

Climate Change and the Coast Conference

Speaker Abstracts

Understanding Sea-Level Rise

Dr John Church: Antarctic Climate and Ecosystems Cooperative Research Centre and CSIRO Marine and Atmospheric Research

Sea level has risen by over 120 m since the last glacial maximum, about 20 thousand years ago. The majority of this rise occurred before 6 thousand years ago. From ancient Roman times until the 18th century there has been little rise in global average sea level. The longest tide gauge records, extending over several centuries, indicate an increase in the rate of rise commenced in the 19th century. A combination of tide gauge data and satellite-altimeter data have been used to estimate sea levels from 1870 to the present. These data show sea levels have risen by about 20 cm over this period, a 20th century rate of rise of 1.7 ± 0.3 mm yr⁻¹ and a significant acceleration in the rate of rise. Satellite-altimeter data from 1993 indicate a rate of rise closer to 3 mm yr⁻¹.

The largest contributions to late 20th century sea-level rise are ocean thermal expansion and the melting of glaciers and ice caps. The ice sheets of Greenland and Antarctica have made smaller contributions. The contributions from changes in terrestrial storage have significant uncertainties. Volcanic activity is one of the causes of decadal variability in sea level. Immediately after an eruption, the decrease in short wave radiation reaching the ocean surface results in an ocean cooling that can persist in the oceans for decades to centuries.

Sea level is likely to continue to rise through the 21st century and beyond. Even after stabilization of greenhouse gas concentrations in the atmosphere, sea levels are likely to continue to rise for decades and centuries because of the long time scales associated with ocean circulation and the ice sheets. There is increasing concern that the large ice sheets of Greenland and Antarctica might contribute significantly to sea-level rise through surface melting (for Greenland) and dynamic responses unless there is a significant reduction in the emission of greenhouse gases.

A rise in sea level leads to more frequent flooding events of a given level. There is already evidence that this has occurred during the 20th century. Changes in the intensity of atmospheric weather patterns (for example, an increase in the intensity of tropical cyclones) will also alter the frequency and intensity of extreme events. By 2100, tens of millions of people may be vulnerable each year to coastal flooding events associated with sea-level rise and extreme events. Appropriate planning and adaptation actions can significantly reduce the number of people affected.

A Developer's Perspective

Darren Cooper: Development Director, Mirvac Western Australia

Climate change is now a globally-acknowledged fact, which has vast potential to impact patterns of human settlement and enterprise. Rising sea levels due to climate change stand to have significant consequences on coastal areas, threatening both private

property and the public realm. In the face of all this, common sense tells us that a precautionary approach is required.

For some years now, Western Australia has adopted a system of coastal setbacks, via a Statement of Planning Policy, which take into account several factors, including long term sea level rise. However does this go far enough?

Western Australia has an outstanding opportunity via its centralised planning system to adopt a leading practice position in relation to coastal planning for an uncertain future. However, blanket restrictions are not the answer. Rather than adopting a solution, good coastal planning outcomes could be achieved under a mechanism by which all the involved stakeholders negotiate and agree good sustainability outcomes.

But will developers be happy with a system which only guarantees certainty of process, rather than certainty of outcome? Provided that the key principles of certainty, equity, transparency and stage implementation are met, most leading Developers would accept such a process. What is required, however, is more balanced policies and decision-making regarding key tradeoff elements, such as density and height. In this way, coastal planning should be seen as a suite of controls, tradeoffs and opportunities, rather than simply blanket setback and height restrictions.

Mayor Paddi Creevey

TBA

Coastal Data and the Impacts of Climate Change in Western Australia

Ian Elliot:

The aim of this paper is to overview coastal data and research in Western Australia relevant to assessment of coastal impacts of projected climate change. The Western Australian coast spans a latitudinal extent far greater than any other Australian State and encompasses a wide variety of physical settings. Processes of change and their impacts are likely to vary significantly around the State. The major data sources for the coast are records maintained by Commonwealth and State Government agencies, particularly data derived from environmental monitoring services provided by the Commonwealth Bureau of Meteorology and the Maritime Branch of the Department of Planning and Infrastructure. The records provide a substantive picture of regional variation in climatologic and oceanographic process around the coast, and have specific application only to the locale in which they were gathered. They enable broad estimation of the type of problems likely to be associated with climate change drivers such sea level rise, changes in storminess, storm surge and inundation of coastal flood plains. The extent to which such information is useful in risk and coastal vulnerability assessment at a local scale remains open to question, as does the adequacy of the information as a basis for modelling coastal change.

It is clear from recent research that global vulnerability and adaptation assessment methods are not applicable at a site-specific scale on the Western Australian coast. For example, current methods used to identify appropriate setback to development on sandy coast are based on two dimensional models such as the Bruun Rule with little relevance to areas underlain by rock platforms or sheltered from offshore swell by reefs and

islands. Actual impacts will be strongly affected by the combination of climate induced change with existing patterns of coastal change. Additionally, there is a need to tailor vulnerability assessment to the changing dynamics of the coast in order for any planned response to perceived risk to be incorporated in an adaptive management process. Presently, adaptive responses are mostly defined by the capacity of the organisation undertaking such assessment, and largely high level in nature. This may require a rethink of the way in which coastal science is coordinated as well as more focussed extension of data acquisition programs for site-specific assessments. Such a multi-disciplinary approach over long enough time periods can only be done through organisations such as the Western Australian Marine Science Institution (WAMSI) which has the capacity to bring together corporate, governmental and academic interests and expertise to serve the community.

Some Oceanic and Estuarine Implications of Sea level Change in the Peel Region

Peter Hick: Peel-Harvey Catchment Council.

The +200 km of both oceanic coastlines and estuarine shorelines of the Peel Region will be affected by sea level changes. The IPCC prediction is for a sea level rise by 2100 of 0.09 -0.88m. Fremantle Sea Level has risen 20cm since 1915 at a rate of 1.38mm/year. However, the interpolation of the data over the past 30 years produces an average figure closer to 3.0mm/year (Hick, 2007).

The effects may initially be noticed during dramatic events, but a combination of gradual rising sea-level, increased storm intensity, tidal and meteorological coincidence are likely to create notable incidents. This will raise alarm but it may be difficult to separate the insidious sea level rise from compounding factors and planning will need to be conservative and rely on expensive engineered mid-term solutions.

The loss of coastline is being calculated using such models as those developed by Bruun (1980) and it will be shown that this model is valid in some of the Peel region's coastline (Hayne, 2002). However, the effect on estuarine shorelines is less well understood and a program to adapt the modelling has commenced. Engineered solutions may be possible for high value property, but of great concern to the PHCC, is the loss of fragile coastal environments and biological diversity typified by the Ramsar-listed wetlands. Coastlines and shoreline ecosystems generally re-establish very quickly and often with biological integrity. However, some situations and intertidal habitats will be lost forever and preservation efforts may be unrewarded.

Estuary basin volume will increase with higher sea level, and although complex to calculate exact exchange volumes, sieching effects, greater tide flow and velocities (probably double) will have a significant effect on existing channel state.

These results and other associated data will from the recently completed study of Climate Change in the Peel Region will be presented.

Climate Change and the Law Present Trends and Possible Future Developments

Glen McLeod: Partner, Minter Ellison Lawyers and Adjunct Professor, Murdoch University

Although there has been some policy development to meet the climate change challenge, directed at emissions trading and carbon offsets, the potential broad scope of the response needed to the Climate Change challenge, has not to date been evident. The broader paradigm of 'sustainable development' or sustainability is the key concept on this subject for the contemporary environmental lawyer.

In regard to coastal developments the statutory framework includes town planning and environmental law. This is complimentary to private law, in particular nuisance and negligence. These torts have for some time been increasingly important in the protection of property rights and the environment.

The legal framework is considered in the context of the relevant administrative and policy challenges facing Government, as well as the interdisciplinary nature of environmental law and the effect this has on policy development and law reform.

The increased scope and complexity of the content of environmental law occasioned by climate change may spread to private law, in particular, actions to protect property, proving damage, director liability and the documentation of transactions.

These are in a sense the soft end of the legal implications of climate change. At the other end there is litigation. In Nigeria for example, Shell was successfully sued for flaring off and creating greenhouse gas in the process. In Australia there have been several cases which indicate how complex the resolution of competing issues will be in the future. The cases will be examined with a view to seeming what they possibly show about the future.

First Pass Assessment of Australia's Coastal Vulnerability

Stefanie Pidcock: Director of the Climate Change Adaptation Section, Australian Greenhouse Office, Department of the Environment and Water Resources

Many of Australia's coastal areas are vulnerable to impacts from climate change. The collective economic, environmental and social value of Australia's coastal areas, combined with the extent of likely biophysical changes under climate change models makes the coastal zone a priority for national focus.

In April 2006, the Natural Resource Management Ministerial Council agreed to substantially progress an assessment of vulnerability of our coasts to climate change. The Australian Greenhouse Office is leading the national coastal vulnerability assessment to:

Identify key vulnerabilities in Australia's coastal zone to climate change, and provide strategic direction on priority research and data gaps; and
Bring together and integrate biophysical and socio-economic analyses to enable decision-makers to better understand the risks of climate change in the coastal zone.

In developing these outcomes, a number of areas of capacity will also be progressed. These are: a national coastal Digital Elevation Model (DEM); a foundation for a Georeferenced Spatial System; and digitisation of various historical data sets.

The presentation will provide an update on progress of the First Pass Assessment of Australia's Coastal Vulnerability to Climate Change, and the rationale and approach to the Assessment.

Potential Impacts of Climate Change on the Swan and Canning Rivers

Dr Luke Twomey: Principal Scientist, Swan River Trust

Based on the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report - Summary for Policy Makers, the Swan River Trust has drafted a paper on the implications of climate change for management of the Swan and Canning estuary. The paper describes two future scenarios which consider various degrees of success by the global community in stabilisation and reduction of greenhouse gasses. The first, typified as business as usual, describes only marginal success. The second represents an aspirational outcome with early and aggressive commitment to greenhouse gas abatement. The basis for Swan Canning estuary climate scenarios were determined from local research data and judgements interpolating, extrapolating or factoring in available data. The scenarios represent plausible alternative circumstances which might be encountered in future river management.

Climate change is already evident in the Swan Canning estuary. The rate of change is increasing relative to the past century and changes to the familiar regime will become increasingly evident and significant as the century progresses. For the next 30 years the rate of change has largely been determined by past decisions made globally. However, in the longer term, differences in outcome between business as usual and aspirational scenarios will become significant.

The system will be altered by diminished stream-flow associated with warming of the water bodies and surrounding environment. There will be changes in the seasonal timing of flows with smaller and later Autumn/Winter flows and potentially similar or possibly higher Summer event flows. Tidal reaches will also be affected by sea-level rise and superimposed storm surges. The lower winter flows, especially during the transitions from salty to fresh in Spring and Autumn, could prolong and exacerbate low oxygen conditions over significant lengths of the tidal riverine reaches.

The potential impacts of these described events on the catchment, ecology, infrastructure, human health and economy are considered, with particular emphasis on adaptation management strategies for the Swan Canning estuary.

The Place of Coasts in the WA Climate Change Adaptation Programme

Steve Waller

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