COASTAL VULNERABILITY ASSESSMENT

22 Grange Avenue, Taroona

CLIENT
Artas Architectural

August 2019
1 Introduction

Geo-Environmental Solutions Pty Ltd (GES) were contracted by Artas Architectural to prepare a coastal erosion hazard assessment for a property at Taroona. The project area consists of a single cadastral title (CT 197026/1) located at 22 Grange Avenue, Taroona (The Site).

An application to conduct construction works has triggered the assessment in accordance with the Interim Planning Scheme (IPS) 2015.

A shoreline erosion assessment has been conducted for the site area by Sharples & Donaldson (2014) which involved an assessment of coastline geomorphology and vulnerability to inundation and erosion processes. This assessment has been reviewed to assess site erosion susceptibility risk.

The proposed development is set back greater than 50 m from present day sea-levels (approximately 0.1 m Australian Height Datum (AHD) based on DPAC (2012) adopted projections and ranges in elevation from 12 m to 13 m AHD. Only a portion of the proposed deck resides within the coastal erosion hazard overlay.

GES have undertaken this assessment using available scientific literature and datasets. Estimations are determined by approximation with appropriate regional information applied where appropriate to site specific information. Data collection and site-specific modelling was undertaken in assessment of the site.

2 Objectives

The objective of the site investigation is to:

- Identify which codes need to be addressed in terms of coastal vulnerability and identify the performance criteria relevant to the project which need addressing;
- Conduct a literature review of all relevant geological, soil investigation and geomorphological information. which are relevant to the site;
- Assess site erosion vulnerability in terms of long term beach recession and short-term storm erosion.
- Conduct a site risk assessment for the proposed development ensuring relevant performance criteria are addressed; and
- Where applicable, provide recommendations on methods and design approach to reduce inundation and erosion impact.

3 Site Details

2.1 Project Area Land Title

The land studied in this report is defined by the following title reference:

- CT 197026/1

This parcel of land is referred to as the ‘Site’ and/or the ‘Project Area’ in this report.

2.2 Project Area Regional Coastal Setting

The site is located at 22 Grange Avenue, Taroona (Figure 1 & Figure 2). The site exposed to the following coastal processes:

- Coastal storm surge and tidal processes within the Derwent Estuary;
- Sea level rise; and
- Wind wave conditions from the northeast and east
Figure 1 Regional Location of Project Area - The Land and Information System, Tasmania (LIST)
3 Planning

3.1 Australian Building Code Board

This report presents a summary of the overall site risk to coastal erosion and inundation processes. This assessment has been conducted for the year 2069 which is representative of a ‘normal’ 50-year building design life category based on a 2018 baseline (ABCB 2015).

Per the Australian Building Code Board (ABCB 2015), when addressing building minimum design life:

‘The design life of buildings should be taken as ‘Normal’ for all building importance categories unless otherwise stated.’

As per Table 3-1, the building design life is 50 years for a normal building.

<table>
<thead>
<tr>
<th>Building Design Life Category</th>
<th>Building Design Life (years)</th>
<th>Design life for components or sub systems readily accessible and economical to replace or repair (years)</th>
<th>Design life for components or sub systems with moderate ease of access but difficult or costly to replace or repair (years)</th>
<th>Design life for components or sub systems not accessible or not economical to replace or repair (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short</td>
<td>1 &lt; dl &lt; 15</td>
<td>5 or dl (if dl&lt;5)</td>
<td>dl</td>
<td>dl</td>
</tr>
<tr>
<td>Normal</td>
<td>50</td>
<td>5</td>
<td>15</td>
<td>50</td>
</tr>
<tr>
<td>Long</td>
<td>100 or more</td>
<td>10</td>
<td>25</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 3-1 Design life of building and plumbing installations and their components

Note: Design Life (dl) in years
3.2 State Coastal Policy

On 16 April 2003 the State Coastal Policy Validation Act 2003 came into effect. This Act replaces the former definition of the Coastal Zone in the State Coastal Policy 1996 and reinstates the Policy. The Act also validates all previous decisions made under the Policy. The following clauses are pertinent to the scope of this report:

1.1. NATURAL RESOURCES AND ECOSYSTEMS

1.1.2. The coastal zone will be managed to protect ecological, geomorphological and geological coastal features and aquatic environments of conservation value.

1.4. COASTAL HAZARDS

1.4.1. Areas subject to significant risk from natural coastal processes and hazards such as flooding, storms, erosion, landslip, littoral drift, dune mobility and sea-level rise will be identified and managed to minimise the need for engineering or remediation works to protect land, property and human life.

1.4.2. Development on actively mobile landforms such as frontal dunes will not be permitted except for works consistent with Outcome 1.4.1.

1.4.3. Policies will be developed to respond to the potential effects of climate change (including sea-level rise) on use and development in the coastal zone.

3.3 The Tasmanian Building Regulations 2016

Building in hazardous areas

As outlined in the Department of Justice web site:

Hazardous areas include areas which are bushfire prone, comprise reactive soils or substances, or are subject to coastal erosion, coastal flooding, riverine flooding, and landslip.

Division 4 - Coastal erosion. Section 58. Works in coastal erosion hazard areas

(1) A person must not perform work in a coastal erosion hazard area unless he or she is authorised to do so under the Act.

(2) If a person intends to perform work in an investigation area of a coastal erosion hazard area, the person must, before performing the work, ensure that the land is classified in accordance with the coastal erosion determination (a) as being an acceptable risk;

(3) A responsible person for work being performed in a coastal erosion hazard area must ensure that the work is being performed in accordance with the Act and the coastal erosion determination.

(4) A person performing work in a coastal erosion hazard area must ensure that the work complies with the Act and the coastal erosion determination.

3.4 Interim Planning Scheme Overlays

3.4.1 Waterways & Coastal Protection Areas (WCPA) Overlay

The site is partially within the Waterways and Coastal Protection Overlay (Figure 3)
3.4.2 Inundation Prone Areas Code (IPAC) Overlay

The site is partially within the IPAC overlay (Figure 4).
3.4.3 Coastal Erosion Hazards Code (CEHC) Overlay

A portion of the site falls within the CEHC overlay (Figure 5).

![Figure 5 CEHC Overlay near the Site](image)

3.5 Proposed Development

The proposed development comprises of the following building structures (Table 1 & Figure 6):

- Proposed studio; and
- A proposed extension to an existing deck
- A proposed earth retaining wall

A 15 year design life is more applicable for proposed structures, however a 50 year design life will be used in the site assessment. The Greater Hobart 2013 LiDAR elevations have been used for Digital Elevation Model (DEM) display purposes and for inundation calculations. The LiDAR elevations have not been needed to be locally adjusted given that they are consistent with the site survey.

Table 1 Summary of Site Areas Falling Within Potential Coastal Vulnerability Zones

<table>
<thead>
<tr>
<th>Site Location</th>
<th>Elevation Range (m AHD)</th>
<th>WCPA (E11) Overlay</th>
<th>IPAC (E15.7.3) Overlay Low Risk</th>
<th>IPAC (E15.7.2) Overlay Medium Risk</th>
<th>IPAC (E15.7.1) Overlay High Risk</th>
<th>CEHC (E16) Overlay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proposed Studio</td>
<td>~13</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Proposed Deck</td>
<td>~12</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>100%</td>
</tr>
<tr>
<td>Extension</td>
<td></td>
<td></td>
<td></td>
<td>100%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retaining Walls</td>
<td>~6.9 to 9.8</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>100%</td>
</tr>
</tbody>
</table>
- Outside of Overlay

3.6 Acceptable Solutions

Where applicable, the need for further performance criteria compliance is outlined in Appendix 1.
3.6.1 Coastal Erosion Hazard Code (CEHC) Areas

Given that part of the proposed development deck extensions reside in the CEHC Area, and there are no acceptable solutions for buildings and works in a CEHC Area, the E16.7.1 P1 performance criteria will need to be addressed.

3.7 Performance Criteria

The following performance criteria are to be addressed:

- E16.7.1 P1

4 Site Vulnerability Assessment

4.1 Previous Studies

A coastal vulnerability assessment was conducted for the Kingborough Council in 2014 (Sharples & Donaldson 2014). The site area has been covered in the investigation. The key points identify in the assessment which are relevant to the site:

- The geology is dominantly very coarse-grained conglomerate with dolerite boulders in a clay matrix; and
- The shorelines comprise of coarse boulder lag deposits with minor slumping hazard. Mass wasting has given way to a heavily armoured shoreline which naturally attenuates swell wave runup, and limits shoreline erosion potential

4.2 Site Physical Setting

4.2.1 Site Topography, Drainage & Hydrogeology

The main residence has a 11° gradient sloping directly towards the coast which steepens to 20° past the proposed retaining wall structure (Figure 7 & Figure 8). Surface water drainage is directed towards the Derwent River approx. 50m to the south east.
4.2.2 MRT Geology Mapping

The geology of the site has been mapped by Mineral Resources Tasmania. The site is inferred to be underlain with:

- Jurassic age dolerite and related rocks.

4.3 Coastal Processes

Coastal modelling has not been conducted for the site. The proposed development area is considered a very low risk due to:

- The shallow land gradient compared with steep angles of repose within the cemented dolerite boulder deposits at an estimated 60°;
- Propensity for self-armouring through mass wasting and therefore a high potential for wave attenuation;
- Wave runup has not been calculated, but estimated Van Der Mere attenuation reductions are in the order of 60% with wave runup estimated at 3 m AHD; and

4.4 Site Erosion Susceptibility

Clay soils are vulnerable to slumping locally through wave scour and over steepening within the wave runup zone. Within the lifetime of the proposed development, there is a low risk that sea level rise induced recession rates and significant sequential 1 in 100-year storm events will induce erosion and slumping which may result in geotechnical instability within the proposed works areas with recession and storm erosion not expected to exceed 4 m by 2069.
Figure 8  Cross Section Through the Proposed Development Site
4.5 Risk Assessment

The qualitative risk assessment criteria have been developed to identify key risks that may arise from building works in areas that are vulnerable to erosion or inundation hazards. The risk assessment is based on 2069 projected life of the building.

The criteria are based on a risk assessment matrix consistent with Australian Standard AS4360 on Risk Management (AS4360). The qualitative assessment of risk severity and likelihood (Appendix 2) were used to help provide a qualitative risk assessment based upon the coastal vulnerability assessment completed for the site.

A detailed risk assessment addressing the performance criteria is presented in Appendix 3. GES has established from the risk assessment that the level of risk is acceptable within the lifetime of the proposed development works. There are no medium or high-risk aspects to the proposed development.

The proposed development is interpreted to be within the stable foundation zone based on the modelled 1% AEP 2069 storm erosion and recession assessment and is adequately set back from coastline. The site is elevated well above the modelled 1% AEP 2069 wave runup levels.

Kris J Taylor BSc (Hons)
Environmental & Engineering Geologist

5 Limitations

The following limitations apply to this report:

- Climate Futures Light Detection and Ranging (LIDAR) digital elevation model is used for the site modelling;
- The LIST cadastral information;
- The values estimated in this report provide an order of magnitude for assessing climate change impacts and in particular climate change induced sea level rise impacts. The information is based on a collation of existing information and data, with some site specific modelling for planning purposes.

6 References


CSIRO (Commonwealth Scientific and Industrial Organisation) 2012, Sea level rise: understanding the past, improving projections for the future.


DCC (Department of Climate Change) 2009, Climate Change Risks to Australia's Coasts, A First Pass National Assessment.


Dean, R.G. & Darymple, R.A. 2002: Coastal Processes with Engineering Applications; Cambridge University Press, UK.


DPIWE, 2008, Coastal Hazards. In Tasmania General Information Paper, DPIWE Tasmania Page


NCCOE, (National Committee on Coastal and Ocean Engineering, Engineers Australia) 2004, Guidelines for responding to the effects of Climate Change in coastal and Ocean Engineering, The Institution of Engineers Australia.


Pugh, D.T. (1987), Tides, Surges and MeanSea-Level, John Wiley and Sons, Chichester,UK.


Sharples, C., Mount, R., Pedersen, T., 2009. THE AUSTRALIAN COASTAL SMARTLINE GEOMORPHIC AND STABILITY MAP VERSION 1: MANUAL AND DATA DICTIONARY. School of Geography & Environmental Studies, University of Tasmania . Manual version 1.1


TCCO (Tasmanian Climate Change Office) 2012, Derivation of the Tasmanian Sea Level Rise Planning Allowances. Technical Paper

## Appendix 1 Acceptable Solutions

### Coastal Erosion Hazard Code (CEHC) Areas

<table>
<thead>
<tr>
<th>Standard</th>
<th>Code</th>
<th>Acceptable Solution</th>
<th>Performance Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use</td>
<td>E16.6 Change of Use</td>
<td>A1 No Acceptable solution</td>
<td>P1</td>
</tr>
<tr>
<td></td>
<td>E16.7.1 Buildings &amp; Works</td>
<td>A1 No Acceptable solution</td>
<td>P1</td>
</tr>
<tr>
<td>Development</td>
<td>E16.7.2 Dependent on a Coastal Location</td>
<td>A1 An extension to an existing boat ramp, car park, jetty, marina, marine farming shore facility or slipway must be no more than 20% of the size of the facility existing at the effective date.</td>
<td>P1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A2 No Acceptable Solution for dredging and reclamation.</td>
<td>P2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A3 No Acceptable Solution for coastal protection works initiated by the private sector.</td>
<td>P3</td>
</tr>
<tr>
<td>Subdivision</td>
<td>E16.8.1 CEHC Area</td>
<td>A1 No Acceptable solution</td>
<td>P1</td>
</tr>
<tr>
<td></td>
<td>Dependent on a Coastal Location</td>
<td>A1 No Acceptable solution</td>
<td>P1</td>
</tr>
</tbody>
</table>
## Appendix 2 Qualitative Risk Assessment Tables

### Consequence Index

<table>
<thead>
<tr>
<th>Consequence</th>
<th>Details - Storm Erosion and Inundation</th>
<th>Details – Waterways and Coastal Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catastrophic</td>
<td>Loss of life, loss of significant environmental values due to a pollution event where there is not likely to be recovery in the foreseeable future.</td>
<td>Very serious environmental effects with impairment of ecosystem function. Long term, widespread effects on significant environment (e.g. RAMSAR Wetland)</td>
</tr>
<tr>
<td>Major</td>
<td>Extensive injuries. Complete structural failure of development, destruction of significant property and infrastructure, significant environmental damage requiring remediation with a long-term recovery time.</td>
<td>Serious environmental impact effects with some impairment of ecosystem function. Relatively widespread medium-long term impacts.</td>
</tr>
<tr>
<td>Moderate</td>
<td>Treatment required, significant building or infrastructure damage i.e. loss of minor outbuildings such as car ports, garages and the like. Replacement of significant property components. linings, hard paved surfaces, cladding, flooring. Moderate environmental damage with a short-term natural or remedial recovery time.</td>
<td>Moderate effects on biological or physical environment (air, water) but not affecting ecosystem function. Moderate short term widespread impacts (e.g. significant spills)</td>
</tr>
<tr>
<td>Minor</td>
<td>Medium loss – repair of outbuildings and repair and minor replacement of building components of buildings. Replacement of floor/window coverings, some furniture through seepage (where applicable). Minor environmental damage easily remediated.</td>
<td>Minor effects on biological or physical environment. Minor short-term damage to small area of limited significance.</td>
</tr>
<tr>
<td>Insignificant</td>
<td>No injury, low loss – no replacement of habitable building components, some remediation of garden beds, gravel driveways etc. Environment can naturally withstand and recover without remediation. Inundation of the site, but ground based access is still readily available and habitable buildings are not inundated, including incorporated garages.</td>
<td>Limited damage to minimal area of low significance.</td>
</tr>
</tbody>
</table>

### Likelihood Index

<table>
<thead>
<tr>
<th>Level</th>
<th>Descriptor</th>
<th>Description</th>
<th>Guideline</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Almost Certain</td>
<td>Consequence is expected to occur in most circumstances.</td>
<td>Occurs more than once per month.</td>
</tr>
<tr>
<td>B</td>
<td>Likely</td>
<td>Consequence will probably occur in most circumstances.</td>
<td>Occurs once every 1 month – 1 year.</td>
</tr>
<tr>
<td>C</td>
<td>Occasionally</td>
<td>Consequence should occur at some time.</td>
<td>Occurs once every 1 year - 10 years.</td>
</tr>
<tr>
<td>D</td>
<td>Unlikely</td>
<td>Consequence could occur at some time.</td>
<td>Occurs once every 10 years – 100 years.</td>
</tr>
<tr>
<td>E</td>
<td>Rare</td>
<td>Consequence may only occur in exceptional circumstances.</td>
<td>Occurs less than once every 100 years.</td>
</tr>
</tbody>
</table>

Source: AS/NZS 4380:2004 Risk Management

### Qualitative Risk Matrix

<table>
<thead>
<tr>
<th>Likelihood of the Consequence</th>
<th>Maximum Reasonable Consequence</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1) Insignificant (2) Minor (3) Moderate (4) Major (5) Catastrophic</td>
</tr>
<tr>
<td>(A) Almost certain</td>
<td>11 High 16 High 20 Extreme 23 Extreme 25 Extreme</td>
</tr>
<tr>
<td>(B) Likely</td>
<td>7 Moderate 12 High 17 High 21 Extreme 24 Extreme</td>
</tr>
<tr>
<td>(C) Occasionally</td>
<td>4 Low 8 Moderate 13 High 18 Extreme 22 Extreme</td>
</tr>
<tr>
<td>(D) Unlikely</td>
<td>2 Low 5 Low 9 Moderate 14 High 19 Extreme</td>
</tr>
<tr>
<td>(E) Rare</td>
<td>1 Low 3 Low 6 Moderate 10 High 15 High</td>
</tr>
</tbody>
</table>

Source: AS/NZS 4380:2004 Risk Management
### Appendix 3 Quantitative Risk Assessment

#### Buildings and Works in a CEHC Area

<table>
<thead>
<tr>
<th>Performance Criteria E16.7.1 P1</th>
<th>Relevance</th>
<th>Management Options</th>
<th>Preliminary Risk Assessment (where relevant)</th>
<th>Further Assessment Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) not increase the level of risk to the life of the users of the site or hazard for adjoining or nearby properties or public infrastructure;</td>
<td>No projected erosion in building areas based on 2069 1% AEP scenario</td>
<td>Insignificant (1)</td>
<td>Rare (E)</td>
<td>Low (1)</td>
</tr>
<tr>
<td>(b) erosion risk arising from wave run-up, including impact and material suitability, may be mitigated to an acceptable level through structural or design methods used to avoid damage to, or loss of, buildings or works;</td>
<td>Shoreline mass wasting resulting in self-armouring and low wave runup erosion risk</td>
<td>Insignificant (1)</td>
<td>Rare (E)</td>
<td>Low (1)</td>
</tr>
<tr>
<td>(c) erosion risk is mitigated to an acceptable level through measures to modify the hazard where these measures are designed and certified by an engineer with suitable experience in coastal, civil and/or hydraulic engineering;</td>
<td>No mitigation required</td>
<td>Insignificant (1)</td>
<td>Rare (E)</td>
<td>Low (1)</td>
</tr>
<tr>
<td>(d) need for future remediation works</td>
<td>Negligible site erosion hazard</td>
<td>Minor (2)</td>
<td>Unlikely (D)</td>
<td>Low (5)</td>
</tr>
<tr>
<td>(e) health and safety of people is not placed at risk</td>
<td>Negligible site erosion hazard</td>
<td>Minor (2)</td>
<td>Unlikely (D)</td>
<td>Low (5)</td>
</tr>
<tr>
<td>(f) important natural features are adequately protected</td>
<td>No natural features of value at the site.</td>
<td>Minor (2)</td>
<td>Rare (E)</td>
<td>Low (3)</td>
</tr>
<tr>
<td>(g) public foreshore access is not obstructed where the managing public authority requires it to continue to exist</td>
<td>Not Applicable</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(h) access to the site will not be lost or substantially compromised by expected future erosion whether on the proposed site or off-site</td>
<td>Negligible site erosion hazard</td>
<td>Insignificant (1)</td>
<td>Rare (E)</td>
<td>Low (1)</td>
</tr>
<tr>
<td>(i) provision of a developer contribution for required mitigation works consistent with any adopted Council Policy, prior to commencement of works.</td>
<td>No need for structural mitigation.</td>
<td>Insignificant (1)</td>
<td>Rare (E)</td>
<td>Low (1)</td>
</tr>
<tr>
<td>(j) not be located on an actively mobile landform</td>
<td>Not a mobile landform</td>
<td>Insignificant (1)</td>
<td>Rare (E)</td>
<td>Low (1)</td>
</tr>
</tbody>
</table>