APPENDIX 2: DATA DICTIONARY FOR THE COASTAL GEOMORPHIC VULNERABILITY MAPPING OF TASMANIA

A2.1 *Introduction*

This Data Dictionary describes four digital (GIS) maps that have been provided with this report. Illustrative extracts from these maps are provided in Appendix 1.

Three polygon maps described in this Data Dictionary, representing indicative storm surge flooding vulnerability zones, were created with the first edition of this report and mapping (Sharples 2004a), and have not been subsequently changed (*fldhz2004_gda*, *fldhz2100min_gda* and *fldhz2100max_gda*).

However the line map *tascsthz_v2gda* is based on a pre-existing digital data set (*tascoastgeo_v4gda*: Sharples 2006), which is the current version of a map of Tasmanian shoreline geomorphic types that was originally digitised during 2000 (Sharples 2000). For the purposes of this coastal vulnerability assessment, certain unnecessary attribute fields were stripped from the *tascoastgeo_v4gda* map, the vulnerability attribute fields *Sandyvuln*, *Muddyvuln*, *Erosvuln, Cliffvuln, Minvuln* and *Unclass* were added based on the geomorphic data contained in *tascoastgeo_v4gda*, and the result is provided as the map *tascsthz_v2gda* which is described in this Data Dictionary. The *tascoastgeo_v4gda* map is available separately[27], and contains certain extra attributes not used for this project, but does not contain the vulnerability attributes created for this project. However, the descriptive coastal geomorphic attributes in *tascoastgeo_v4gda* and *tascsthz_v2gda* are identical.

The descriptive geomorphic data in both *tascoastgeo_v4gda* and *tascsthz_v2gda* comprises geological and geomorphic descriptions of the coastal landforms of Tasmania at 1:25,000 scale. The data is presented as a line map (the LIST[28] digital coastline map of Tasmania as at 2000, supplied by DPIW, which nominally represents the High Water Mark line at 1:25,000 scale), which has been manually sub-divided into over 12,000 geomorphically – distinct line segments, ranging from several kilometres to as little as 50m or so in length. Each distinctive segment has been attributed with geomorphic attributes pertaining to that segment, as described in the Data Model below (Section A2.2). The entire Tasmanian coastline, all major islands including the Bass Strait islands (but excluding Macquarie Island), and most minor islands above approximately 1 hectare in area have been attributed in this way, amounting to 6472 km of shoreline at 1:25,000 scale.

The current coastal geomorphic data set (*tascoastgeo_v4gda* / *tascsthz_v2gda*) builds upon a previous digital map of Tasmanian Shoreline Geomorphic Types (*osracstamg_v1.shp* and *coastgeo_v1.shp*), which was originally prepared for the Australian Maritime Safety Authority's (AMSA) Oil Spill Response Atlas (OSRA) and the Australian Coastal Atlas by Sharples (2000), and which was based largely on available geological and topographic mapping, published coastal geomorphology descriptions (e.g., Cullen 1998), a great deal of airphoto interpretation, previous (paper) mapping of Tasmanian coastal landforms at 1:50,000 scale (also using airphoto interpretation) by Munro (1978), and limited ground-truthing by C. Sharples.

The Tasmanian Coastal Vulnerability map described in this report (*tascsthz_v2gda*) is the second version of this map. The first version (*tascsthz*) was created in 2004 using an earlier version of the Tasmanian Shoreline Geomorphic Types map (*tascoastgeo_v3*) (Sharples 2004a). Additional descriptive geomorphic data has subsequently been added to the Shoreline Geomorphic Types map, as a result of further ground truthing and the addition of recent geological mapping supplied by Mineral Resources Tasmania (see Sections 2.7 & 4.3.5). Some attribute fields have been renamed,

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[27] The digital map *tascoastgeo_v4gda* is maintained and licensed by DPIW, and was made available for the purposes of this project.

[28] Land Information System Tasmania.

and some attributes re-numbered in order to create a more user-friendly and comprehensive landform classification. Finally, some coastal lagoons and estuaries not previously included have been added to the map. The resulting updated Geomorphic map (*tascoastgeo_v4gda*) has then been used to re-create the indicative coastal vulnerability categories *minhaz* and *sandy* that were previously derived in *tascsthz* (now renamed *Minvuln* & *Sandyvuln* in *tascsthz_v2gda*), and several new vulnerability categories have been mapped and are also provided in *tascsthz_v2gda* with new attribute fields (*Muddyvuln*, *Erosvuln, Cliffvuln* and *Unclass*).

A2.2 *Data Models*

This section describes several digital (GIS) maps providing detailed descriptive data on Tasmanian coastal geomorphic (landform) types, and an indicative assessment of their vulnerability to coastal hazards resulting from climate change and sea-level rise. The data has been prepared as ESRI ArcView shapefiles, which are geo-registered in metric MGA (Zone 55) co-ordinates based on the GDA94 datum.

The following tables summarise the data model developed for each shapefile; and the next section (A2.3) provides the attribute tables ("lookup tables"), where relevant, for the fields specified in the data models.

A2.2.1 Geomorphic Description and Coastal Vulnerability Map

Shapefile: *tascsthz_v2gda.shp* (MGA co-ordinates, based on the GDA94 datum)
Type: Line map.
Description: LIST 1:25,000 HWM line map, manually divided into geomorphically distinct segments. Data records tagged to each segment contain geomorphic descriptions of the shoreline, together with an indicative ("first pass") assessment of the vulnerability of coastal segments to a range of erosion, slumping and recession hazards related to sea-level rise. Coastal segments with minimal vulnerability to these hazards are also identified.

This map does not include assessments of indicative vulnerability to coastal storm surge flooding hazards, which are instead provided in separate polygon maps (see Sections A2.2.2, A2.2.3 & A2.2.4 following).

Field	**Type**	**Width**	**Attributes**	**Comments**
Feat_id	number	6	Consecutive unique numbers for each unique shore segment.	Some *feat_id* numbers are duplicated, because where original shoreline segments have been sub-divided during ongoing editing, each sub-division retains the original *feat_id*.
Feat_len	number	6 (2 decimal places)	Length of line segment in metres	Calculated automatically in Arcview
Confidence	string	2	Whether segment has been ground-truthed, or geomorphic classification is based only on map data and airphoto interpretation.	Refers to coastal segments ground truthed by C. Sharples since 2000. See attribute table: Section A2.3.2.

Updated	string	10	Date of data currency or last update, as a string in format "DD/MM/YYYY" (eg, 07/04/2001 for 7th April 2001)	Applies to geology, geomorphology and ground truth descriptors only; Indicative vulnerability descriptors have all been added recently for the purposes of this project.
Shoreline Geomorphic (landform) Type Descriptors:				
Upperint	string	2	Upper intertidal zone landform type	See attribute table: Section A2.3.1.
Lowerint	string	2	Lower intertidal zone landform type	See attribute table: Section A2.3.1.
Backshore	string	2	Backshore landform type	See attribute table: Section A2.3.1.
Exposure	string	1	Shoreline segment exposure	Exposure of the individual coastal segment to wave energy. Not to be confused with amount of wave energy received by the coastal region (*Wavenzn*); See attribute table and discussion: Section A2.3.1.
Slope	string	1	Intertidal zone slope	See attribute table: Section A2.3.1.
Sedbudg	string	2	Sediment budget	Applied to sandy shorelines only, indicates whether currently gaining sand (prograding), losing sand (receding) or stable (equilibrium); See attribute table and discussion: Section A2.3.1.
Geomorphic System Control Classifiers:				
Time	string	2	Relevant time period	Always 'present day' for this project. See attribute table: Section A2.3.1.
Bedrock	string	2	Shoreline bedrock type	See attribute table: Section A2.3.1.
Profile	string	1	Hinterland slope/topography class	See attribute table: Section A2.3.1.
Wavenzn	string	2	Wave energy zone	Indicator of average annual wave energy received by a coastal region. Not to be confused with exposure to wave energy (*Exposure*); See attribute table and discussion: Section A2.3.1.
Process	string	1	Geomorphic process	Always 'marine/coastal' for this dataset. See attribute table: Section A2.3.1.

Coastal Geomorphic Vulnerability Descriptors:				
Sandyvuln	string	2	Identifies sandy shorelines, attributed according to potential vulnerability to erosion with sea-level rise.	See attribute table: Section A2.3.3.
Muddyvuln	string	2	Identifies soft muddy shores (mainly estuarine and deltaic) potentially vulnerable to erosion or significant change with sea-level rise.	See attribute table: Section A2.3.3.
Erosvuln	string	2	Identifies soft clayey – gravelly or colluvial shores potentially vulnerable to progressive erosional recession and / or slumping	See attribute table: Section A2.3.3.
Cliffvuln	string	2	Identifies hard-rock coastal cliffs potentially vulnerable to rock fall, collapse, slumping and erosion (with or without sea-level rise).	See attribute table: Section A2.3.3.
Minvuln	string	2	Identifies sloping hard-rock shorelines having minimal vulnerability to coastal geomorphic hazards.	See attribute table: Section A2.3.3.
Unclass	string	2	Identifies shores not classified into any of the above vulnerability categories.	See attribute table: Section A2.3.3.
Other:				
Notes	string	200	General notes and comments pertaining to the coastal segment.	Used to note special geomorphic issues or mapping issues.
Reference	string	200	Bibliographic citation for published data sources used in mapping the shoreline segment. Full bibliographic citation provided where possible, in preference to referring to a separate bibliographic list.	Reference to published data sources where these are the primary source of data for all or specified attributes of a particular coastal segment. See also *Confidence* attribute – no *Reference* provided where information largely derived from air photo interpretation and/or fieldwork by C. Sharples. **NOTE:** Attribute created subsequent to v.1 of this map, thus not yet attributed for most coastal segments.

A2.2.2 Coastal Storm Surge Flooding Map - 2004 Scenario

Shapefile: *fldhz2004_gda.shp* (MGA co-ordinates, based on the GDA94 datum)
Type: Polygon map
Description: Indicative coastal areas within the altitude range of historically recorded storm surge flooding to 0.01% exceedance levels, adjusted to 2004 mean sea level (see Section 4.3.2). Polygons derived from the 25m DEM of Tasmania (2nd edition, 2004).

Field	Type	Width	Attributes	Comments
2004AHD	number	16 (2 decimal places)	Altitude in metres above Australian Height Datum (AHD)	Historical 0.01% exceedance storm surge flood levels interpolated between the closest usable tide gauge records and adjusted to 2004 mean sea level (see Section 4.3.2).

A2.2.3 Coastal Storm Surge Flooding Map - Minimum 2100 Scenario

Shapefile: *fldhz2100min_gda.shp* (MGA co-ordinates, based on the GDA94 datum)
Type: Polygon map
Description: Indicative coastal areas within the altitude range of historically recorded storm surge flooding to 0.01% exceedance levels, adjusted to minimum projected 2100 mean sea level (see Section 4.3.2). Polygons derived from the 25m DEM of Tasmania (2nd edition, 2004).

Field	Type	Width	Attributes	Comments
2100minAHD	number	16 (2 decimal places)	Altitude in metres above Australian Height Datum (AHD)	Historical 0.01% exceedance storm surge flood levels interpolated between the closest usable tide gauge records and adjusted for minimum projected sea-level rise to 2100 (see Section 4.3.2).

A2.2.4 Coastal Storm Surge Flooding Map - Maximum 2100 Scenario

Shapefile: *fldhz2100max_gda.shp* (MGA co-ordinates, based on the GDA94 datum)
Type: Polygon map
Description: Indicative coastal areas within the altitude range of historically recorded storm surge flooding to 0.01% exceedance levels, adjusted to maximum projected 2100 mean sea level (see Section 4.3.2). Polygons derived from the 25m DEM of Tasmania (2nd edition, 2004).

Field	**Type**	**Width**	**Attributes**	**Comments**
2100maxAHD	number	16 (2 decimal places)	Altitude in metres above Australian Height Datum (AHD)	Historical 0.01% exceedance storm surge flood levels interpolated between the closest usable tide gauge records and adjusted for maximum projected sea-level rise to 2100 (see Section 4.3.2).

A2.3 *Attribute Tables ("Lookup Tables")*

This section provides listings of the attributes (and their codes) used in fields in the data models described in Section A2.2 above. Brief explanations of each field and attribute are also provided.

A2.3.1 Coastal Geology and Geomorphology Descriptors

The following tables provide details of the attributes used to describe coastal landforms in the *tascsthz_v2gda* dataset, and essentially constitute a simple descriptive classification of landforms in terms of their *form* and *fabric* (i.e., constituents), with less emphasis on their *genesis*. The attribute tables for *Upperint, Lowerint, Backshore, Slope, Exposure, Time, Bedrock, Profile, and Process* were originally developed by Sharples (2000), who gave detailed descriptions of each attribute. A number of additional attributes have been added to some of these attribute tables, and the data fields for some shoreline segments have been edited to use the new attributes. However in all cases, the attributes used in the original shoreline mapping (Sharples 2000) have all been retained as categories (with their original codes) in the attribute tables and can still be used; the new attributes are either sub-divisions of original attributes used by Sharples (2000) – in which case the original attributes are now used as "undifferentiated" attributes and the new attributes as more specific subsets – or the new attributes are entirely new categories of feature and have been assigned codes which were previously not used by Sharples (2000).

The following figure provides a diagrammatic explanation of the fields used to describe the geology and geomorphology of the coastline. The following tables list the attributes and attribute codes pertaining to fields in the *tascsthz_v2gda* data model provided in Section (A2.2). Attribute tables are not provided for fields that are adequately explained in the Data Models themselves. Note that several attribute field names in *tascsthz_v2gda* have been changed subsequent to the first edition of this report (Sharples 2004a) and the map *tascsthz* used therein. This is a result of changes in the field names used in the source map (*tascoastgeo_v4gda*). These changes were designed to make the field names less cryptic (more user-friendly), however the actual data in these fields has not been changed except where there has been updating as a result of ground-truthing and other new information. The *tascoastgeo_v4gda* Data Dictionary (Sharples 2006) provides a full history of changes to the map data set between its various versions.

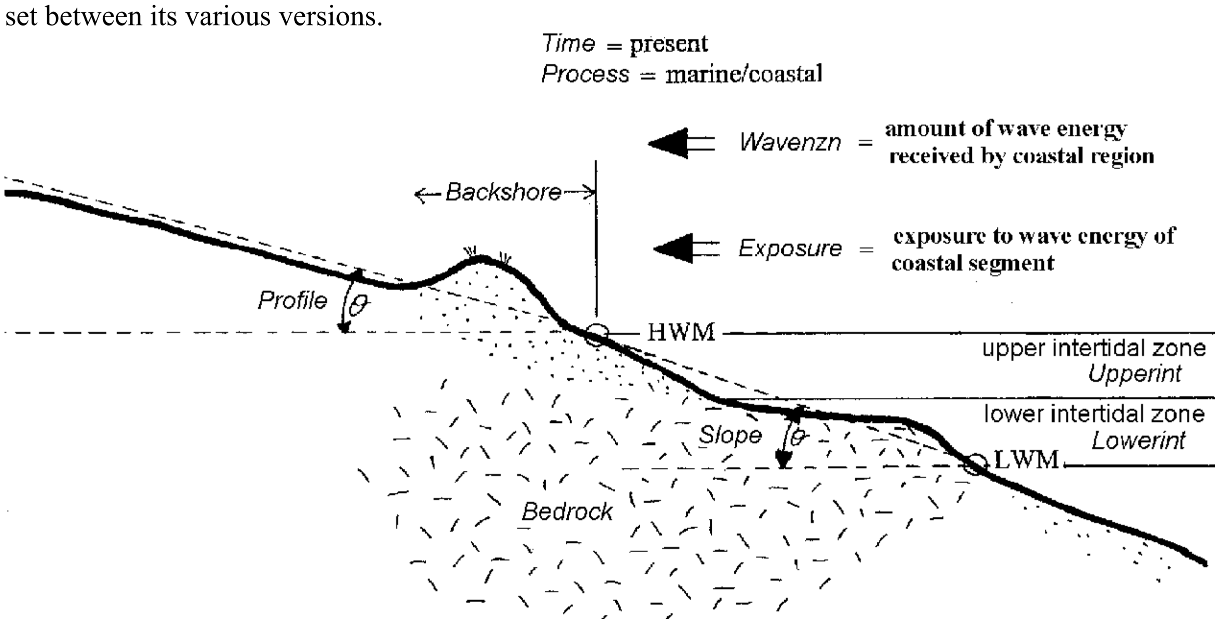

Figure 51: Diagrammatic representation of key geomorphic attribute fields of the Shoreline Geomorphic Types map (*tascoastgeo_v4gda*, used to produce *tascsthz_v2gda*)

Shoreline Geomorphic Type Descriptors:

These attribute fields provide a simple description of coastal landforms within each distinctive coastal segment. The descriptors are based on the form and fabric (constituents) of the coastal landforms, rather than upon their genesis. These descriptors describe the types of landforms that have been produced by the broader independent geomorphic system controls that have influenced the development of each coastal segment. Some (but not all) of the geomorphic system controls are classified in the attribute fields listed as "Geomorphic System Control Classifiers" in the Data Model (Section A2.2) and further below.

Upper Intertidal Zone Landform Type

Used in shapefile/theme: *tascsthz_v2gda.shp*
Field name: *Upperint*
Field type: string (character)
Field width: 2
Explanation: Landform type forming the upper intertidal zone (up to high water mark). This is the part of the shoreline zone usually thought of as characterising a shoreline type. Attributes 00 – 12 were used in the original shoreline mapping (v.1) by Sharples (2000); all other attributes are more detailed sub-divisions which have been added subsequently (but as yet have not been applied to the entire coast of Tasmania). Since the new attributes are all sub-divisions of those used previously, it is possible to "retro-fit" the more detailed categories defined here back to the broader undifferentiated categories used previously.

Note that some attribute codes have been re-ordered and re-numbered as compared to the codes used in the previous version of *tascsthz* (and its source map, *tascoastgeo_v3*). This was done to create a more logical coding system; all codes within the data have been systematically re-assigned in accordance, and the vulnerability attributes *Sandyvuln* and *Minvuln* have been recalculated using the new attribute codes where relevant.

Attribute summary:

Characters (00 - 99)	Upper Intertidal landform type (*Upperint*)
00	shoreline type unknown
01	**Cliffs** (dominantly vertical or very steep to at least 5m above high water mark)
02	**Rocky (bedrock) shoreline undiff.** (*in situ* bedrock, may include small cliffs rising to <5m above high water mark) *unconsolidated sediment accumulations absent or minor*
21	Rocky (bedrock) shore covered by *in situ* bedrock breakdown material (angular to subrounded pebble/cobble/boulder shores, commonly with bedrock outcrop)
22	Angular boulder (± cobble/pebble) shores (colluvium, collapses, slumps)
23	Angular boulder (± cobble/pebble) shores (colluvium, collapses, slumps) - with common bedrock outcrop protruding
03	**shell, pebble, cobble ('shingle') or boulder (*undifferentiated)* beach or shoreline**
31	rounded (wave washed) shell/pebble/cobble/boulder (*undifferentiated*) shores
32	wave washed shell beaches or shorelines
33	wave washed shell beaches or shorelines - with common bedrock outcrop protruding

34	rounded (wave washed) pebble/cobble beaches or shores
35	rounded (wave washed) pebble/cobble beaches or shores - with common bedrock outcrop protruding
36	rounded (wave washed) cobble/boulder beaches or shores
37	rounded (wave washed) cobble/boulder beaches or shores - with common bedrock outcrop protruding
04	**mixed fine- medium sandy and *undifferentiated* shell, pebble, cobble or boulder beach or shoreline**
41	mixed fine – medium sandy and *undifferentiated* shell, pebble, cobble or boulder beach or shoreline - with common bedrock outcrop protruding
42	mixed fine – medium sandy and shell beach or shoreline
43	mixed fine – medium sandy and shell beach or shoreline - with common bedrock outcrop protruding
44	mixed fine – medium sandy and undiff. pebble/cobble beach or shoreline
45	mixed fine – medium sandy and undiff. pebble/cobble beach or shoreline - with common bedrock outcrop protruding
46	mixed fine – medium sandy and (rounded, wave washed) cobble/boulder shore
47	mixed fine – medium sandy and (rounded, wave washed) cobble/boulder shore – with common bedrock outcrop protruding
48	mixed fine – medium sandy and angular (collapse or breakdown) boulder (± cobble/pebble) shore
49	mixed fine – medium sandy and angular (collapse or breakdown) boulder (± cobble/pebble) shore - with common bedrock outcrop protruding
05	**sandy beach or shoreline - grainsize undetermined**
51	sandy beach or shoreline - grainsize undetermined – with common bedrock outcrops protruding
06	**sandy beach or shoreline - coarse grained** (coarse sand = grain diameters > 0.5mm; Pettijohn *et al.* 1973)
61	sandy beach or shoreline - coarse grained – with common bedrock outcrop protruding
07	**sandy beach or shoreline - fine to medium grained** (= grain diameters 0.0625 – 0.5mm; Pettijohn *et al.* 1973)
71	sandy beach or shoreline - fine to medium grained – with common bedrock outcrop protruding
08	**muddy or silty shoreline** (may be pebbly or cobbly; typically fine sands with high mud (silt/clay) content, darker in colour than sandy shores)
81	muddy or silty shoreline – with common bedrock outcrops protruding
09	permeable artificial shoreline, e.g., rip – rap, boulders, gravel fill.
10	impermeable artificial shoreline, e.g., concrete sea walls, wooden walls.
11	other artificial shoreline (including excavated shorelines), *undifferentiated*
12	artificial shoreline - type unknown

Lower Intertidal Zone Landform Type

Used in shapefile/theme: *tascsthz_v2gda.shp*
Field name: *Lowerint*
Field type: string (character)
Field width: 2
Explanation: Landform type comprising the lower intertidal zone. This element is water covered for a significant proportion of the tidal cycle. Note that attributes (04) and (45) have been added to the attribute table subsequent to compilation of the original shoreline geomorphic mapping (v.1, Sharples 2000); most lower intertidal zones now classified as (04) or (45) were previously classified as (99).

Attribute summary:

Characters (00 - 99)	Lower Intertidal landform type (*Lowerint*)
00	with unknown lower intertidal characteristics
01	with rocky shore platform
02	with near shore rocks or reefs (exposed at low tide, can be up to 500m offshore)
03	with rocky shore platform *plus* near shore rocks or reefs (can be up to 500m offshore)
04	sloping sandy bottom (± submerged bottom rocks) in lowest intertidal to subtidal zone
45	sloping rocky bottom in lowest intertidal to subtidal zone
05	with intertidal or shallow subtidal flats - grainsize undetermined
07	with intertidal or shallow subtidal sand flats
08	with intertidal or shallow subtidal mudflats (may include marshy vegetated intertidal mudflats). (Note: Mudflats are typically fine sands with high mud (silt/clay) content, darker in colour than sandy shores)
09	with permeable artificial structures, e.g., rip-rap.
10	with impermeable artificial structures, e.g., concrete sea walls
11	with other artificial structures (including excavated shorelines or wrecks)
12	with artificial structures - type unknown
20	with intertidal or shallow subtidal flats - grainsize undetermined - *plus* rocky shore platform
22	with intertidal or shallow subtidal sand flats *plus* rocky shore platform
23	with intertidal or shallow subtidal mudflats *plus* rocky shore platform. (Note: Mudflats are typically fine sands with high mud (silt/clay) content, darker in colour than sandy shores)
25	with intertidal or shallow subtidal flats - grainsize undetermined - *plus* near shore rocks or reefs (can be up to 500m offshore).
27	with intertidal or shallow subtidal sand flats *plus* near shore rocks or reefs (can be up to 500m offshore).
28	with intertidal or shallow subtidal mudflats *plus* near shore rocks or reefs (can be up to 500m offshore). (Note: Mudflats are typically fine sands with high mud (silt/clay) content, darker in colour than sandy shores)
30	with intertidal or shallow subtidal flats - grainsize undetermined - *plus* rocky shore platform *and* near shore rocks or reefs (can be up to 500m offshore).
32	with intertidal or shallow subtidal sand flats *plus* rocky shore platform *and* near shore rocks or reefs (can be up to 500m offshore).
33	with intertidal or shallow subtidal mudflats *plus* rocky shore platform *and* near shore rocks or reefs (can be up to 500m offshore). (Note: Mudflats are typically fine sands with high mud (silt/clay) content, darker in colour than sandy shores)
98	pending mapping
99	with no distinctively different lower intertidal shoreline element (upper intertidal zone grades continuously down to subtidal zone without significant substrate change)

Backshore Landform Type

Used in shapefile/theme: *tascsthz_v2gda.shp*
Field name: *Backshore*
Field type: string (character)
Field width: 2
Explanation: Landform types occurring immediately above high water mark. This does not refer to the hinterland, but simply records the landform types present *immediately* inland of the intertidal zone itself. Most attributes are as used by Sharples (2000) in the original (V.1) shoreline mapping, with the exception that attributes 15 – 18, 21 – 26 and 31 - 34 have been added (to indicate artificial backshores fronting unconsolidated

sediment plains, to provide sub-types of colluvium or weathered bedrock, and to further categorise dune-backed shores, respectively).

Attribute summary:

Characters (00 - 99)	Immediate Supratidal Zone (*Backshore*)
00	unknown
01	Cliffs (rising at least 5m above high water mark) – mainly bare bedrock
02	Bedrock ± soil (not notably cliffed but may include small cliffs rising to <5m above high water mark; no dunes) *undifferentiated* – may include bedrock, colluvium, slumps and soil. NOTE "bedrock" may include unlithified non-marine sediments where *Bedrock* = 01
21	Colluvium (including slumps & cliff collapses) with or without soil development (*undifferentiated*)
22	Colluvium (including slumps & cliff collapses) with little or no soil development
23	Colluvium (including slumps & cliff collapses) with significant soil development
24	Colluvium (undifferentiated) associated with significant cliffs
25	Slopes of deeply weathered bedrock (bedrock ± soil, where bedrock is softened and erosion-prone due to intense fracturing ± deep chemical weathering).
26	Cliffs of deeply weathered bedrock (where bedrock is softened and erosion-prone due to intense fracturing ± deep chemical weathering).
03	Dunes & aeolian sandsheets undifferentiated (one or more dune ridges, or aeolian sand sheet, back-dune area types undifferentiated)
31	Dunes (one or rarely more dune ridges, backed and/or underlain by bedrock ± soil substrate in immediate back dune area, no significant unconsolidated sediment plain behind or underlying dunes)
32	Dunes (one or more dune ridges, with unconsolidated sediment plain in immediate back dune area and/or underlying any back dunes) [sediment plains <50m to >>100m wide]
33	Dunes (one or more dune ridges, with lagoon(s) and unconsolidated sediment plain in back-dune area) [sediment plains <50m to >>100m wide]
34	Aeolian sandsheets (generally thin, with or without some dune forms) mantling bedrock in the backshore.
04	Sediment flats, unconsolidated or unlithified (may be sandy plain, but no notable dunes in backshore zone) [sediment flats may range from ~10m to >>100m wide]
05	Marshy low-lying supratidal sediment flats; mostly saltmarsh (= sediment flats subject to inundation) [sediment flats may range from ~10m to >>100m wide]
06	CURRENTLY UNUSED CLASSIFICATION (ex "mangroves" – never used in Tas!)
07	Lagoon (usually where impounded by low sand spit without dunes)
10	Reclaimed land (artificially filled)
15	Artificial fill over unconsolidated sediment plain [sed. plains <50m to >>100m wide]
11	permeable artificial structures, e.g., rip rap
16	permeable artificial structures, e.g., rip rap, fronting unconsolidated sediment plain with or without dunes [sed. plains <50m to >>100m wide]
12	impermeable artificial structures, e.g., concrete sea walls
17	impermeable artificial structures, e.g., concrete sea walls, fronting unconsolidated sediment plain with or without dunes [sed. plains <50m to >>100m wide]
13	other artificial structures (including excavations and roads)
18	other artificial structures (including excavations and roads) , fronting unconsolidated sediment plain with or without dunes [sed. plains <50m to >>100m wide]
14	artificial structures - type unknown
99	pending mapping

Intertidal Zone Slope

Used in shapefile/theme: *tascsthz_v2gda.shp*
Field name: *Slope*
Field type: string (character)
Field width: 1
Explanation: The slope of the intertidal zone (only), measured in degrees. The slope categories used are based on formats previously used for the AMSA/OSRA Oil Spill Response Atlas. By convention, the slope is the angle of a line drawn from high water mark to low water mark irrespective of intervening irregularities. Note that intertidal zone slopes on sandy beaches may vary seasonally or in response to storm wave action; thus the slope should be measured from high to low water mark only, and may be subject to some variation. This attribute therefore provides only a very broadly generalised indicator of intertidal zone slope, and no greater accuracy than this should be assumed.

Attribute summary:

Character (0-9)	Shoreline slope (intertidal zone only) (*Slope*)
0	unknown
1	steep >30°
2	moderate 30° - 5°
3	flat <5°
4	steep >30° (unconfirmed)
5	moderate 30° - 5° (unconfirmed)
6	flat <5° (unconfirmed)
7	pending mapping

Shoreline Segment Exposure

Used in shapefile/theme: *tascsthz_v2gda.shp*
Field name: *Exposure*
Field type: string (character)
Field width: 1
Explanation: Shoreline exposure is a rough qualitative measure of the degree to which a particular shoreline segment is exposed to whatever wave energy impinges on the broader coast of which it is a part, over time.

Note that exposure to wave energy is not a quantitative measure of the amount of wave energy received by a shoreline, but simply an indicator of the degree of exposure to whatever wave energy impinges on the relevant stretch of coast. Thus an "exposed" coastal segment in western Tasmania will probably receive considerably more wave energy over time than an equally "exposed" segment in eastern Tasmania. The separate geomorphic system control attribute *Wavenzn* (see below) provides an indicator of the actual amounts of wave energy received over time along different regions of the Tasmanian coast. Thus, it is roughly true to say that two equally exposed coastal segments in the same wave energy zone (*Wavenzn*) will receive about the same amount of wave energy over time, whereas two similarly exposed segments in different wave energy zones will receive different amounts of energy over time.

Exposure to wave energy is here presented as a Shoreline Geomorphic Type Descriptor rather than as a Geomorphic System Control (see below), on the basis that the processes of coastal landform development, influenced by geomorphic system controls, have produced local variations in exposure as a function of the intricate shape of shoreline bays and headlands as they have actually developed in response to system controls such as bedrock structure and wave climate (wave energy).

Wave energies received by Tasmanian coastlines may derive from ocean swells or more localised and shorter-term storm and wind waves. The most important source of both oceanic swells and storms affecting Tasmanian coasts are the strong and constant swells and storm waves which arrive on Tasmania's south and west coasts during all seasons from a south-westerly or westerly direction (Davies 1978), and which refract eastwards through Bass Strait and northwards up the east coast (see Figure 52). These waves and storms are generated by mid-latitude cyclonic systems in the "Roaring Forties" region of the Southern Ocean, south of Tasmania (Short 1996, p. 15, 17, 26), and generate moderate to high swell waves which dominate the south and west coasts all year round. The exposure attribute *Exposure* is currently classified in this dataset mainly based on the degree of exposure of shorelines to these direct or refracted south-westerly swells and storms, and were manually classified by visually estimating exposure to these swell and storm wave approach directions.

Note however, that this exposure classification requires updating and improvement for the north-east, east and south-eastern coasts of Tasmania. Whereas the south-westerly swells and storm waves are at all times the dominating wave energies received by the west, northwest, southwest and southern coasts of Tasmania, and refraction of these waves impinges on the south-eastern, eastern, northern and northeastern coasts as shown in Figure 52 below, the latter coasts are also strongly affected by infrequent but intense easterly and south-easterly storms generated by low pressure systems (East Coast Cyclones) moving south-eastwards through the Tasman Sea, to the east of Tasmania (Short 1996, p.15, 26). South-easterly, and to a lesser extent easterly storm and swell wave approach directions produced by these east coast low pressure systems have a major influence on Tasmania's eastern, south-eastern and northeastern coasts, hence it is important that the current shoreline exposure attribute (*Exposure*) for these coasts should as soon as possible be reviewed and reclassified to account for exposure to easterly and south-easterly storm waves and swells, as well as to refracted south-westerly swells.

An additional caveat on this exposure classification results from the fact that shores relatively sheltered from the most important storm wave directions may still be exposed to other less frequent, but still important, storm wave approach directions. This should also be reflected in future updates of this attribute.

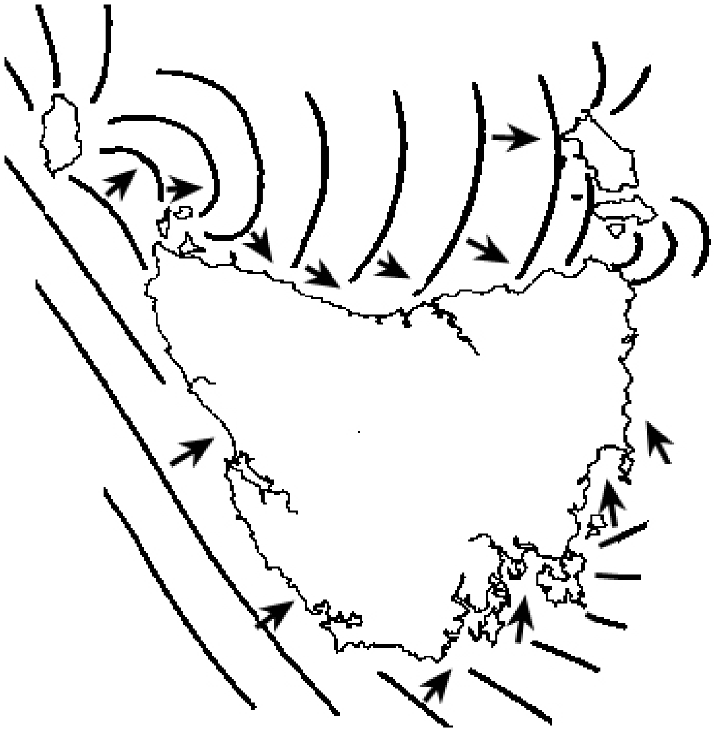

Figure 52: Map of Tasmania indicating diagrammatic oceanic swell wave crests and approach directions assumed in mapping shoreline exposure (based on refraction of the dominating south-westerly swell around Tasmania). Swells only refract over the continental shelf where they begin to "feel bottom" at about 120m water depth, and not in deep ocean waters. Note that this map, and the exposure attribute *Exposure* based on it, remain in need of future upgrading in the eastern, north-eastern and south-eastern coastal regions of Tasmania, to take into account exposure to the south-easterly and easterly swells and storm wave approach directions which are significant in those regions.

Attribute summary:

Character (0-9)	Shoreline segment exposure (*Exposure*)	
1	exposed	(aspect of shoreline segment faces towards within 45º of important swell and storm wave approach directions)
2	semi-exposed	(aspect of shoreline segment faces between 45º - 135º from important swell and storm wave approach directions)
3	sheltered	(aspect of shoreline segment faces >135º from, or is sheltered from, important swell and storm wave approach directions)
4	pending mapping	

Sediment Budget

Used in shapefile/theme: *tascsthz_v2gda.shp*
Field name: *Sedbudg*
Field type: string (character)
Field width: 2
Explanation: Sediment budget for sandy shorelines. This characteristic applies only to sandy shorelines, and applies as at the date of data currency, but is intended to identify the long-term sand budget. The *Sedbudg* attribute is intended to identify whether sand is being permanently lost from a sandy shoreline segment (recession), is being progressively added to the shoreline segment's sand budget (progradation), or is in long-term equilibrium (in which case any sand lost from the system is being balanced by sand added to the system).

Short term "cut & fill" beach cycles in which sand is lost from the upper beach during storm erosion, dumped in the near-shore sub-tidal zone, then later returned to the beach (onshore-offshore sand movements) are not intended to be considered. Similarly, "beach rotation" whereby sand may episodically be moved laterally along a beach for a period, then moved back for a period, is also not intended to be considered. However, without long-term monitoring or some other clear evidence of a long term trend[29], beach sediment budgets may be difficult to determine with certainty. For example, the presence of incipient foredunes is not necessarily evidence of progradation, as these commonly form on equilibrium or receding beaches during intervals between major storms. Similarly erosion scarps may not necessarily be evidence of recession, but can be simply a brief phase of erosion super-imposed on a longer term progradation trend.

As a result, some sediment budget attributes recorded in this dataset may prove to be incorrect. However, in the absence of long-term studies providing more confident sediment budget assessments for Tasmanian beaches, the sediment budget attributes recorded in this dataset are useful as an indication of beaches considered likely to be receding, in equilibrium or prograding on current knowledge.

The sediment budget attributes provided in this data set (*tascsthz_v2gda*) have partly been based on information provided by Frances Mowling (Ph.D. candidate, University of Tasmania, 2004) and Mike Pemberton (Tasmanian Department of Primary Industries & Water), based on their field observations of many Tasmanian beaches over the last decade or so, with the exception of south-west Tasmanian beaches where the attributes were obtained from Cullen (1998).

Attribute summary:

Character (00-99)	Sediment budget (sandy shores) (*Sedbudg*)
00	Not a sandy shoreline, or segment not classified
01	Receding sandy shore (net sand loss from shoreline system)
02	Stable sandy shore (any sand lost from shoreline system is balanced by sand gained)
03	Prograding sandy shore (net sand gained by shoreline system)
99	Sandy shore, sediment budget undetermined.

[29] For example, studies of historical records including air photos, or stratigraphic evidence of progradation or recession.

Geomorphic System Control Classifiers :

In contrast to the Shoreline Geomorphic Type Descriptors (above), which give a simple form and fabric – based description of the coastal landforms developed in each coastal segment, the following Geomorphic System Control Classifiers identify some (but not all) of the broader characteristics ("system controls") of each coastal region that have influenced or determined the type of coastal landforms that have actually developed in each region. A key distinction between the two groups of attributes is that, whereas the shoreline geomorphic type descriptors describe the types of coastal landforms that have developed in response to coastal processes, the geomorphic system controls are independent variables which were not produced *by* coastal processes, but which exert an influence *upon* coastal geomorphic processes and the development of coastal landforms.

This distinction between "system controls" which influence landform development, and geomorphic type descriptors which describe the landforms that have actually developed, underpins the concept of "Georegionalisation". Georegionalisation (Houshold *et al.* 1997) provides a means of characterising (and predicting) the distribution of shoreline landform types at a broader level than that provided by the shoreline geomorphic type descriptors. Coastal georegions are defined by identifying the parameters (system controls) *influencing* the development of coastal landforms, and mapping the spatial variation in each of these. Each georegion then consists of one or more cells (or segments of coastline) having a unique combination of influences (system controls) influencing and determining coastal landform development. It can then be predicted that each unique georegion, because of its unique set of controlling parameters, will have certain characteristic associations of coastal landforms (although there will of course be many coastal landform types common to many georegions).

In effect, the coastal georegions map out the influences controlling shoreline landform development, whilst the shoreline geomorphic type descriptors map the actual landforms which have developed in response to those georegion controls. One consequence of this is that, whereas the shoreline geomorphic type descriptors used in this dataset classify landforms within the intertidal and immediate backshore zone specifically, the georegions refer to a broader coastal zone (including some near-coastal hinterland elements and offshore wave climate characteristics) which has exerted an influence on the development of the intertidal zone itself.

The geomorphic system controls classified in this data set are listed below:

- *Time*
- *Bedrock Geology*
- *Coastal Profile (topography)*
- *Wave Energy (climatic controls)*
- *Geomorphic Process*

However, it is recognised that these system controls are not sufficient to fully characterise coastal georegions, and it is envisaged that more work will be undertaken in future to further develop this georegional approach to coastal landform classification. In particular, it is envisaged that it will be necessary to develop a "*Geomorphic History*" system control attribute to supplement the above system controls. A geomorphic history system control would allow a georegional model of coastal development to take into account such things as sand supply sources (e.g., past glacio-fluvial sand outwash to the coast) which are not modelled by the currently attributed system controls, yet play a major role in coastal development by determining the availability of sand to build beaches and dune systems.

However, notwithstanding that the system controls classified to date in this data set do not fully describe coastal georegions, most of them are nevertheless of immediate value for a range of coastal research and management purposes independent of georegional modelling.

Each geomorphic system control is a separate field in the data model. The system control fields are discussed below, with a listing of the categories (attributes) which each parameter has been divided into for the purposes of this dataset.

Relevant Time Period

Used in shapefile/theme: *tascsthz_v2gda.shp*
Field name: *Time*
Field type: string (character)
Field width: 2
Explanation: Landform development has varied over geological time, and it is possible to analyse landforms in terms of their development at different stages in geological history. For the purposes of this project the coast is being analysed in terms of its present day status and ongoing development. The field *Time* is included in this analysis purely in order to make the data compatible with possible future work which may extend the landform development analysis to other time periods.

This field (attribute) would become useful if, for example, Last Interglacial coastal landforms were being mapped and differentiated in the dataset; a different value of *Time* could be used to identify these landforms and allow them to be plotted or analysed separately from the present day coastal landforms.

Attribute summary:

Characters (00-99)	Time period (*Time*)
00	present day

Shoreline Bedrock (Substrate) Type

Used in shapefile/theme: *tascsthz_v2gda.shp*
Field name: *Bedrock*
Field type: string (character)
Field width: 2
Explanation: Bedrock geological type occurring at or underlying the shoreline. Where the shoreline comprises unconsolidated Quaternary sediments that have accumulated in response to coastal or estuarine processes, the bedrock type is that type known or inferred to underlie the shoreline. Bedrock types are based on a lithostructural classification developed by Dixon & Duhig (1996) and Houshold *et al.*(1997), which broadly groups Tasmanian bedrock types according to their differing erosion and weathering characteristics (based on their lithologies and structural styles), and thus their effects on landform development. The attribute categories used for this field are as used by Sharples (2000), with the exception that two further categories (41 & 45) have been added; these sub-divide category 04 (undifferentiated) into two sub-categories where these have been mapped (currently, these sub-categories have only been applied in south-eastern Tasmania).

Bedrock geology, particularly lithology and structure, strongly influence coastal landform development in a variety of ways. Such controls include the influence of geological structures and lithological variations on coastal erosion rates, and hence on coastal plan form and profile development, and the influence of bedrock lithology on the amounts and type of coastal sediment derived from local bedrock erosion.

Previous work (Dixon & Duhig 1996, Houshold *et al.* 1997) identified 11 broad *lithostructural* (rather than primarily stratigraphic) categories into which Tasmanian bedrock associations can be grouped so as to reflect major differences in their structural and lithological characteristics, and thus in their response to erosion. Essentially, it can be expected that the differing lithostructural characteristics of the rocks grouped in each category will give rise to somewhat differing types of landforms. The same 11 categories are used in this project.

It is important to note that, although the lithostructural "bedrock geology" categories listed below can include some relatively unlithified or unconsolidated sedimentary sequences (e.g., parts of "01 - Terrestrial sediments"), they do not include presently accumulating or geologically-recent sediments of coastal or estuarine origin, but rather sediments which were deposited in previous (non-coastal) environments at a location which later became coastal. The purpose of the Bedrock Geology system control classifier is to identify the bedrock materials upon which the coast has *formed* - that is, the bedrock *system controls* on coastal development - but not the sedimentary *products* of coastal development in response to those system controls.

Essentially, if a bedrock material (lithified or unlithified) predates and/or has actually or potentially controlled coastline development, then it is a georegion system control; however if it has been produced *by* coastal processes, then it is not a independent system control and is not used to classify georegions.

Attribute summary:

Characters (00-99)	Bedrock type (*Bedrock*)
00	unknown
01	terrestrial sediments, variably lithified (mostly unlithified or only semi-lithified) and mostly undeformed. (Gravels, sands, clays, boulder beds, tuffs; mostly Tertiary age, but including some un-lithified or semi-lithified Quaternary sediments that are not themselves the product of Holocene coastal processes. Thus, may include terrestrial fluvial, glacial or colluvial sediments deposited over hard bedrock during Pleistocene glacial phases when sea level was much lower, and now forming the substrate into which the present shoreline has eroded)
02	undeformed, largely unfaulted basalt (mostly Tertiary age, some Jurassic and Triassic)
03	dolerite (mostly Jurassic age) or Cretaceous syenite masses – large bodies
04	flat-lying dominantly arenite/lutite sequences *undifferentiated* (mostly Permo-Triassic Parmeener Supergroup) ± sub-ordinate small dolerite or syenite intrusions
41	Permo-Carboniferous dominantly glacio-marine tillite, sandstone, siltstone and shale sequences (Lower Parmeener Supergroup)
45	Late Permian and Triassic dominantly terrestrial sandstone- mudstone sequences (Upper Parmeener Supergroup)
05	folded dominantly arenite/lutite sequences (mostly Mathinna and Eldon Groups)
06	folded, structurally dismembered sedimentary and volcano-sedimentary sequences (mostly Late Precambrian - Cambrian sequences)
07	mafic/ultramafic complexes (mostly Cambrian)
08	folded, dominantly lutite sequences (mostly the lower-middle Rocky Cape Group and correlates)
09	folded, quartzite/schist associations and quartzose clastic sequences (includes Precambrian quartzites, quartzite/schist associations, Owen Group conglomerates, upper Rocky Cape Group, etc)
10	carbonate rocks (limestones or dolomites of all ages)
11	granitoids (all ages)

For these reasons, the bedrock type mapped in each coastal segment is the bedrock or substrate underlying any superficial Quaternary coastal sediments, including extensive areas of coastal sands and dunes. In some areas there is very little coastal or near-coastal bedrock outcrop and the bedrock geology is unknown, but in most such parts of the Tasmanian coast it has proved possible to infer the bedrock geology from interpretation of the regional geology. Where a coastal stretch is comprised of a sea cliff which exhibits several different rock types in vertical succession, the coastal bedrock type is classified as the lowest rock type, upon which most wave energy impinges. For example, near Deep Glen Bay (SE Tas) Permian sedimentary rocks overlie Devonian granite which outcrops to only a few metres above sea level. The coastal bedrock type is classified as granitoid, since nearly all wave energy impinges on the granites, rather than directly on the overlying sedimentary rocks.

Hinterland Slope / Topography Class

Used in shapefile/theme: *tascsthz_v2gda.shp*
Field name: *Profile*
Field type: string (character)
Field width: 1
Explanation: A qualitative indication of the broad topographic type of the immediate coastal hinterland zone (extending inland beyond the immediate backshore zone). This field is categorised into broad topographic types likely to have had differing influences on the development and nature of the intertidal zone.

The coastal profile is important in coastal landform processes since it partly determines the degree to which gravitational energy interacts with marine processes such as wave energy to either erode bedrock or deposit sediments to landwards, and the degree to which aeolian processes can erode, transport and deposit sand inland.

Coastal Profile (*Profile*) refers to the generalised slope of the coastal hinterland, not that of the intertidal zone, since whereas the intertidal zone slope (*Slope*) is a *product* of coastal landform development, the hinterland slope (*Profile*) is more generally a pre-existing or independent *control* on coastal processes. Partly because of the differing implications of intertidal (shoreline) and hinterland (system control) profile slopes, the categories of each are defined differently.

The categories (attribute values) of coastal profile used here are those used by Sharples (2000), which are closely similar to the georegion topographic categories originally defined by Dixon & Duhig (1996).

Attribute summary:

Character (0-9)	Coastal profile (coastal hinterland slope / topography class) (*Profile*)
1	plains 0° - 6°
2	gentle to moderate slope terrain 6° - 20°
3	steep slope terrain >20°
4	high cliffed coast (Bedrock cliffs, sometimes mountainous, rising well above maximum zone of direct wave impact (typically >50m high cliffs), regardless of profile angle inland of cliff tops. This profile category is indicative of resistant coastal rock types that tend to form steep shoreline profiles particularly where exposed to high wave energies)

Wave Energy Zone

Used in shapefile/theme: *tascsthz_v2gda.shp*
Field name: *Wavenzn*
Field type: string (character)
Field width: 2
Explanation: The Wave Energy attribute *Wavenzn* as used in this dataset is an indicator of the average wave energy received over time by a stretch of coast. Note that wave energy zones (*Wavenzn*) are clearly distinguishable from "exposure" zones (*Exposure*), in that the latter simply indicate the degree to which a certain shore is exposed to whatever wave energy is available, whereas *Wavenzn* provides a indication of how much wave

energy actually is available on (or received by) a given stretch of Tasmanian coast over time. Thus, for example, a "highly exposed" coast in a high wave energy zone will receive considerably more wave energy over time than a "highly exposed" coast in a low wave energy zone.

Comprehensive measured quantitative data on this parameter is unavailable for Tasmanian coasts, however Davies (1978) used geomorphic criteria including beach sand sorting, grainsize, and other characteristics to derive a qualitative indication of the relative amounts of wave energy received by different parts of the Tasmanian coast. Davies' scheme has been used to divide the Tasmanian coast into 8 broad wave energy zones (see Figure 53), which have been used to create the wave energy attribute *Wavenzn* for this dataset.

An additional ninth category is reserved for coastal lagoons and estuaries substantially sheltered from oceanic swell and storm waves in all coastal regions of Tasmania. These are coastal water bodies which do not receive significant wave energy directly from the ocean. Wave energies within these embayments depend mainly on wind waves generated across their fetch, and the energy of these may vary considerably between these embayments, depending on local conditions.

However, whilst little measured data on wave energy is available for the Tasmanian coast, Harris *et al.* (2000) have produced a digital model of annual average (mean) wave heights around the Tasmanian coast (see Figure 54). Wave energy varies as the square of wave height (Pond & Pickard 1983), hence average annual wave height can be used as an indicator of average annual wave energy. The annual average wave height model for the Tasmanian coast (Harris *et al.* 2000) shows a reasonable correlation with the wave energy zones derived from Davies (1978) - compare Figure 53 and Figure 54 – and in addition provides a continuously-variable and semi-quantitative indicator of average wave energies received by coastal regions.

It is envisaged that in future the average annual wave height model provided by Harris *et al.* (2000) could be used to create a more quantitative and regionally-variable attribute indicating average wave energy variations around the Tasmanian coast than is currently provided by the *Wavenzn* attribute used in the present dataset.

Attribute summary:

Character (00-99)	Wave Energy Zone (from Davies 1978) (*Wavenzn*)
0	Not classified
1	Highest energy coast (West Coast South)
2	High energy non-embayed coast (West Coast North)
3	High energy embayed coast (South Coast)
4	High-moderate energy coast (East Coast South)
5	Moderate energy coast (East Coast North)
6	Low- moderate energy coast (Bass Strait East)
7	Low energy coast (Bass Strait West)
8	Lowest energy coast (D'Entrecasteaux Channel)
9	Sheltered coastal lagoons and estuaries on all coasts (special category for coasts not exposed to oceanic swells and storm waves)

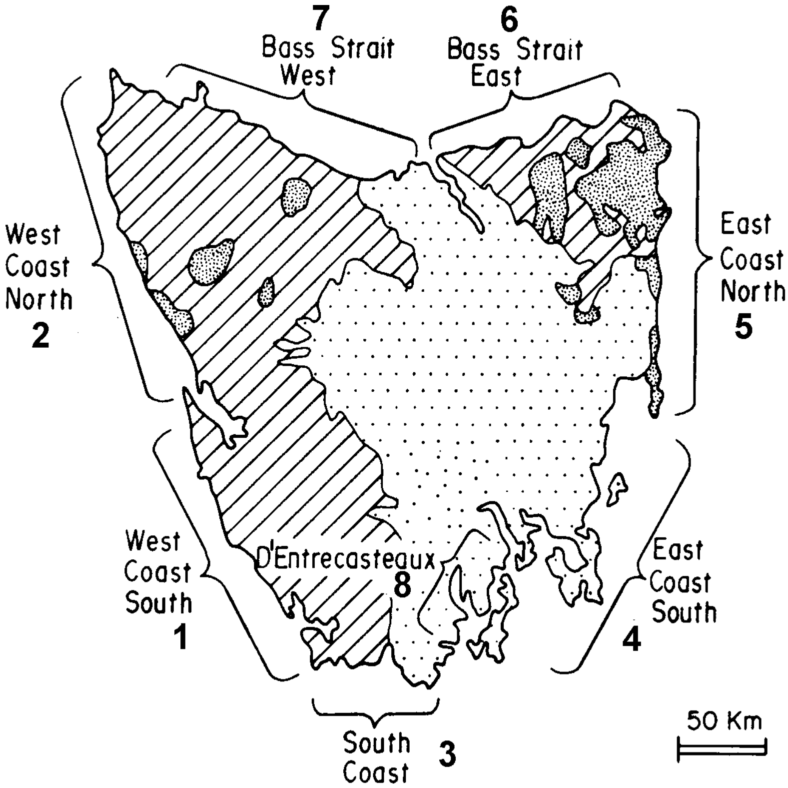

Figure 53: Wave Energy Zones around the Tasmanian coast (adapted from Figure 7.1 of Davies 1978), showing *Wavenzn* numbering as per attribute table.

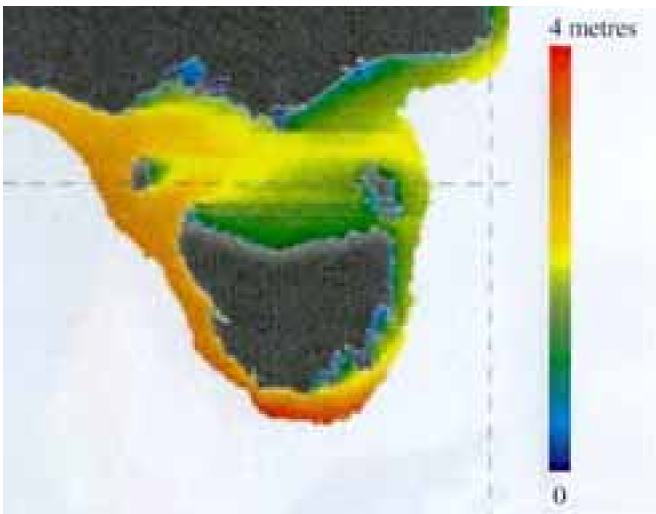

Figure 54: A model of average annual wave heights around the Tasmanian coast (adapted from Figure 7A of Harris *et al.* 2000). Wave energy is proportional to the square of the wave height (Pond & Pickard 1983), hence this model can be used as an indicator of average annual wave energies received around the Tasmanian coast. This model shows a reasonable correlation with the wave energy zones derived from Davies (1978) (see Figure 53 above), and could in future be used to produce a more semi-quantitative and regionally - variable wave energy attribute than the broadly-zoned *Wavenzn* attribute currently used in this dataset (Figure 53 above).

Geomorphic Process

Used in shapefile/theme: *tascsthz_v2gda.shp*
Field name: *Process*
Field type: string (character)
Field width: 1
Explanation: Landforms develop in response to a variety of different geomorphic processes, of which only the "marine/coastal" process group is relevant to this data set. The field *Process* is included in this analysis purely in order to make the data compatible with possible future work which may extend the landform analysis to other geomorphic process systems.

Attribute summary:

Character (0-9)	Geomorphic process (*Process*)
0	fluvial
1	aeolian (terrestrial, non-coastal)
2	marine/coastal (includes coastal aeolian processes)
3	glacial
4	periglacial
5	karst

A2.3.2 Ground Truth and Confidence Descriptor

Used in shapefile/theme: *tascsthz_v2gda.shp*
Field name: *Confidence*
Field type: string (character)
Field width: 2
Explanation: Provides indication of whether shoreline segment has been ground-truthed by C. Sharples since 2000, or whether geomorphic classification is based on existing map data and airphoto interpretation only.

Attribute summary:

Characters (00 - 99)	Degree of ground-truthing (*Confidence*)
00	Not ground truthed during editing of this coastal data set (based on combinations of airphoto, topographic and geological map interpretation, including extensive previous airphoto interpretation by Munro (1978)).
01	Field inspection (ground-truthing) by C. Sharples in the course of editing this coastal geomorphic data set (i.e., since 2000).

A2.3.3 Indicative Coastal Vulnerability Zone Descriptors

Sandy Coast Erosional Recession Vulnerability Shores

Used in shapefile/theme: *tascsthz_v2gda.shp*
Field name: *Sandyvuln* (formerly *sandy* in *tascsthz*)
Field type: string (character)
Field width: 2
Explanation: Identifies all sandy shorelines (defined as shorelines with substantial sand deposits in the upper intertidal zone, which may be with or without cobble berms, protruding rock outcrops or shore platforms), and categorises these into types potentially vulnerable to erosion and/or recession due to sea-level rise.

Attribute summary:

Characters (00 - 99)	Sandy Coast Erosional Recession Vulnerability Shores (*Sandyvuln*)
00	Not identified as a sandy shoreline.
01	Undifferentiated sandy shorelines (all sandy shorelines not fitting any of the other categories below). Most sandy shorelines have been further differentiated into categories 20, 25, 30 & 35 below; those shorelines remaining in category 01 are sandy shores not fitting any of the latter categories - for a variety of reasons. *Potential susceptibility to erosion and recession due to sea-level rise undetermined. Many of these sandy shorelines will be susceptible to erosion and some to recession, however they require individual assessment since they have geomorphic characteristics differing in certain ways from those sandy shores classified as 20, 25, 30 or 35 (below).* Definition: [(*Upperint* = 04 or 05 or 06 or 07 or 41 or 42 or 43 or 44 or 45 or 46 or 47 or 48 or 49 or 51 or 61 or 71) AND NOT ALLOCATED TO ANY OTHER CATEGORY BELOW]

20	Open ocean sandy shorelines backed by low-lying plains of unconsolidated (generally sandy) sediments. Includes some erosion-prone sandy shores backed by low sediment plains but with artificial coastal protection works intended to prevent coastal erosion. *These shores are potentially susceptible to erosion and significant recession due to sea-level rise (see report Section 2.3).* Definition: [(*Upperint* = 04 or 05 or 06 or 07 or 41 or 42 or 43 or 44 or 45 or 46 or 47 or 48 or 49 or 51 or 61 or 71) AND (*Backshore* = 03 or 32 or 33 or 04 or 05 or 07 or 15 or 16 or 17 or 18) AND (*Profile* = 1) AND NOT ALLOCATED TO COASTAL RE-ENTRANT CATEGORY 30 BELOW]
25	Open ocean sandy shorelines immediately backed by bedrock (including semi-lithified Tertiary sediments and colluvium) rising above sea level. However, includes some sandy shores immediately backed by hard artificial coastal protection works intended to prevent coastal erosion which may or may not in turn be backed by low sediment plains. *These shores are potentially susceptible to beach erosion and lowering or loss due to sea-level rise, but erosional recession of the shoreline is likely to be minimal over 50 – 100 year time frames except where the backing bedrock is only semi-lithified, is deeply weathered or is colluvium-mantled. The latter shoreline types are mostly also classified as erosion or slump-prone under the Erosvuln* attribute (*see Report Sections 2.6 & 2.7 & 4.3.5*). Definition[30]: [(*Upperint* = 04 or 05 or 06 or 07 or 41 or 42 or 43 or 44 or 45 or 46 or 47 or 48 or 49 or 51 or 61 or 71) AND (*Backshore* = 01 or 02 or 21 or 22 or 23 or 24 or 25 or 26 or 31 or 34 or 10 or 11 or 12 or 13 or 14) AND NOT ALLOCATED TO COASTAL RE-ENTRANT CATEGORY 35 BELOW]
30	Coastal re-entrant sandy shorelines backed by low-lying plains of unconsolidated (generally sandy) sediments. Includes some erosion-prone sandy shores backed by low sediment plains but with artificial coastal protection works intended to prevent coastal erosion. *These shores are potentially susceptible to erosion and significant recession due to sea-level rise, in ways described by coastal re-entrant behaviour models (see report Section 2.4).* Definition: [(*Upperint* = 04 or 05 or 06 or 07 or 41 or 42 or 43 or 44 or 45 or 46 or 47 or 48 or 49 or 51 or 61 or 71) AND (*Backshore* = 03 or 32 or 33 or 04 or 05 or 07 or 15 or 16 or 17 or 18) AND (*Profile* = 1) AND (re-entrant shores selected as *Wavenzn* = 9[31] and Robbins Island & Franklin Sound (south Flinders Is.) tidal channels manually selected)]

[30] The definition of *Sandyvuln* attributes 25 and 35 (sandy shores backed by bedrock) have been modified slightly from that previously used in Sharples (2004a) to define the equivalent *sandy* shoreline vulnerability types, however the outcome is that *Sandyvuln* still identifies the same shoreline types as *sandy* did. The changes comprise the addition of *Backshore* types 24, 25 & 26 (colluvium associated with cliffs, and weathered bedrock types) and *Backshore* type 34 (rocky backshores with thin aeolian sandsheets). The added shoreline types are simply additional categories of bedrock or colluvial backshores that have been added to the geomorphic map *tascsthz_v2gda*, and *tascoastgeo_v4gda* upon which the latter is based.

[31] Subsequent to the production of the first edition of this report and mapping (Sharples 2004a), an additional attribute code ("9") has been added to the attribute codes for the Wave Energy attribute *Wavenzn* in *tascoastgeo_v4gda* and *tascsthz_v2gda*. This attribute code has been used to identify sheltered coastal re-entrants not significantly exposed to oceanic wave energies, and hence the same attribute code effectively identifies the majority (but not quite all) of coastal re-entrants as defined for the purposes of mapping the sandy coast vulnerability attribute *Sandyvuln* (see also discussion in Section 4.3.3).

35	Coastal re-entrant sandy shorelines immediately backed by bedrock (including semi-lithified Tertiary sediments and colluvium) rising above sea level. However, includes some sandy shores immediately backed by hard artificial coastal protection works intended to prevent coastal erosion which may or may not in turn be backed by low sediment plains. *These shores are potentially susceptible to beach erosion and lowering or loss due to sea-level rise, but erosional recession of the shoreline is likely to be minimal over 50 – 100 year time frames except where the backing bedrock is only semi-lithified, is deeply weathered or is colluvium-mantled. The latter shoreline types are mostly also classified as erosion or slump-prone under the Erosvuln* attribute (*see Report Sections 2.6 & 2.7 & 4.3.5*). Definition: [(*Upperint* = 04 or 05 or 06 or 07 or 41 or 42 or 43 or 44 or 45 or 46 or 47 or 48 or 49 or 51 or 61 or 71) AND (*Backshore* = 01 or 02 or 21 or 22 or 23 or 24 or 25 or 26 or 31 or 34 or 10 or 11 or 12 or 13 or 14) AND (re-entrant shores selected as *Wavenzn* = 9, and Robbins Island & Franklin Sound (south Flinders Is.) tidal channels manually selected)]

Muddy Potential Vulnerability Shores

Used in shapefile/theme: *tascsthz_v2gda.shp*
Field name: *Muddyvuln*
Field type: string (character)
Field width: 2
Explanation: Identifies all shores mapped to date as "muddy or silty" shores. These are soft sediment shores composed predominantly of unconsolidated sediments of finer grainsize than sand, although a sandy or pebbly component may often be present in the sediments (see Section 2.5). These sediments are easily mobilised by wave or current action, hence they most commonly accumulate only on sheltered estuarine or coastal embayment shores. These sediments have a variety of origins, ranging from *in-situ* shoreline breakdown of underlying clayey Tertiary-age sediments (*Bedroc*k = 01), to fluvial deltaic deposition of silt derived from catchment erosion. The response of these Tasmanian shores to sea-level rise and climate change is likely to be variable (see Section 2.5), however their soft and thus mobile nature indicates that significant change is likely, probably involving erosional retreat of these shore in many cases, but potentially accretion or progradation in some cases.

These shores are sub-divided into those backed by extensive low-lying plains of unconsolidated sediment (which are potentially vulnerable to significant erosional recession of the shorelines), and those backed by bedrock (which in most cases are potentially vulnerable to only limited erosional recession except where the bedrock comprises semi-lithified types (*Bedrock* = 01), in which case these shorelines are vulnerable to progressive erosional retreat and are also classified as such under the *Erosvuln* attribute (see below and Sections 2.6 and 4.3.5).

Attribute summary:

Characters (00 - 99)	Muddy Potential Vulnerability Shores (*Muddyvuln*)
00	Not identified as a muddy shore
10	Soft muddy shores backed by extensive low - lying unconsolidated sediment plains. Includes some muddy shores backed by low sediment plains but with artificial shoreline protection works intended to prevent erosion. *These shores are potentially vulnerable to significant change with sea-level rise, potentially including significant erosional recession.* Definition: [(Upperint = 08 or 81) AND (Backshore = 03 or 32 or 33 or 04 or 05 or 07 or 15 or 16 or 17 or 18) AND (Profile = 1)]
20	Soft muddy shores mostly backed by bedrock. May include some narrow backshore sediment plains. *These shores are potentially vulnerable to limited change including shoreline erosion and lowering, however erosional recession of the shoreline is likely to be minimal in most cases over 50 – 100 year time frames except where the backing bedrock is colluvium-mantled or is only semi-lithified (Bedrock = 01), in which case significant slumping and / or erosional recession is possible (see Report Section 2.6 & 2.7). The latter shoreline types are mostly also classified as erosion-prone under the Erosvuln* attribute (see below and Section 4.3.5) Definition: [(Upperint = 08 or 81) AND (NOT SELECTED AS ATTRIBUTE 10 ABOVE)]

Soft Clayey - Gravelly or Colluvial Shores Vulnerable to Progressive Erosional Recession and / or to Slumping

Used in shapefile/theme: *tascsthz_v2gda.shp*
Field name: *Erosvuln*
Field type: string (character)
Field width: 2
Explanation: Identifies shores with semi-lithified or deeply weathered (soft) bedrock, or colluvium (slope deposit) - mantled bedrock of any sort rising above sea level in the immediate backshore. These shores are potentially vulnerable to progressive erosional retreat and / or slumping in response to normal coastal processes at a constant sea level, and increasingly so in response to rising sea levels (see Sections 2.6 & 2.7). This vulnerability category combines shoreline vulnerability categories discussed separately in Sections (2.6) and (2.7) of this report, since there is considerable overlap between these types (e.g., semi-lithified Tertiary sediment shores (*Bedrock* = 01) of the sort described as prone to progressive erosion in Section (2.6) may also be prone to slumping where the backshore profile is steeper (see for example Figure 14)).

Narrow sandy beaches may be present in the upper intertidal zone, and the backshore bedrock may be thinly mantled by windblown (aeolian) sands including dunes, however the presence of colluvium or semi-lithified bedrock rising above sea level in the immediate backshore causes these shores to behave differently compared to predominantly sandy shorelines in response to sea-level rise (see discussions Sections 2.3, 2.6 & 2.7). This category also includes sea cliffs in semi-lithified Tertiary sediments, which were excluded from the hard-rock sea cliff vulnerability category *Cliffvuln* (below) due to their somewhat different response to wave attack (see Section 2.8).

Attribute summary:

Characters (00 - 99)	Soft Clayey - Gravelly or Colluvial Shores Vulnerable to Progressive Erosional Recession and / or to Slumping (*Erosvuln*)
00	Not identified as soft clayey - gravelly or colluvial shores
10	Low profile soft clayey – gravelly shores. Includes some semi-lithified bedrock shores with artificial shoreline protection works intended to prevent erosion (and usually constructed in response to an existing erosion problem). *These shores are predominantly vulnerable to progressive erosional recession (see Section 2.6)* Definition: [(*Bedrock* = 01) AND (*Profile* = 1) AND (*Backshore* = 01 or 02 or 21 or 22 or 23 or 24 or 25 or 26 or 31 or 34 or 10 or 11 or 12 or 13 or 14)]
20	Moderately to very steep soft clayey – gravelly or colluvial shores. Includes some shores of deeply weathered (softened) bedrock. *These shores are vulnerable to both progressive erosional recession and to slumping (see Section 2.7)* Definition: [{(*Bedrock* = 01) OR (*Backshore* = 21 or 22 or 23 or 24 or 25 or 26)} AND {*Profile* = 2 or 3 or 4}]

Hard-Rock Sea Cliff Rock Fall and Retreat Vulnerability Shores

Used in shapefile/theme: *tascsthz_v2gda.shp*
Field name: *Cliffvuln*
Field type: string (character)
Field width: 2
Explanation: Identifies all shores having hard-rock cliffs greater than 5m height in the upper intertidal or immediate backshore zones, and potentially prone to rock falls, collapse, slumping and erosional retreat. However does not include cliffs where the bedrock comprises semi-lithified sediments such as Tertiary-age sedimentary rock (*Bedrock* = 01); the latter shorelines are included in the progressive erosion & slumping vulnerability category (*Erosvuln*) as they are likely to exhibit slumping behaviour more characteristic of the latter category (see Section 2.8).

Cliffed shores in the *Cliffvuln* vulnerability category are sub-divided into a type more exposed to wave energy (*Exposure* = 1 or 2) and a type less exposed (*Exposure* = 3), reflecting a potentially greater or lesser hazard of rock fall and cliff retreat respectively. This is essentially a partial "Second Pass" or "Regional" assessment of this hazard and is subject to the pitfalls of Second Pass assessments as outlined in Section (3.3.1) of this report, however differences in *Exposure* are likely to significantly affect sea cliff hazards (see Section 2.8). A pure "First Pass" Indicative Assessment (as defined in Section 3.2 of this report) which does not differentiate by *Exposure* category can be obtained by simply lumping these categories together.

Attribute summary:

Characters (00 - 99)	Sea Cliff Rock Fall, Collapse and Retreat Vulnerability (*Cliffvuln*)
00	Not identified as a hard rock sea cliff at least 5 metres high
10	Moderately to highly exposed lithified (hard) rock coastal cliffs (>5m high) *Potentially vulnerable to rock falls, collapse, slumping and cliff-line retreat.* Definition: [({*Upperin*t = 01} or {*Backshore* = 01 or 24}) AND (Exposure = 1 or 2) BUT NOT (Bedrock = 01)]
20	Sheltered lithified (hard) rock coastal cliffs (>5m high) *Potentially vulnerable to rock falls, collapse, slumping and cliff-line retreat, but probably less vulnerable that the more exposed types (*10 *above).* Definition: [({*Upperin*t = 01} or {*Backshore* = 01 or 24}) AND (Exposure = 3) BUT NOT (Bedrock = 01)]

Minimal Vulnerability Shores

Used in shapefile/theme: *tascsthz_v2gda.shp*
Field name: *Minvuln* (formerly *minhaz* in *tascsthz*)
Field type: string (character)
Field width: 2
Explanation: Identifies shoreline segments considered to have minimal vulnerability to coastal geomorphic hazards, especially geomorphic changes or flooding related to sea-level rise and climate change. Essential gently to moderately sloping hard-rock shores, with or without rocky shore platforms.

Attribute summary:

Characters (00 - 99)	Minimal Vulnerability Shores (*Minvuln*)
00	Not identified as a minimal vulnerability shoreline
01	Hard rocky shorelines with moderately sloping backshores. *Considered to have minimal vulnerability to coastal erosion, slumping, cliff collapse or storm surge inundation.* Does not include vertical sea cliffs, known colluvium slopes or (commonly only semi-lithified) Tertiary sediment bedrock, which may be susceptible to block collapse, slumping or progressive erosion. Does not include narrow sandy shores immediately backed by bedrock (these are likely to be susceptible to beach erosion, at least, and are identified by attributes 25 & 35 of the *Sandyvuln* field described above). Definition[32]: [(*Upperint* = 02 or 21) and (*Backshore* = 02 or 34) and (*Profile* = 2 or 3)] BUT NOT [(*Bedrock* = 01)]

[32] The definition of *Minvuln* has been modified slightly from that previously used in Sharples (2004a) to define the equivalent *minhaz* shoreline type, however the outcome is that *Minvuln* still identifies the same shoreline types as *minhaz* did. The changes comprise the addition of the *Upperint* shoreline type 21 (rocky shores with *in situ* breakdown material) and *Backshore* type 34 (rocky backshores with thin aeolian sandsheets), and the deletion of "BUT NOT Backshore = 21 or 22 or 23". The two added shoreline types are closely similar to *Upperint* 20 and *Backshore* 02 respectively in terms of their response to wave erosion and flooding, and the deleted *Backshore* types were redundant since they were already excluded by the definition anyway. *Backshore* type 34 may be susceptible to increased sand mobility in the backshore with climate change (see Section 2.9), however the propensity for shoreline erosion or flooding - which are the hazards addressed by *Minvuln* - are not affected by this.

Unclassified Vulnerability Shores

Used in shapefile/theme: *tascsthz_v2gda.shp*
Field name: *Unclass*
Field type: string (character)
Field width: 2
Explanation: Identifies shoreline segments that have not yet been classified into any vulnerability category, nor as minimal vulnerability shores.

Attribute summary:

Characters (00 - 99)	Unclassified Vulnerability Shores (*Unclass*)
00	Not an unclassified vulnerability shoreline (i.e., classified as having some indicative vulnerability under the *Sandyvuln*, *Cliffvuln*, *Muddyvuln* or *Erosvuln* attributes, or as a minimal vulnerability shore under *Minvuln*).
01	Vulnerability unclassified Definition: [(*Minvuln* = 00) and (*Sandyvuln* = 00) and (*Cliffvuln* = 00) and (*Muddyvuln* = 00) and (*Erosvuln* = 00)]

APPENDIX 3: TOWARDS A "SECOND PASS" ASSESSMENT OF COASTAL VULNERABILITY

A3.1 *Introduction*

This Appendix briefly describes mapped data on several regionally and locally variable vulnerability factors which can be used to provide some refinement of the indicative vulnerability zones described in Section (4.3), so as to produce a *Regional ("Second Pass') Indicative Assessment* of coastal vulnerability to certain hazards, as described in Section (3.3.1). Such an assessment has not been conducted during the course of this project, since the relevant data requires some further refinement, as noted below. However, the current status of the relevant data is noted here in order to facilitate its future refinement and use in a regional ("second pass") indicative assessment of Tasmanian coastal geomorphic vulnerability to climate change and sea-level rise.

It is emphasised that any "second pass" assessment conducted using the data described below, even when further refined, can provide only a partial assessment of site-specific variations in levels of coastal vulnerability, and must be treated with great caution since many other site-specific variables – whose assessment was well beyond the scope of this project – also play a significant role in determining the level of vulnerability at any particular coastal site. Thus for example, whilst sediment budget, coastal exposure and wave energy (as described below) play an important role in determining the degree of susceptibility to erosional recession of particular sandy shorelines, other locally-variable factors not assessed here may in some cases be so important as to raise or lower the level of vulnerability at particular sites out of all proportion to the influence of sediment budget, exposure and wave energy at those sites. Some of these other important site-specific vulnerability factors for a variety of coastal hazards are identified in Section (2.0).

Partially complete datasets on the following regionally variable factors – which partly determine the relative level of vulnerability at particular coastal sites – are provided in the *tascoastgeo_v4gda* map dataset (Sharples 2006) used in this undertaking this project, and these attribute fields are retained in the *tascsthz_v2gda* map file accompanying this report:

- Wave energy zones
- Exposure to wave energy
- Sediment budget

The above factors are described in the following sections below.

A3.2 *Wave Energy Zones*

Wave energy zones for the Tasmanian coast provide an indicator of the total or average annual swell and storm wave energy received by particularly coastal regions over time. Coasts receiving greater average annual wave energies can be expected to change most rapidly in response to sea-level rise (other factors being equal), and indeed it is notable that sandy shoreline recession in Tasmania at the present time is most prominently in evidence on Tasmania's west and south-west coasts, which receive the highest wave energies of any Tasmanian coast (see Section 2.3).

A relatively crude wave energy zoning for Tasmanian coasts has been prepared and is encoded in the *Wavenzn* attribute of the *tascoastgeo_v4gda* (Sharples 2006) and *tascsthz_v2gda* map files (see details in Appendix 2). Very little direct measurements of wave energy exists for Tasmanian coasts, although it is likely that some useful data could be extracted from records obtained by a handful of wave-rider buoys stationed in a few locations around the Tasmanian coast. Instead, the *Wavenzn* zoning has been based on a qualitative assessment of wave energy zones around Tasmania provided by Davies (1978), who inferred average coastal wave energies from studies of beach sand grainsizes, sorting, and other wave-dependant characteristics. However, a more quantitative annual average wave height model for Tasmanian coasts has recently been provided by Harris *et al.* (2000). Since wave energy is proportional to the square of wave height (Pond & Pickard 1983, p. 219), it is envisaged that this annual average wave height model could be used to provide a more detailed and regionally variable semi-quantitative indicator of Tasmanian coastal wave energies. However this work has yet to be undertaken.

See further discussion in Appendix 2.

A3.3 *Exposure to Wave Energy*

Whereas wave energy zoning refers to the total amount of wave energy received by a coastal region, the complex and often indented plan-form of many coastal regions means that the wave energy that arrives at a coast is not expended equally at all points along the shoreline. In virtue of the orientation of particular shores to the wave approach direction, and the presence or absence of features such as sheltering headlands or other barriers, certain shoreline segments will be more exposed to wave energy, and others will be relatively sheltered.

Thus, exposure to wave energy determines the proportion of the available wave energy that will actually be expended on a particular shoreline segment. In any given coastal wave energy region, the more exposed shores will receive higher proportions of the available wave energy and thus are likely to change most rapidly in response to sea-level rise, whereas more sheltered shores will receive less wave energy and are likely to change more slowly.

A measure of the exposure of individual shoreline segments to prevailing wave energy on Tasmanian coasts has been manually prepared and is encoded in the *Exposure* attribute of the *tascoastgeo_v4gda* dataset (Sharples 2006). This was prepared by visually estimating the exposure of individual coastal segments to the direct and refracted prevailing westerly and south-westerly swells and storms that are the dominant waves impinging on the Tasmanian coast throughout the year (Short 1996). See also Appendix 2 discussion.

However, north-eastern, eastern and south-eastern Tasmanian coasts also receive less frequent but intense storm waves from easterly and south-easterly approach directions, which are generated by infrequent low pressure systems in the Tasman Sea. It is desirable that the exposure attributes for NE, E and SE Tasmanian coasts, as currently provided by the *Exposure* attribute of the *tascoastgeo_v4gda* and *tascsthz_v2gda* map datasets, be modified to take account of these important storm wave sources, however this refinement has not yet been undertaken.

See further discussion in Appendix 2.

A3.4 *Sediment Budget*

The term "sediment budget" is here used primarily in relation to sandy shorelines, and refers to the degree to which sandy shorelines are progressively and over the long term losing or gaining sand, or are in a stable equilibrium. In effect, "sediment budget" is equivalent to the "shoreline movement" parameter which has been used in a number of overseas vulnerability assessments that apply a Coastal Vulnerability Index (CVI) in a way which is equivalent to the "Second Pass Assessment" methodology described in this report (see Section 3.3.1 discussion).

Sand gain or loss from a shoreline may occur for a variety of reasons, including sea-level rise erosion (as discussed in Section 2.3), influx of new sand sources from rivers or longshore drift, or in a variety of other ways depending on the coastal geomorphic processes operating in particular regions.

A few Tasmanian beaches are progressively gaining sand – "prograding" – for example on the eastern sides of King and Flinders Islands where sand drifted around the coast of those islands is progressively building up on their eastern sides, which are in the "lee" of the predominating westerly swells driving longshore drift around those islands. Similarly, the southern end of Ocean Beach (west coast) is prograding due to progressive and continual southwards drift of sand from more northerly eroding parts of the beach. Most Tasmanian beaches, however, appear to be currently either in equilibrium (neither gaining nor losing sand), or are losing sand (for reasons which may include contributions from erosion due to sea-level rise).

Sediment budget is highly relevant to determining the response of sandy shores to sea-level rise. Where a beach is currently prograding, an excess sand supply is implicitly available. This has the potential to counter-act the erosive effects of sea-level rise, since sand eroded and moved offshore by rising seas is being replaced by the excess sand available in the local coastal system, hence currently prograding shores are more likely to remain stable or even continue to prograde with sea-level rise. On the other hand, shores currently in sediment budget equilibrium are likely to begin losing sand and receding with sea-level rise (see Section 2.3), while those currently losing sand and receding are likely to show accelerated rates of recession with increased sea-level rise.

It should be noted, however, that it cannot be assumed that these "linear" responses to sea-level rise will necessarily occur. Due to complex "non-linear" processes that may occur in the coastal environment, there may be situations where changes related to sea-level rise will completely change the sediment budget on a shore, so that its behaviour will not be as simply predicted as suggested above. Ultimately, site-specific assessments and coastal behaviour modelling will be necessary to resolve likely coastal behaviour at particular sites with any confidence (see Section 2.3).

It is difficult to determine whether some beaches are prograding, in equilibrium or receding without long term monitoring (which has not been conducted in Tasmania). Some smaller scale erosion or accretion phenomena on beaches may simply be part of the cyclic "cut-and-fill" process, rather than evidence of longer term recession or progradation. However, in some cases beaches and dunes exhibit clear morphological or stratigraphic evidence of long term and ongoing progradation and recession.

During the course of this project some data have been collected on Tasmanian beaches that are thought to be prograding, in equilibrium, or receding. This information is encoded in the *Sedbudg* attribute of the *tascoastgeo_v4gda* and *tascsthz_v2gda* maps (see Appendix 2). Much of these data were obtained from Mike Pemberton (earth scientist, DPIW) and Frances Mowling (Ph.D. candidate, University of Tasmania), whose observations of Tasmanian beaches over many years have allowed determination of likely sand budgets at a number of beaches. Data from Cullen (1998) was also used for south-west Tasmanian beaches.

However, the sediment budget status of many beaches in the *tascsthz)_v2gda* map dataset remains uncertain, hence the sediment budget attribute could currently only be applied to certain beaches in the course of regional "second pass" indicative assessment of sandy coast erosion vulnerability in Tasmania. It is envisaged that the sediment budget attribute would become a more useful regional variable for coastal vulnerability assessment if more data were collected over time on the sediment budgets of a wide range of Tasmanian beaches.

See further discussion in Section (2.3) and in Appendix 2.

APPENDIX 4: WORK UNDERTAKEN

This report and accompanying digital maps (*tascsthz_v2gda*) comprise the second edition of an indicative mapping of Tasmanian coastal geomorphic vulnerability to climate change and sea-level rise.

The preparation of the first edition of this report (Sharples 2004a) and the accompanying digital coastal vulnerability maps was undertaken by Chris Sharples (geological and coastal geomorphology consultant) during 2004 for the Strategic Policy Division of the Tasmanian Department of Primary Industries & Water (DPIW). A review of relevant scientific literature was undertaken (as described in Section 2.0), and digital mapping was prepared as described in Section (4.3), using ESRI Arcview GIS software and digital base maps supplied by DPIW for this project. The project was undertaken under the supervision of, and was reviewed by, the Sea Level Reference Group established by DPIW (see Section 1.5).

The work to produce this second edition was undertaken by Chris Sharples during 2005 – 2006, again as a consultant to the Strategic Policy Division of DPIW, and again under the supervision of the same Sea Level Reference Group. This second edition constitutes a considerable extension of the scope of work undertaken for the first edition. The changes and additions undertaken for this second edition are identified in the Foreword to this edition.