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National Coastal Geomorphic and Stability Mapping Project

Submission by Chris Sharples to the Inquiry into Climate Change and Environmental Impacts on Coastal Communities (Standing Committee on Climate Change, Water, Environment and the Arts

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The "Smartline" Coastal Landform Map of Australia and its use in Coastal Vulnerability Assessment

Background – Chris Sharples

I am qualified as a geologist with degrees from the University of Tasmania (B.Sc. (Hons) 1980, M.Sc. 1990). Since around 1990 my professional interests have centred on landform research and management (geomorphology). I have worked mainly as a self-employed contractor for private firms, Local, State & Commonwealth government agencies; with several brief stints as an employee of Tasmanian land management agencies including the Forest Practices Authority and Parks & Wildlife Service. My professional work over the last 18 years has focussed on management issues relating to landforms, including erosion, landslip, water quality protection, and karst (cave) mapping and protection. For the last ten years much of my focus has been on coastal landform issues, including investigation of the potential for coastal erosion and recession in response to sea-level rise. During 2004 – 2006 I undertook a major project for the Tasmanian Department of Primary Industries & Water to prepare a detailed map of Tasmanian coastal landforms and erosion hazards; this was the precursor for the current national 'Smartline' coastal mapping project outlined below. I am currently based at the University of Tasmania where – along with Dr Richard Mount – I manage a team preparing the national Smartline map.

The 'Smartline' Map Project

Myself & Dr Richard Mount are currently finalising a project to prepare a detailed map of coastal landforms for the entire Australian continent, and to use this map to identify shores potentially sensitive in differing ways to a range of physical impacts including erosion, slumping, and cliff-retreat which may result from sea-level rise and other coastal processes. This project is being undertaken under contract to Geoscience Australia and the Department of Climate Change, and is a significant component of the First Pass Coastal Vulnerability Assessment for Australia which is being finalised by the Department of Climate Change. This submission attempts to provide a very brief summary of the project, however more information will be available in various documents being prepared for the project, as well as on the www.ozcoasts.org.au coastal data website maintained by Geoscience Australia.

Geomorphic (landform type & process) information is an essential part of any coastal vulnerability assessment as it is the variations in *both* the constituents (rock, sand, mud, etc) and forms (topography) of the coast which fundamentally determine the widely varying sensitivity

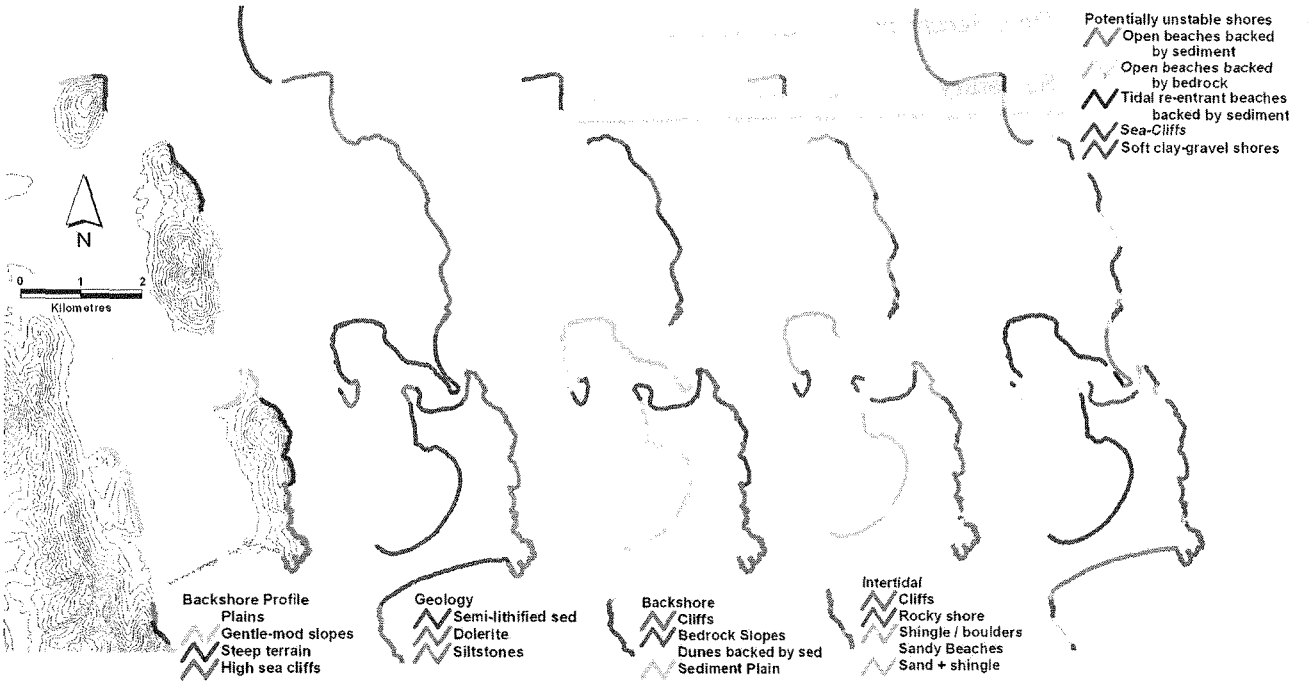

Figure 1: Example of the Smartline map format. The Smartline is a single line map of the coast capturing data representing multiple attributes or characteristics of each coastal segment. The multiple lines depicted here are a graphical representation of several (but not all) of the layers of information contained within the Smartline. The right-hand line depicts a variety of differing coastal landform stability classes that can be identified by digitally querying the data layers within the Smartline.

of different coastal areas to effects of sea level rise such as erosion and shoreline recession. At the outset of the current First Pass Vulnerability Assessment of the Australian coast, it was recognised that a key requirement was comprehensive information (mapping) of the distribution of coastal landform types. However, whilst a great deal of relevant geological, geomorphic, topographic and other mapping exists for the Australian coast, this mapping has been prepared for various parts of the coast in numerous different formats, for different purposes, at different scales and using different classifications. There is no one nationally-consistent geomorphic map of the Australian coast suitable for sensitivity assessment, except at scales too coarse to be of real use. This meant it would be very difficult and confusing to consistently assess coastal vulnerability at a national level using the hundreds of disparate data sets in existence.

The 'Smartline' project has been undertaken for Department of Climate Change and Geoscience Australia to remedy this problem by combining several hundred relevant mapped datasets into a single nationally-consistent map, using a mapping format previously trialled successfully in Tasmania.

The format is a simple digital (GIS) line map of the coast, which is split into segments where-ever any significant change in coastal landforms occurs, and to each of which are attached multiple attributes describing the landforms of each coastal segment (see figure). It is important to understand that the attributes attached to each segment describe not only the nature of the shoreline at the precise position of the mapped line, but also the nature of landforms to landwards and seawards, the underlying geology, the degree of exposure to wave energy, and a range of other parameters. The map is as detailed as available source data allows, and in many places the mapping picks out individual features such as cliffs, rocky headlands, pocket beaches

or shore platforms which may be only a few tens of metres long. To the writer's knowledge, the Australian coastal landform Smartline map represents the longest coastline whose landforms have ever been mapped using a consistent classification system at such a high level of detail.

Compilation of the map has involved little fieldwork (sadly), but rather an extensive process of:

- searching out, identifying, accessing and licensing the several hundred existing coastal mapping datasets from around Australia that were considered relevant to the purpose;
- developing and using a variety of innovative GIS (digital data) processing techniques to extract data from pre-existing mapping in a range of formats (line, polygon, grid) and transfer it accurately to the new line map; and finally:
- reclassifying the many varied data sets into a single nationally consistent landform mapping classification.

The line map format that was chosen for this national coastal mapping exercise has been dubbed the "Smartline" because:

- it has proven to be a flexible format into which large amounts of information from differing sources can be imported relatively quickly by efficient geoprocessing means; and most importantly:
- it is a format which allows easy extraction of a wide range of information through simple electronic query procedures.

First Pass Coastal Stability Mapping

The contribution of the Smartline map to the National First Pass Coastal Vulnerability Assessment is precisely that, once compiled in a nationally – uniform format, it has been possible to query the map data to produce national mapping showing the distribution of coastal landforms of differing physical sensitivity to sea – level rise, ranging from robust hard rocky shores, to unstable sea-cliffs, slump-prone shores, progressively eroding clayey-gravel shores, soft muddy shores and erodible sandy shores of a number of different basic types. These coastal landform groupings are being referred to a "stability classes", since they identify the potential for shores to physically change (erode or grow) or not. See Figure 1.

Note however that while the Smartline map allows identification of coastal landform types sensitive to instabilities such as erosion, it does not indicate sensitivity to coastal flooding, the risks of which are being assessed in separate projects using topographic and other datasets separate to the Smartline map.

The use of the Smartline coastal geomorphic map of Australia to identify coastal landform stability classes for the entire Australian continental coast is a logical "First Pass" stage in coastal vulnerability assessment, which allows quite detailed assessment of the national scale and distribution of shorelines having varying types of potential response to sea-level rise. Nonetheless, additional "Second Pass" and onwards stages of investigation are needed to focus further attention on wave energies and a wide range of local coastal processes and variables relevant to more detailed assessment of the vulnerability of particular coastal locations.

Future applications of the Smartline map

The value of the national Smartline coastal geomorphic map will not be exhausted with its use in the present First Pass National Coastal Vulnerability Assessment. The national map that has been compiled contains a wealth of detailed and consistently-classified information on coastal

landforms which is expected to be valuable for numerous coastal planning, management and research purposes into the future – anything indeed which requires detailed maps showing the distribution of different coastal landform components such as beaches, mudflats, rocky shores, cliffs and many other landform types. The map also provides a ready framework to which a wide range of additional data may be attached for specific purposes, including biological, and socio-economic data pertaining to the coast. For example, it is proposed that the Surf Life Saving Australia (SLSA) beaches database will be attached to the Smartline map, allowing users to obtain a wide range of database information about specific beaches by simply clicking on particular mapped beaches.

Chris Sharples
27th January 2009