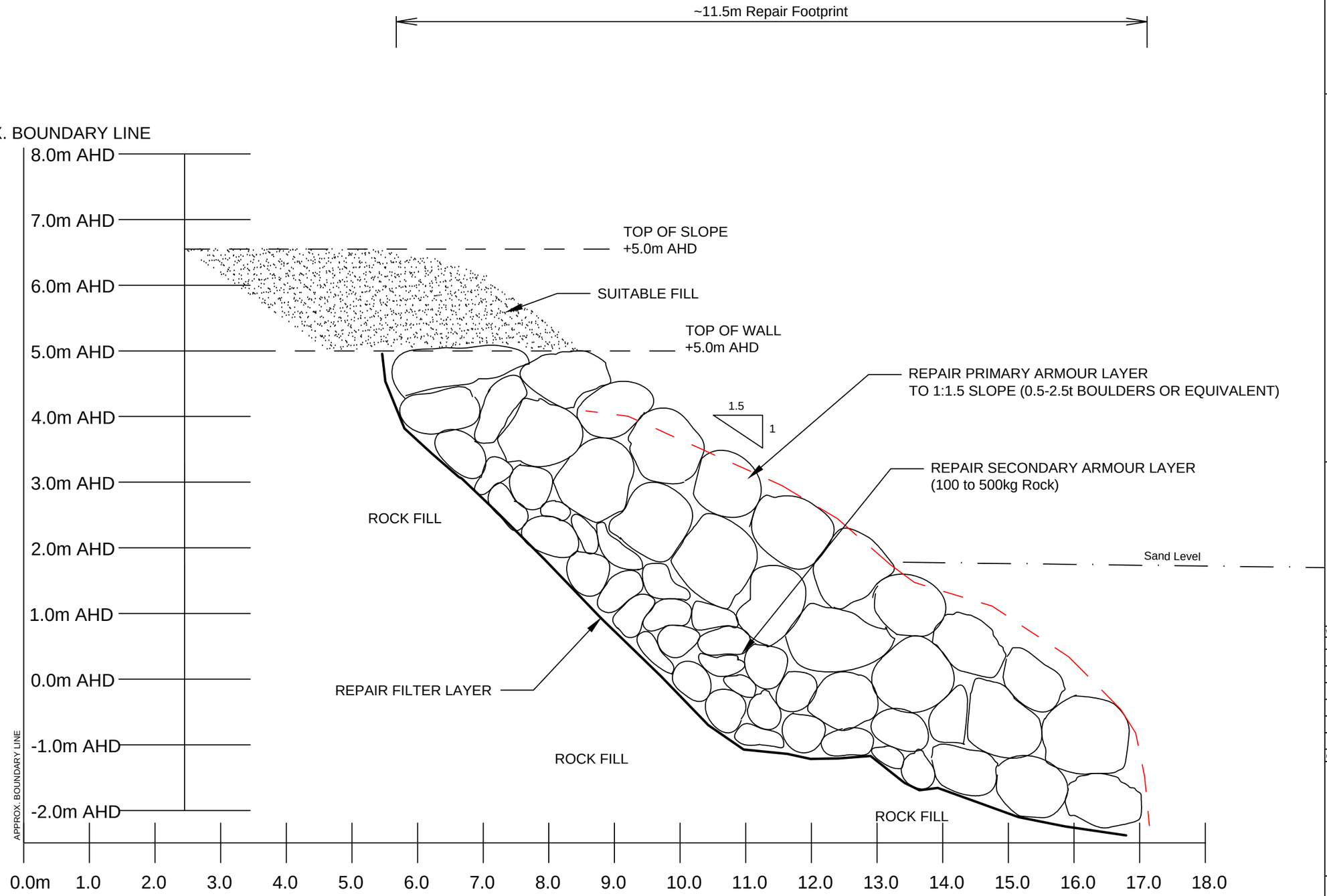

PROJECT NAME
BELONGIL SEAWALL REPAIRS

DRAWING TITLE
X-SECTION (PRESENT)
6 CHILDE STREET

DRAWING No. BSR - CS5 - 003 | REVISION: A

DRAWN : SK | CHECKED : AJ | APPROVED : AJ
RPEQ 2876

SIZE: A3 | SCALE : A3 | DATE : 28 Feb, 2017




# TYPICAL REPAIR PROFILE

LOCALITY PLAN

NOTES

- Repairs to be in accordance with Supreme Court of NSW Consent Orders 2010/426976 Dated 12/08/16

LEGEND

Present Profile (2016)

VERTICAL DATUM: AHD | HORIZONTAL DATUM: -

REVISION REGISTER

| REV.NO. | DATE | DESCRIPTION | BY | ENG. | APP. |
|---|---|---|---|---|---|
| A | 24/02/17 | Updated Drawing | SK | AJ | AJ |

International Coastal Management
OFFICE 50G 1 MacArthur Parade, Main Beach, 4217, QLD, Australia
POST PO Box 306, Main Beach LPO, Main Beach QLD, 4217, Australia
TELEPHONE +61 7 55640564 FAX +61 7 55329147
WEBSITE www.coastalmanagement.com.au

PROJECT NAME
BELONGIL SEAWALL REPAIRS

DRAWING TITLE
REPAIR WORKS
6 CHILDE STREET

DRAWING No. BSR - CS5 - 004 | REVISION: A

DRAWN : SK | CHECKED : AJ | APPROVED : AJ

RPEQ 2876

SIZE: A3 | SCALE : A3 | DATE : 28 Feb, 2017


# CONSTRUCTION PLAN

LOCALITY PLAN

NOTES

1. Construction access to be from 'Old Jetty Site' - Construction access to be adequately fenced
2. Smooth transition of crest and toe to adjacent wall (Typical)

LEGEND

Safety Fence

Approximate Property Boundary

VERTICAL DATUM: AHD | HORIZONTAL DATUM: -

REVISION REGISTER

| REV.NO. | DATE | DESCRIPTION | BY | ENG. | APP. |
|---|---|---|---|---|---|
| - | - | - | - | - | - |
| - | - | - | - | - | - |
| - | - | - | - | - | - |
| - | - | - | - | - | - |
| - | - | - | - | - | - |
| A | 24/02/17 | Updated Drawing | SK | AJ | AJ |

International Coastal Management
OFFICE 50G 1 MacArthur Parade, Main Beach, 4217, QLD, Australia
POST PO Box 306, Main Beach LPO, Main Beach QLD, 4217, Australia
TELEPHONE +61 7 55640564 FAX +61 7 55329147
WEBSITE www.coastalmanagement.com.au

PROJECT NAME
BELONGIL SEAWALL REPAIRS

DRAWING TITLE
CONSTRUCTION PLAN

DRAWING No. BSR - CS5 - 005 | REVISION: A

DRAWN : SK | CHECKED : AJ | APPROVED : AJ
RPEQ 2876

SIZE: A3 | SCALE : A3 | DATE : 28 Feb, 2017

## ATTACHMENT B

## ICM Report 2000

International Coastal Management PTY LTD (ICM)
OFFICE 50 / G Arm, SYC Marina. Main Beach. Qld. 4217. Australia
POST PO Box 306. Main Beach LPO. Main Beach. Qld. 4217. Australia
TELEPHONE +61 7 5564 0564 FAX +61 7 5532 9147
WEBSITE www.coastalmanagement.com.au

Report on

# PROPOSED
# INTERIM EROSION PROTECTION WORKS
# FOR LOTS 32 TO 36 SECTION 3 OF DP 1623

## PART A: DESIGN REPORT

Prepared by Angus Jackson

INTERNATIONAL COASTAL MANAGEMENT

Revised 28/1/2000

INTERNATIONAL COASTAL MANAGEMENT

Ph 07 55 640564

Fax 07 55 329147

EMAIL icm@onthenet.com.au

Web www.onthenet.com.au/~jackson

## INTRODUCTION

Following the issue of emergency police orders to protect Lots 32 & 33 (n° 6 Childe St) in an effective and efficient manner, a design typical cross section (drawing n° BB-GT-99-01) for interim erosion protection works was prepared to allow works to commence on these lots as a matter of urgency. The proposed design was similar to that constructed by the landholders of Lots 17-26 to the south, and would be suitable for the remaining private properties to the north (Lots 32 to 36), all of which are at significant risk from erosion. This design was based on extensive experience with emergency protection works, and evaluation of those local works which have proven to be effective and efficient. The design was more substantial than the sand bag wall to protect Lots 27-31 constructed by Byron Shire Council without any detailed design.

The emergency interim works to protect Lots 31 – 36 were stopped after an injunction from Byron Shire Council, and a design report and other details have been requested. To fulfil the request for a design report, this report sets out the issues considered and the criteria adopted in the design of the interim works. The other details requested are being prepared by Mr Phil Wallace of Smith + Wallace, the locally based consulting engineers who designed the upper bank stabilisation, and supervised the setout and construction of the works to date.

## BACKGROUND

Since the early 1980's I have maintained a professional interest in the studies and ongoing emergency works at Byron Bay. In 1992, I was employed as a coastal engineering consultant for several coastal management matters by Byron Shire Council. In light of my background in the design and construction of erosion protection works I was approached by the landholders of Lots 17-26 to advise on interim emergency protection works for those lots. Subsequently, I was approached by Mr Geoff Tauber (Lots 32 & 33), and on 7/8/99 I inspected the erosion along the remaining unprotected private properties (Lots 31 – 36) to ascertain what work was required to protect these properties, and specifically for him to comply with the police order for him to protect his property.

At the time I inspected the beach and these properties, there was a high unstable erosion scarp. The tide was high, and although it was only a neap (low tidal range) tide and the waves were relatively small, they were reaching the toe of the erosion scarp. The larger waves were reflecting from the scarp. A number of mature trees had fallen across the beach as a result of the erosion and were a hazard to beach users, and more trees were in imminent danger of falling as the top of the bank collapsed. The top of the erosion scarp appeared to be along the property boundaries in places, and was in the order of 10 m landward of the seaward face of the sandbag wall which had been constructed by Byron Shore Council (BSC) as emergency works to comply with

the police order to protect the properties immediately to the south of Lot 32. It was evident to me that: -

- the above properties were in danger of severe damage if further erosion occurred
- the unstable bank was a danger to the public
- if the erosion of Lot 32 continued, the emergency erosion protection works constructed by Byron Shire Council to seaward of Lot 31 could be outflanked, damaged and rendered ineffective.

The survey of the affected properties prior to commencement of works is attached as attachment A.

## RECOMMENDED WORKS

A wide variety of erosion protection works have been used along the Byron Bay foreshores. These include: -

- natural protection from dune only
- beach scaping
- car bodies
- timber pile walls and groynes
- concrete blocks and rubble
- hay bales
- sand filled bags
- rock walls

As well as these type of works there are now a number of engineered modular systems such as rock filled gabions and precast interlocking concrete units which are used for erosion protection works.

In the design of the recommended erosion protection works the following issues were considered pertinent: -

- Severe erosion had continued to cut into the properties during the winter period over which accretion would normally occur. (While severe erosion can occur in winter, this is not as usual as in summer) Sand appears to be moving into Byron Bay around Cape Byron, but this is likely to be slow, and even in the absence of further storms, full recovery of the upper beach to provide an adequate storm buffer before the summer storm season was not likely. Therefore the beach erosion is very likely to worsen at times before winter next year and "no action" is not a practical option.

- 1.5-2t sand filled geotextile bags was being used to protect the adjacent properties southward. The bag size is relatively small, and while this type of structure is often favoured as it can be removed easily if necessary, the geotextile can be damaged

during construction or by vandals. Damage to some of the sand filled bags is already evident.

- Damage to the sandfilled bags can lead to rapid failure of the whole structure during storm wave attack. Should the erosion protection works fail during a future erosion event, safe access by equipment along the seaward side of the property to repair the wall will be very difficult, and may in fact be impossible.

- Emergency rock walls constructed (without design) during past severe erosion situations to the south and other similar coastal areas have proven to be effective and efficient. Such walls can be topped up or removed if necessary. Rock walls can easily be upgraded and repaired. Therefore, they are very suitable for interim works where the design conditions may be exceeded, or they need to be upgraded for a longer recurrence interval event.

The works need to act as an interim protection measure until the Coastal Management Plan is completed and a comprehensive and integrated strategy can be implemented. This is expected to take a further 2-5 years. There are already many kilometres of erosion protection works that have been constructed to protect public and private assets to the south. When the Coastal Management Plan is completed, any interim erosion protection works may need to be removed, relocated or upgraded to comply with the plan. There is considerable concern that the proposed works will become permanent. However, if the works are designed to be enable removal, and are approved as interim works only, such interim protection works should not be stopped. The alternative is to risk further ad hoc works with the resultant risks and costs associated with the construction of works during erosion conditions

In light of the substantial risk to property and beach users, and as construction of effective erosion protection works is difficult, more costly, and often dangerous during a storm wave event, delays in implementation should be avoided.

Therefore it was considered that to provide a reasonable level of interim protection while the Coastal Management Plan is completed, suitable interim erosion protection works should be constructed to achieve the following objectives: -

- be able to designed and installed without critical delays
- be effective for at least 5 years
- be able to withstand short term overloading without failure
- be able to be upgraded after short term overloading or deterioration in conditions
- be removable or upgradable after determination of the Coastal Management Plan, if necessary
- not to cause significant adverse impacts to adjacent properties or beach amenity
- to complement protection works to the south

With the data and time available, design and construction of a "simple", robust rock wall based on the well-tested "Gold Coast" standard rock wall design was recommended for construction.

## DESIGN CRITERIA

To achieve the above objectives, the following design criteria were used:-

**Recurrence interval**: The wall design has been based on at least a min of a 1 in 10yr erosion event using the data available. This provides a minimum risk that the wall will be severely damaged over the next 2 – 5 years. Should the Coastal Management Plan include a rock seawall in the location of the proposed works, the proposed interim works can easily be rebuilt or additional armour added to achieve the desired standard which will need to be specified in the Coastal Management Plan.

**Wave heights:** Waves will be broken and depth limited at the seaward face of the wall. With the data available, for the proposed recurrence period, it is estimated that waves heights of up to approx. 3 m at the wall could occur. Experience has shown that the proposed design (which is based on the Gold Coast design) can provide protection for a greater size wave. Should larger waves occur, then some damage will result which can be repaired.

**Damage levels**: The works have been designed to accommodate up to at least a 1 in 10 year event. As rock walls are flexible they slump if the capacity of the wall is exceeded. After such damage, topping up would be required. With the proposed minimum crest height of +5.0m AHD and maximum toe level of -1.0m AHD, slumping and overtopping could occur but will be minimised for the design conditions. If a more conservative design is required, the crest level can be increased and the toe extended seaward and /or lower.

**Alignment**: To be efficient, it is important that the wall alignment is such that the property protected is maximised, but it must also be as far landward as practical to minimise potential adverse impacts on the beach and down drift properties. Obviously if the wall is only exposed to wave action for a small percentage of the time, then the adverse impacts will be small. However, the wall protecting the public carpark and caravan park at Byron Bay is well into the active beach zone, and would be expected to have had some impact on downdrift properties. The seaward property alignment of the properties to be protected is such that these properties are effectively further landward than the properties further southward where the erosion had intruded well within the properties. To join into the wall to the south which is along the erosion scarp, the wall alignment has been designed along the seaward property alignment. This will allow sufficient access between the back of the wall and the buildings on these properties for earth moving equipment to be used to top up or repair any damage to the walls. Also, in this location, the beach will not recede into private property in

which case the beach would then become private. During erosion periods, pedestrians will be able to walk along the top of the wall.

**Extent**: The works are designed to extend initially from the southern boundary of Lot 32 along a suitable alignment to the northern boundary of Lot 36. However, the works should be extended southward to the rock wall on Lot 26 using the same design cross section to protect all of the presently inadequately protected private properties north of Lot 26 to minimise further ad hoc design.

**Termination Details:** At the southern extremity of the new works, the new wall needs to link in with the existing walls to prevent a localised weak point. At least the short term, it is likely that the sandfilled geotextile bag wall along Lots 27-31 will remain. The new rock wall should join into the existing wall. As this wall appears to vary significantly from the design sketches provided, and as no detailed "as constructed" details have been provided, it will be necessary to determine on site the exact details of the join, when the excavation for the new wall exposes the back of the bags. The new rock wall should extend at least 2m into Lot 31 behind the alignment of the outer layer of bags, and the outer layer of bags replaced outside of the rock wall. Any excess bags should be used to deepen the toe and raise the crest at the join. In the longer term, it is likely that the rock wall will need to be extended to, and joined into, the similarly designed rock wall at Lot 26. This will involve overlapping of the geotextile and merging of the armour layers without a gap.

At the northern end the wall should initially be returned landward with the primary armour wrapping around the northern face. Ideally, the return should be at least 10m landward and the alignment of the top of the wall should preferably be along the northern alignment of Lot 36. However, this would involve construction on Lot 37 which is owned by DUAP. If approval is not forthcoming to construct the return as part of the emergency protection works it can easily be extended further landward if further erosion occurs at this end during the interim period.

**Rock size and type;** The rocks used must be durable, non-fractured and generally in the size ranges specified; primary armour 1.5 – 5t, secondary armour 100-500kg. As the works are both emergency and interim works, a tight specification on rock sizes was not initially detailed. It was assumed that approx 50% or greater of the rocks supplied from the quarry for each layer will be larger than the average size and this has been added to the design cross section. In practice, rock seawalls are very flexible and unless grossly underdesigned the slope can adjust to suit the wave conditions without failing. (eg light armour is stable if the slope is flatter - this is shown clearly by the behaviour of emergency dumped rock.) However, should the primary armour rock sizes be smaller than specified, then additional topping up will be required after the slope flattens. As rocks, boulders and sandbags up to the sizes shown in the design can be readily moved with an excavator fitted with a rock grab, the works can be removed or relocated if the works or their location are not in accordance with the Coastal Management Plan being prepared, or subsequent Coastal Management Plans. On the Gold Coast where all beachfront buildings over $25,000 must be protected by

an approved boulder wall along a designated alignment, it is not uncommon for the rocks and boulders in old substandard walls to be removed and a new wall constructed. If smaller rocks than specified are incorporated in the wall, this is not an issue as if they are not buried by wave action they can easily be removed from the beach by using a fixed or mobile sceening plant. This has been done successfully on the Gold Coast beaches.

**Geotextile**: A 1200 gram ( or heavier) needle punched geotextile is recommended. The geotextile needs to be continuous, and the joins should be lapped or sewn as per manufacturers spec.

**Impacts on beach and adjacent properties**: In evaluating the potential impacts the short and long term erosion rates have been considered. Of main concern are the short-term erosion impacts, which are far greater than the possible long-term impacts for the interim period. Further, there is a great deal of uncertainty about the long-term recession rates which will no doubt be addressed in the Coastal Management Plan. As the works are interim only at this stage, the long-term adverse effects to the beaches and properties in the vicinity of the works should be insignificant. The wall is intended for emergency protection in erosion events. It is likely that at most times waves will not reach the wall, and the wall will have no impact on the sand movements along the coast, or across the active beach profile which is both above and below water level. In storm wave events there is increase wave energy and the active beach profile extends further seaward and landward. During such events the wall will impact on the local coastal processes and in particular will dissipate wave energy. A general concern with rock walls in the active zone is that they can withhold sand from the active system, which may cause erosion downdrift. However, as these walls are not isolated and are not seaward of the adjoining walls to the south, additional erosion of the unprotected properties to the north is not considered a major issue for interim works.

## FINAL DESIGN

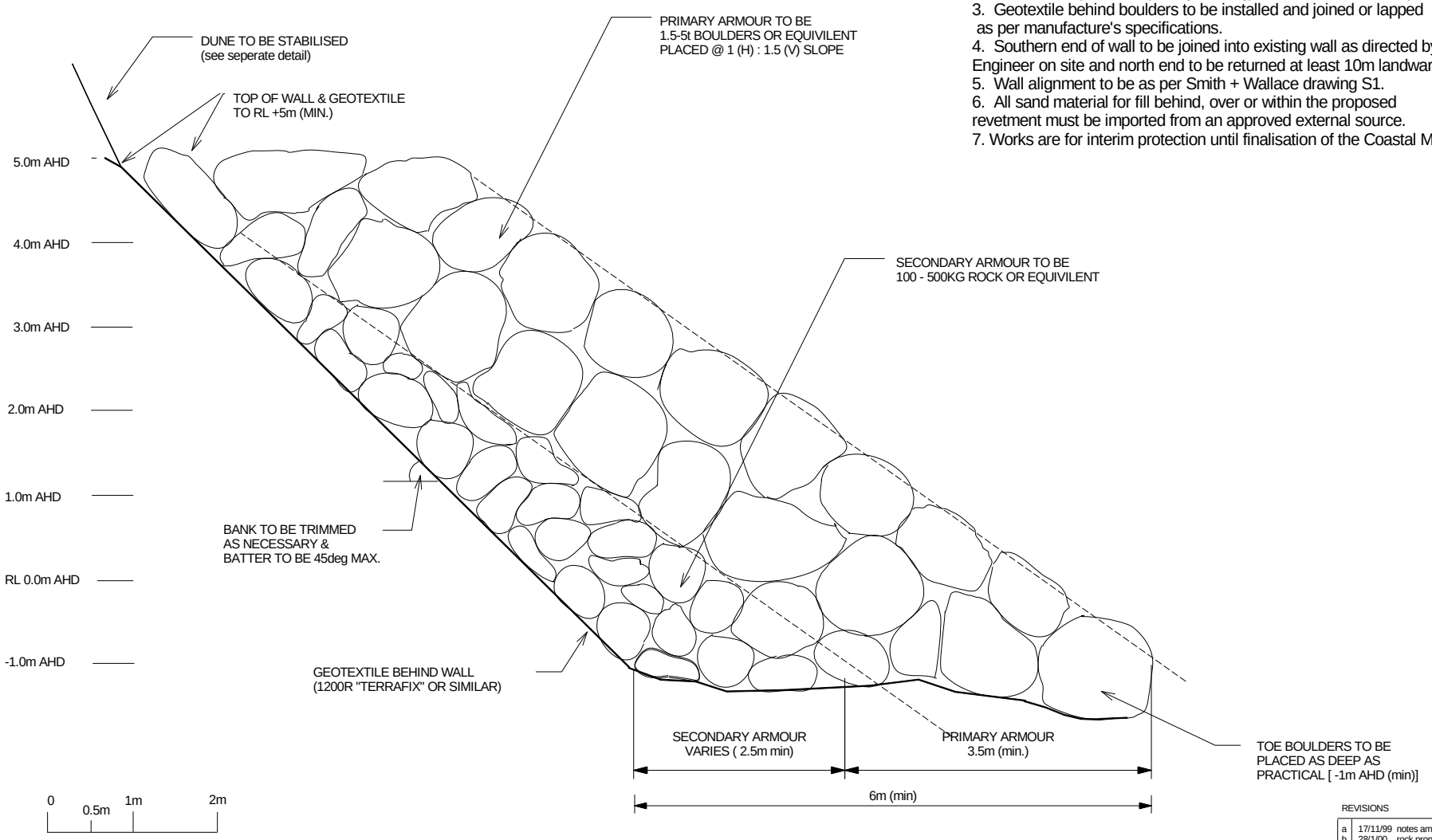
Specific issues raised by Byron Shire Council officers, the mayor and their engineering adviser Doug Lord, have been incorporated where practical into the final design, which is suitable for Lots 27 – 36 (drawing n° BB-31/38-99-01a). A copy of the final cross section is attached as attachment A.

# ATTACHMENT A

DRAWING BB-31/38-99-01b

NOTES:

1. Rock to be as per min. weights specified and not to be fractured during quarring or placement.
2. Rock sizes to be such that at least 50% of rocks in each layer are greater than the average of the weight range specified. ie:-
   for primary armour (1.5t - 5t) at least 50% of rock by weight >3.25t
   for secondary armour (100kg - 500kg) at least 50% of rock by weight >300kg
3. Geotextile behind boulders to be installed and joined or lapped as per manufacture's specifications.
4. Southern end of wall to be joined into existing wall as directed by Engineer on site and north end to be returned at least 10m landward.
5. Wall alignment to be as per Smith + Wallace drawing S1.
6. All sand material for fill behind, over or within the proposed revetment must be imported from an approved external source.
7. Works are for interim protection until finalisation of the Coastal Management Plan.




REVISIONS

| | | |
|---|---|---|
| a | 17/11/99 | notes amended |
| b | 28/1/00 | rock proportions added to note 2<br>additional note 7 added<br>"interim" added to title |
| c | 5/06/00 | extended to include lots 27-36 |


INTERNATIONAL COASTAL MANAGEMENT
COASTAL ENGINEERING CONSULTANTS
P.O.BOX 7196
GOLD COAST MAIL CENTRE
AUSTRALIA 9726
PH. 07 5564 0564
PH/FAX 07 5532 9147
EMAIL icm@onthenet.com.au


INTERIM EROSION PROTECTION WORKS
LOTS 27-36, S3, DP 1623
BELONGIL

DESIGNED BY:
A. JACKSON
BE, CPENG, MIE

| SCALE | SHEET | DRAWING N° | REV. |
|---|---|---|---|
| AS SHOWN | | BB-31/38-99-01 | c |
| DATE 28/10/99 | APPROVED | TYPICAL X-SECTION | |