CHALLENGES AND POTENTIAL SOLUTIONS FOR IMPLEMENTING RECENT COASTAL MANAGEMENT REFORMS

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Abstract

The management of coastal hazards has always been a challenge for local, state and federal governments in Australia. For NSW, a prescribed framework for coastal hazards management was borne out of the severe storm events of the 1970s, resulting in the *Coastal Protection Act 1979*. Changes to NSW's Coastal Management Framework in 2009-10 were also in response to a recognised threat, namely sea level rise and its potential impacts to Australia's population. This resulted in the *Sea Level Rise Policy Statement 2009*, modifications to NSW's *Coastal Protection Act 1979* and new *Guidelines for Preparing Coastal Zone Management Plans* in 2010. The NSW Government has again instigated reforms to the Coastal Management process, which includes the withdrawal of the sea level rise benchmarks, greater provisions for protection of lands subject to erosion by landholders and clearer guidance on S149 notifications.

Recent experience working with many local councils in preparing coastal zone management plans under the evolving Coastal Management Framework has highlighted a number of significant issues and challenges in managing coastal risks. These issues have and are likely to continue to persist regardless of the content of the latest NSW coastal reforms.

Local councils have a duty of care to inform and manage known risks, which includes the potential impacts projected to occur from future sea level rise. Councils therefore seek a robust and defensible methodology for assessing coastal hazards that can provide certainty to the community and avoid on-going debate about the positioning of "lines on a map".

There are also challenges for councils in implementing actions to manage known coastal hazards. Attempts to 'accommodate' coastal risks through development controls have been highly contentious with the local community. Local governments are also given little incentive (e.g. funding) for alternative strategies such as acquisition, even through economically viable means such as 'buy-back / lease-back' schemes.

This paper describes potential solutions to some of the challenges facing NSW councils regarding coastal management and a way forward in the context of recent coastal reforms.

The Coastal Management Framework in NSW

The beach is a very important part of Australian life and culture. As coastal development was spreading north and south of Sydney, the severe storms of the late 1960s and 1970s demonstrated to communities the power of the ocean to threaten and even destroy homes and property along the coastal fringe.

Emerging from these events was both a surge in research by the engineering and science community as well as legislative action from the NSW Government in the form

of the *Coastal Protection Act 1979*, which remains the key legislation governing management of coastal hazards in NSW. It has always been understood that a better knowledge of coastal processes is required if communities are to be better prepared for such risks in the future.

Many of the methodologies used to determine coastal hazards today were developed from the field data and subsequent research associated with the prevalent coastal storms in the 1970s, including the Coastal Studies Unit of the University of Sydney (established in the early 1970s) and the NSW Government (particularly the Public Works Department [PWD]). The storms of 1974 were particularly damaging on the central NSW coast, and have become the defacto benchmark for hazards studies in NSW generally.

The 1990 Coastline Management Manual (CMM) prepared by PWD documented the NSW Government's (former) Coastal Hazards Policy 1988 and preferred methods for coastal hazards definition along with the scope and context for development of coastal management plans. The CMM remained in place for the next 20 years, and still provides a valuable and relevant resource for descriptions of coastal processes and their associated hazards.

The next major update to the NSW coastal management framework also stemmed from a recognised threat to coastal communities, namely sea level rise. The CMM had previously included consideration of sea level rise, as the scientific community has long recognised this potential threat (supported by the first IPCC report in 1990). In 2009-10, increasing political and community awareness of the threat from sea level rise drove changes to the NSW coastal management framework, which utilised the projections provided by IPCC (2007) along with accompanying CSIRO research findings (McInnes et al., 2007).

The NSW Government produced the *NSW Sea Level Rise Policy Statement 2009*, which set sea level rise benchmarks for use in coastal assessments and replaced the Coastal Hazards Policy 1988. The CMM was also overhauled, replaced by the *Guidelines for Preparing Coastal Zone Management Plans* in 2010. The new guidelines recommended a risk based approach to coastal hazards management, aligning with the risk based approach to planning espoused in the *NSW Planning Guideline: Adapting to Sea Level Rise* (2010).

Now in 2012, presumably in response to another shift in political and community perception and understanding of climate change, the NSW Coastal Management Framework has again been modified. The previous *NSW Sea Level Rise Policy Statement 2009* has now been repealed, meaning that the state-wide sea level rise benchmarks no longer apply. The NSW Government has indicated local councils "have the flexibility to determine their own sea level rise projections to suit their local conditions" (NSW Environment and Heritage, 2012), although it is unclear if or how local councils may be equipped to do this.

In addition, the recent reforms contained in the *Coastal Protection Amendment Act 2012* simplifies the process for landowners to place and maintain "temporary coastal protection works", with no certificates or planning approvals required for works on private lands, and a more straightforward approach to approval certificates for such works on public lands. Penalties for misplacement of such works on beaches have been halved. The Amendment Act also repeals the notification of "risk categories" on Section 149 certificates for properties affected by coastal hazards up to 2100. New guidance on the wording of Section 149 certificates is due to be released shortly. The process of defining and managing coastal hazards is also set to be revised as part of the latest NSW Government reforms.

Impact of Recent Changes to Local Councils

Under Section 733 of the *Local Government Act 1993*, local councils have a duty of care to inform their constituents about known risks, including coastal hazards, and to manage such risks using the best available information. If councils exhibit good faith in fulfilling their duty of care, they receive an exemption from liability for the impacts of such risks (although it is understood that this exemption has never truly been tested in court). Thus, regardless of the political position of the NSW Government, local councils have a duty to inform their constituents of, and plan for, the risks associated sea level rise, given that there is overwhelming scientific evidence that sea level rise is occurring and will continue to occur into the foreseeable future (even if there is uncertainty regarding the projected rate of the rise). This is in addition to managing risks from known and measured coastal hazards such as storm erosion, shoreline variability, long-term shoreline recession, coastal inundation and wave overtopping.

Throughout the past 35 years, irrespective of the various changes in position in coastal management, the issues faced by coastal communities and their local councils in accommodating coastal processes and addressing associated risks have remained much the same, and are largely summarised as:

- **Uncertainty** of predictions and the inability to draw "lines on a map" with credibility and the confidence of the local community;
- **Conflicts** between the rights of the landowner to protect property and the rights of the wider community (usually through council) to protect beach amenity; and
- **Difficulties in funding** preferred management approaches, and the equity for sharing of costs between the local community, visiting community (i.e. tourists), directly affected private landholders, and the broader people of NSW.

The most recent reforms by the NSW Government will leave many councils questioning:

- What sea level rise benchmarks should be applied now that councils are expected to have the expertise to determine their "own sea level rise projections to suit their local conditions"?
- Will use of the values adopted in the previous Sea Level Rise Policy Statement (which are largely consistent with most other Australian states and generally supported by most scientific literature) invite criticism from councillors and the community given that the NSW Government has repealed these levels?
- How can coastal hazards associated with sea level rise be assessed reliably and defensibly, especially if Councils are to be confident about maintaining exemption of liability under S733?
- How to apply planning and development controls that accommodate future sea level rise? and
- How to inform and educate local constituents on the hazards associated with coastal processes and how these coastal processes are modified under future climate conditions, including sea level rise?

Councils (or Councillors) may seize the opportunity to adopt scaled-back development controls in the coastal zone, or indeed, take a more conservative line, especially if there is little consequence to private landholders.

This paper outlines a robust approach to addressing these issues, which will enable councils to maintain their duty of care in managing coastal hazards and sea level rise risks despite recent NSW government reforms.

Certainty in an Uncertain Science

It is certain that a key concern for the community, and local councils, is the uncertainty of coastal hazards studies and associated mapping. Public attention is quickly realised on the impact of hazard mapping upon property values (noting that the "mapping" is seen to have the impact, not the hazard itself). This concern becomes amplified when new hazards appear on Section 149 notifications. The thrust of community anguish often becomes focused on the credibility of the mapping itself.

Another major point of contention is the potential impact upon development rights. Once again, scrutiny is often placed upon the credibility of the scientific study and hazard lines, even before councils have updated their planning frameworks. A second or even third scientific opinion is sometimes sought, and may not necessarily provide any greater certainty of the likelihood of the coastal risks. This can further undermine the community's confidence in the hazards definition process.

Coastal processes are extremely complex, and therefore, all methodologies used to evaluate and predict future responses have limitations and require judicious assumptions. The community and local councils are justified in questioning the "exactness" of the outcomes of some methodologies, given that assumptions and limitations could yield significant variability in hazard definition.

The volume of data on coastal processes has increased dramatically since the *Coastal Protection Act 1979* was created. This has generally highlighted the significant natural variability of the coastal environment, which challenges many traditional methodologies and assumptions. There is now more than 35 years of wave height and period data, and up to 20 years of directional wave data for NSW sites. Photogrammetric data has been compiled for many beaches, and while this data is still problematic and periodic, the number of available dates has increased. The ability to capture data of the beach face and nearshore zone has improved with the use of aerial laser survey (LiDAR), and this will greatly augment existing data sets into the future. Complementing the improvements in data are a range of new approaches for estimating hazards, particularly for the key hazards of beach erosion and long term recession that are underpinned by recent and comprehensive coastal processes research (refer Patterson, 2009, 2010; Huxley, 2009, 2010; Rollason *et al*., 2010a).

Yet despite improvements in data, it remains merely a record or 'snapshot' of recent geologic evolution of the shoreline. For example, 20 years of directional wave data is unlikely to be representative of the full extent of the wave climate. Historical data is therefore limited in its ability to forecast future responses to sea level rise or a changed wave climate.

A key input to a definition of coastal hazards is the projections for sea level rise. In the absence of a 'standard' or guideline value, the NSW Government has suggested that councils adopt projections that are 'widely accepted by competent scientific opinion', or even adopt a range of projections. In fact, there is far more uncertainty regarding the determination of shoreline response to sea level rise than the uncertainty in sea level rise estimates themselves.

Given the uncertainties associated with sea level rise projections and expected shoreline responses, the most pragmatic approach for councils is to require a range of assumptions to be tested and the limits of the methodologies adopted to be made explicit. That is, councils do not need to set the range of assumptions, but simply require this in their technical studies. It is reasonable to expect the engineers and scientists conducting the studies to determine the range of legitimate assumptions to test for sensitivity.

This approach will produce a range of hazard extents, which means there is a further step required to interpret the range of outputs in defining hazard extents. It is no longer acceptable to define discrete hazard lines based on a single set of assumptions. The Risk Management framework is an appropriate and practical platform to express the likelihood of hazard extents on a map, which can and should incorporate the bounds of uncertainty of the assumptions used and limitations of the methods applied to calculate the hazard (see Rollason and Haines, 2011; Rollason *et al*, 2010b).

In a number of studies for local councils conducted by the authors, the scale for "likelihood" shown in Table 1 has been used to qualitatively describe three or four hazard lines at each planning timeframe. The scale descriptors may be easily updated to improve understanding by community, for example by using "almost certain", "best estimate" and "worst case", as in Table 2. This would also enable councils to provide a 'best estimate' hazard line to the NSW Government (who are conducting state-wide collation of hazard mapping), without compromising councils' ability to utilise a risk based probabilistic approach.

A risk probability approach would enable councils to investigate a range of sea level rise projections in a manner that is reasonable and defensible to the community, as well as meeting their duty of care obligations. For example:

- the average rate of sea level rise measured since 1993 of ~ 3-4 mm/year, extended to 2100, could be adopted as the 'almost certain' scenario;
- the mid-level projections for future sea level rise from IPCC and CSIRO could be adopted as the 'best estimate' scenario; while
- the upper limit of projections (including sea ice melt and other less certain factors) could be adopted as a 'worst case' scenario.

An example of how recession due to the sea level rises above could be combined with existing beach erosion hazards to form the three hazard estimates is provided in Table 2.

New methods have been developed by the academic community that will enable the quantitative probability of hazard extents to be calculated (e.g. percent probability of exceedance; see Wainwright *et al.*, 2012). This is the next obvious step in improving confidence and certainty in the hazards mapping process.

The risk based approach can greatly assist with improving the community's confidence in the process being followed and the outcomes of hazards studies, which is a vital step for local councils in implementing any plan. A risk based approach can also be applied to deriving management decisions from the hazards estimates.

Table 1 Risk Likelihood / Probability for Coastal Hazards

Probability	Description
Almost Certain	There is a high possibility the event will occur as there is a history of periodic occurrence
Likely	It is likely the event will occur as there is a history of casual occurrence
Possible	There is an approximate 50/50 chance that the event will occur
Unlikely	There is a low possibility that the event will occur, however, there is a history of infrequent and isolated occurrence
Rare	It is highly unlikely that the event will occur, except in extreme circumstances, which have not been recorded historically.

Table 2 Example Beach Erosion and Shoreline Recession Hazard Probability Zones

Probability	Immediate	2050	2100
Almost Certain	'average' beach erosion [1]	Immediate 'average' beach erosion + recession due to sea level rise of 3 mm/year (= current rate of rise)	Immediate 'average' beach erosion + recession due to sea level rise 3 mm/year (= current rate of rise)
Best Estimate	'maximum' beach erosion at any position along the beach [1]	Immediate 'maximum' beach erosion + recession due to mid-estimate of sea level rise (~ 0.23m)	Immediate 'maximum' beach erosion + recession due to mid-estimate of sea level rise (~ 0.47m)
Worst case	'extreme' beach erosion [2]	**Worst Case of either**: Immediate 'maximum' beach erosion + recession due to mid-estimate of sea level rise (~ 0.23m) **OR** Immediate 'extreme' beach erosion + recession due to sea level rise of 3 mm/year (= current rate of rise) **OR** Immediate 'maximum' beach erosion + recession due to sea level rise of 3 mm/year (= current rate of rise) + more easterly wave climate	**Worst Case of either**: Immediate 'maximum' beach erosion + recession due to mid-estimate of sea level rise (~ 0.47m) **OR** Immediate 'extreme' beach erosion + recession due to sea level rise of 3 mm/year (= current rate of rise) **OR** Immediate 'maximum' beach erosion + recession due to sea level rise of 3 mm/year (= current rate of rise) + 0.9 m SLR + more easterly wave climate

[1] *based on photogrammetric data measurements*
[2] *Assumed to be 'maximum' erosion plus difference between 'maximum' and 'average' beach erosion*

Conflicts in Managing Existing Development, Future Development and Section 149s

It will not be possible to provide complete certainty if and when an impact will occur. Indeed, most decisions are made with a degree of uncertainty of outcomes. Conflicts with community can be diffused somewhat by adopting a risk based format that describes the probability of hazard impact, thus making it transparent regarding the assumptions and limitations applied in deriving the hazard maps. Notwithstanding, local councils will still be required to decide how to manage existing assets and land at risk; what planning and development controls are appropriate for managing future coastal risks; and what notification to provide to local community through Section 149 certificates.

An important split in decision making for councils is between the approach to managing future development compared with existing development (Rollason and Haines, 2011). This approach is likely to be accepted by community as reasonable: councils would be very unlikely (or justified) to implement a significant and costly action for an existing private or public asset for which the hazard impact is not expected to occur for 50 to 100 years. In contrast, when applying development controls to future development,

councils may consider the potential risk to a parcel of land over a 100 year timeframe or more, depending on the type of development and the expected landholder and community benefit from that land.

Risk-based Approach for Existing Development

As an extension to the risk assessment approach, a process for managing existing development has been developed that incorporates the estimated timeframes for the identified risk into the determination of priorities for action. The approach builds upon the typical risk tolerance scale (Table 3) used to determine what level of risk needs to be treated as a priority. As shown in Table 4, the approach specifies that existing development at immediate risk should be treated as a priority, firstly through developing a preferred action then commencing approvals and funding for this action, and applying a hazard trigger (e.g. a distance) as the basis for implementing the action.

For existing development at risk in 50 to 100 years, there is no immediate need to act. A management option can be flagged, but does not need to be confirmed at this stage. Instead, a trigger(s) shall be set that allows for the management option to be fully investigated, approved and funded before the hazard impact occurs. This approach ensures that actions need only be implemented as needed, but should a risk occur earlier than planned, a process is in place to ensure the appropriate risk treatment is implemented prior to an unwanted, damaging impact.

Table 3 Risk Tolerance Scale

Risk Level	Action required	Tolerance
Extreme / High	Eliminate or Reduce the risk or Accept the risk provided residual risk level is understood	**Intolerable**
Medium	Reduce the risk or Accept the risk provided residual risk level is understood	**Tolerable**
Low	Accept the risk	**Acceptable**

Table 4 Prioritisation for Risk Treatment Based upon Estimated Timeframes

Timeframe for Extreme / High Risks	Treatment Approach
Present Day	• Implement no regrets actions • Implement site specific management actions as required
2050	• Implement no regrets actions • Identify potential management option(s) • Identify trigger for implementation, should the option(s) be required.
2100	

The trigger based approach to managing existing development must be properly designed to ensure that opportunistic implementation of management actions occurs when assets are replaced. Without such a mechanism, the trigger based approach is

simply a “do nothing” approach, which may ultimately increase the overall cost of coastal management in the long term. For private property and land, the opportunistic implementation of management action is triggered when a house is re-developed, through planning and development controls. For council assets, the asset replacement cycle within an asset management plan is a key trigger, as discussed in the following section.

Risk-based Approach for Future Development

For future development, delaying action until impacts are imminent will significantly increase the financial burden on the local community to manage those impacts in the future, both in terms of the value of assets and land at risk, and the cost to address the risks. Councils are also bound to implement planning decisions based upon the best available information in order to receive an exemption from liability under the *Local Government Act 1993*. In this case, actions to manage future development are required at the present, even though hazard impacts may not occur for 50 or 100 years.

Planning and development controls offer the ability to manage existing or future hazards to greenfield, brown field and infill developments and redevelopments, at little cost to council. Innovation in the way planning controls are applied in response to coastal hazards is required, not just in the way hazards are defined. In floodplain management, 0.5 m freeboard above the 1 in 100 year planning level is a contingency value that is readily accepted in planning schemes, and demonstrates an acceptance of uncertainty with respect to defining the flood hazard. It is not unreasonable to take a similar approach to coastal hazard lines (possibly translated as a horizontal set-back) when applying planning controls.

In the previous section, it was recommended that more than one hazard line be delineated at each timeframe. In studies conducted for local councils in NSW, this was initially met with resistance by councils’ planners, however, more recent work has demonstrated that multiple lines may improve the flexibility to permit different types of development where appropriate within different levels of coastal risk.

It is recommended that the type of development (and therefore, development lifespan as a proxy for risk ‘consequence’) be used to determine the relevant hazard probability line within the relevant timeframe to be applied. This concept has been borne out of similar floodplain development matrices, which specify different controls for different land uses. The approach for coastal recession is summarised in Table 5.

This approach to planning has a number of advantages:

- Matching the hazard impact (timeframe and likelihood) to the type of development avoids unnecessarily sterilising land that could reasonably be used for certain types of development that have a shorter lifespan than the expected hazard impact;
- conversely, unsuitable (at risk) land is not (re)developed inappropriately;
- The controls upon development are commensurate with the type of development and its expected lifespan, again ensuring that development is not restricted unreasonably; and
- As the hazard lines are updated, the planning approach may still apply to the new lines.

Table 5 Example Timeframe and Hazard Likelihood for Development Types

Land Use Categories	**Coastal Zone Land Use Categorisation Schedule**	**Hazard Line Timeframe**	**Worst case** *(Seaward of)*	**Best Estimate** *(Seaward of)*	**Almost certain** *(Seaward of)*
Essential Community Facilities	Community facility which may provide an important contribution to the notification and evacuation of the community during flood events; Hospitals, SES, Ambulance, Police and Fire Stations.	**2100**	*Not permitted*	*Not permitted*	*Not permitted*
Sensitive Facilities	Communications facility; Hazardous industry; Liquid fuel depot; Educational establishments, Nursing homes, Housing for Aged, Disabled and Special Care	**2100**	*Not permitted*	*Not permitted*	*Not permitted*
Subdivision	Subdivision of land which involves the creation of new allotments, or titles	**2100**	Permitted with controls	*Not permitted*	*Not permitted*
High Density Residential	Attached dwellings and multiple-dwelling housing, residential flat buildings, boarding houses and group homes.	**2050**	Permitted with controls	*Not permitted*	*Not permitted*
Low Density Residential	Single dwellings, dual occupancy & semi-detached dwellings	**2050**	Permitted with controls	*Not permitted*	*Not permitted*
Concessional Development: Additions/ Alterations/ Extensions	An addition or alteration to an existing dwelling or building	**Immediate**	Permitted with controls	*Not permitted*	*Not permitted*
Commercial, Industrial (inc. tourist accom.)	Business or Office premises, Entertainment facility, Hotel; Industry / Light industry, Medical centre, Mote,; Motor showroom; Place of worship; Recreation facility (e.g. RSLs, bowling club buildings and greens, golf club houses), Restaurant, Shops,	**2050**	Permitted with controls	*Not permitted*	*Not permitted*
Recreational and Non-urban	Parks, public open space / recreation, cycleway / shared pathways, lifeguard towers, ocean pools, jetties, wharves, boat ramps, other recreation facilities (e.g. picnic shelters), golf courses (not including club buildings)	**Immediate**	Permitted	Permitted with controls	*Not permitted*
Public Buildings	SLSC buildings, beach pavilions, amenities blocks / buildings, storage buildings.	**2050**	Permitted	Permitted with controls	*Not permitted*
Tourist Related Development	Camp or caravan site – short term sites (1) only; Ecotourism, Holiday cabins,	**Immediate**	Permitted	Permitted with controls	*Not permitted*
Utilities and Infrastructure	Infrastructure that is required to provide public utilities to the community such as roads, water and sewer supply, gas, power and communication services.	**2100**	Permitted	Permitted with controls	*Not permitted seaward of immediate almost certain only*

Community concerns also arise regarding the potential restrictions on development rights that may be applied as a result of coastal hazards mapping. The planning approach described here is again reasonable in setting a different standard for development of single dwellings compared with subdivision or multi-unit (high density) residential developments. Single dwellings could reasonably be expected to be updated within a 50 year timeframe (particularly given the harshness of coastal

environments on property), in which case application of a hazard control for the 2100 timeframe is overly conservative and restrictive. The replacement of a single dwelling with another does not dramatically change the risk profile.

Subdivisions or increases in the density of development are different because this directly increases the value of property at risk within the same land area. There is also a question of equity and duty of care with respect to subdivision: once land is subdivided by developers, the risk to the land is bequeathed to the individual property owners who purchase the land. Once land is subdivided, the designated land use is likely to remain in perpetuity. It is reasonable then to reduce the likelihood of risk impact by applying a longer (2100 or beyond) hazard planning control for subdivisions.

Approach to Section 149 Notifications

Section 149 (2) notifications require local councils to identify any policy or development control plan applicable to each parcel of land. Section 149 (5) notifications may provide more specific or detailed information regarding risks, such as coastal hazards. The NSW Government has indicated that it shall provide advice to councils regarding the content and context for coastal hazard notifications. A key concern of the NSW Government related to the previous 'risk categories' and advice for Section 149 notifications that proposed specification of future risk to a property for a 50 and 100 year timeframe when the occurrence (timing and extent) for such risks is uncertain.

Timeframes of 50 to 100 years are very appropriate for planning and development controls because present day decisions may have ramifications for these timeframes (depending upon the type of development). For Section 149 (5) notifications regarding risk, it is unreasonable to burden a property with a notification for a potential risk in 100 years when the hazard extent will be reviewed and the property may change hands many times within this timeframe. Whether or not Section 149 (5) notifications are made regarding coastal risk, there is no impediment to councils to implement appropriate planning and development controls. For future risks, it may be sufficient to notify of coastal hazards planning policies through the Section 149(2) process only.

Managing the Major Asset Owner: Council

It is important to note that local councils are actually the largest owner of land and assets in the coastal zone. Local councils typically own and manage surf clubs, stormwater infrastructure, wastewater and water infrastructure, roads and paths, and public open space and recreational lands. Many of these assets are very costly and have a long design life (e.g. stormwater assets are expected to last 75-100 years, surf clubs may last over 50 years). In most regions, private property makes up a very small percentage of the assets at high or extreme risk, even though such assets receive the majority of public attention (even by councils).

Regardless of state or federal coastal policies or initiatives, local councils can and should be attending to their own assets first: council-owned assets are far easier to manage as they are in the direct control of council, while the asset management planning process provides a good mechanism for trigger based action.

The key "trigger for action" for councils is asset replacement. For example, when a surf club reaches the end of its useable life and requires replacement, this becomes an appropriate trigger to either relocate the surf club, or redesign the facility to better withstand coastal hazards impacts. Similarly, replacement of stormwater outlets may

be redesigned with tidal flaps to limit the ingress of high tides and sea level rise, or with removable sections to progressively shift outlets landward in response to shoreline recession.

Councils may choose to build movable/sacrificial lifeguard towers, picnic facilities, even small kiosks / commercial enterprise buildings, accepting that as such assets are lower cost, they can be readily replaced if and as needed. In the interim, the local community benefits from the facilities being at close proximity to the beach.

Councils may see the greatest gains in reducing the risk from coastal hazards by managing their own assets and developments first. Energy should be expended on integrating coastal zone management plan into other areas of council, particularly the engineering works departments who implement asset management, and the strategic planning departments that periodically carry out activities assessed and approved under Part 5 of the *Environmental Planning and Assessment Act 1979*. Councils who implement actions to manage their own assets and development will have greater credibility and acceptance from the community when it is time to implement coastal management actions that directly affect the local community.

Funding: Who shall pay?

Lack of funding has long been a serious impediment to coastal hazards management, and there are many examples of coastal zone management plans within which the major options have not been adopted or implemented due to a lack of funding. For example at Narrabeen Beach, one iteration of the coastline management plan recommended a seawall be built along the beach to protect the expensive, densely populated back beach. This was strongly opposed by the community, resulting in a policy for voluntary repurchase of waterfront properties. Clearly such a policy is unworkable for the local council, as it requires many millions of dollars to repurchase all of the immediately affected properties. Similarly, many plans recommend beach nourishment as a form of 'soft' protection, however, the practicalities of obtaining sand from terrestrial sources (given the NSW Government's position that prevents offshore sand sourcing) makes this option prohibitively expensive.

There is also, quite fairly, a question around "who should pay" for coastal management actions, particularly where private landowners directly benefit at the expense of the public; or conversely, when a landowner loses property due to a previously unknown (or unexpected) risk.

Many coastal councils have only a small resident population and thus a limited rate base to fund all of their service requirements, of which coastal management is only one part. Yet it is the beaches in the regional council areas that help to attract visitors, who support the local economy through tourism, but do not (or cannot) contribute to the upkeep and provision of services such as wastewater, water, stormwater, roads, car parks, recreational facilities and lifeguard facilities at the beach (through council rates on landholders). Concepts such as a levy upon nightly accommodation have been applied in some local government areas, but this is not easily applied to holiday house rentals. Such levies may also concern the local community who rely on tourism for income. Ways of accessing contributions from visitors towards managing the coastlines that they visit is certainly worth further investigation, but would not be expected to supply the necessary funding in entirety.

Assistance from the State and / or Federal government is needed to help carry the burden for larger scale actions. At the current time, without funding, there is often an impasse in selecting any management approaches at all: protection options are

typically very costly, and may negatively impact beach amenity; accommodate options may be short term and/or also very costly; and retreat options that allow for a continuing beach are unpalatable to private property owners unless compensation is at market rates, and so also too costly. Federal or state funding could initially be used to investigate management options or novel funding arrangements via pilot programs, with a view to preparing workable arrangements for the large scale funding that will be required as recession or inundation impacts eventuate. It is unknown if or when such federal or state funding may arrive, and certainly councils may consider lobbying within governments for such assistance (noting that times of disaster, such as following the recent devastating Hurricane Sandy on the east coast of USA, are grimly opportune).

For example, the buy-back lease-back option for retreat has very high environmental and social benefits, and economically it is less burdensome than many alternatives, but it is not feasible for local councils to initially fund such a program at any effective scale. Buy-back / lease-back involves the purchase of potentially affected properties at market rates, then leasing the properties back to the original owners (or others) at rental market rates, preferably on a long lease arrangement. Thus the initial investment for property purchase can be recouped through rental income (which is likely to be high given the location of the properties) until such time as the hazard impact becomes imminent. Such arrangements would be most effective where the property is purchased in sufficient time for the investment to be cost-positive. This option ensures the owners are fully compensated (and indeed, can choose to live in their homes until an impact is imminent). When recession impacts are imminent, the house is demolished to permit shoreline retreat. A pilot program would be ideal to test such an option and further develop suitable investment and payback arrangements that could be rolled out more broadly if or as required in the future.

Conclusions

Over the last 35 years, as the framework of coastal management in NSW has been implemented and changed, the issues faced by local communities and their local councils have remained largely the same, driven by uncertainty, conflicts in land rights, and the inability to effectively fund practical solutions.

A risk approach to identifying and managing coastal hazards is considered the most appropriate framework for dealing with the uncertainty surrounding existing coastal processes and expected future responses to climate change. Prescribing definitive hazard lines on maps that do not account for intrinsic uncertainty and assumptions in adopted methods is inviting criticism and scepticism from an increasingly aware and climate-savvy community. Future management of coastal hazards must acknowledge the uncertainties in climate change projections and estimates for shoreline response, and must incorporate provisions for addressing these uncertainties within forward planning programs.

Whilst there have been recent innovative steps in the way coastal hazards are being defined, there needs to be innovation in the application of land use planning controls within affected areas. Importantly, future landuse management needs to provide for optimum utilisation of land without unnecessarily sterilising land that could still be used for certain types of development (e.g. development with an economic lifespan that is shorter than the timeframe for expected hazard impact). Conversely, it is important that lands vulnerable to future risk are not overly developed and commoditised in a manner that infers perpetual benefit from such lands.

A major portion of assets at risk from coastal hazards are in the direct control or ownership of council, including services such as stormwater, wastewater, water, roads,

as well as public buildings and recreational lands on the coast. Without the need for state or federal policy guidance, councils may substantially reduce their coastal risk by integrating coastal zone management across the departments of council, most importantly, asset management, engineering and works, and strategic planning.

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