



Marine Estate
Management Authority

Threat and Risk Assessment Framework for the NSW Marine Estate



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Threat and Risk Assessment Framework for the NSW Marine Estate

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This framework and a glossary of key terms are available at: www.marine.nsw.gov.au

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Disclaimer

The information contained in this publication is based on knowledge and understanding at the time of writing (April 2015). However, because of advances in knowledge, users are reminded of the need to ensure that information upon which they rely is up to date and to check currency of the information with the appropriate officer of the NSW Marine Estate Management Authority or the user's independent adviser.

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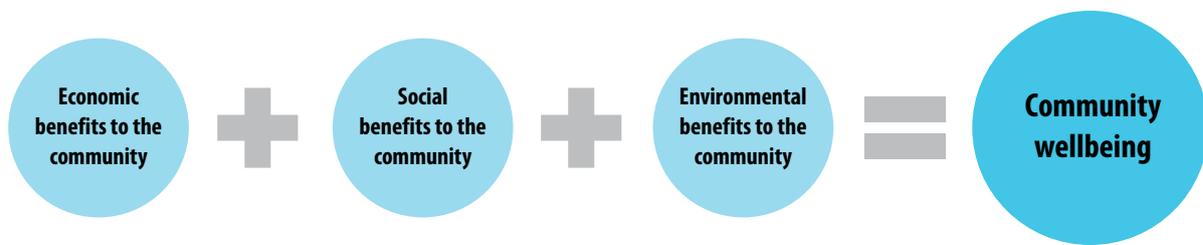


1. Introduction

The Marine Estate Management Authority (MEMA) advises the NSW Government on how to have ‘a healthy coast and sea, managed for the greatest wellbeing of the community, now and into the future.’¹ It was established under the *Marine Estate Management Act 2014*.

MEMA’s aim is to maximise community wellbeing—the sum of the economic, social and environmental benefits of the Estate to the NSW community (Figure 1).²

Figure 1: Community wellbeing is the sum of economic, social and environmental benefits to the community



A central challenge is to ensure that threats to those benefits are efficiently and effectively managed and that management efforts are well targeted at the most significant threats.

A 5-step decision-making framework helps MEMA meet this challenge (Figure 2). The framework is described in *Managing the NSW Marine Estate: Purpose, Underpinning Principles and Priority Setting* (the Principles Paper). In summary, these steps are:

- identify key benefits and threats to those benefits that the Estate provides to the NSW community
- prioritise threats based on the risk (a combination of likelihood of a threat occurring and consequence of the threat) they pose to community wellbeing, so that management efforts can focus on the most important issues
- assess the adequacy of current management settings and alternative options for addressing priority threats
- implement the most cost effective management settings that adequately address threats
- be accountable to the NSW community in terms of monitoring the effectiveness of management settings.

Threat and risk assessment is the focus of the second step in this 5-step process. It does not evaluate the possible management responses to threats; this is done in the third step.

This paper outlines a threat and risk assessment process. It is designed as a guide for practitioners. It also aims to broaden public understanding of threat and risk assessment so people can have more input into in MEMA’s decisions and priorities.

1 Marine Estate Management Authority (2013), *Managing the NSW Marine Estate: Purpose, Underpinning Principles and Priority Setting*, NSW Marine Estate Management Authority, November (the Principles Paper).

2 These three categories of community benefit were identified in the MEMA Principles Paper. They are, respectively, benefits derived by the community from the Marine Estate that are of an economic/financial nature (e.g. commercial fishing), benefits to the community of a social/relational nature (e.g. family visits to the beach) and benefits to the community that are of an environmental nature (e.g. intrinsic existence and bequest values). Overall community benefits equate to community wellbeing as outlined in the MEMA vision.



Figure 2: Threat and risk assessment is the second step in putting the principles for managing the NSW Marine Estate into practice³

Step 1	HOW THE COMMUNITY BENEFITS FROM THE ESTATE	Identify key economic, social and environmental benefits, and perceived threats and opportunities derived from the Estate	Develop ongoing engagement strategy: <ul style="list-style-type: none"> ■ community consultation ■ expert input ■ stakeholder surveys 	<i>Principle 1</i>
Step 2	ASSESS THREATS AND RISKS TO BENEFITS	Expert assessment of threats and opportunities to the key economic, social and environmental benefits	Prioritise threats based on their likelihood and consequence and consider relevant scale: <ul style="list-style-type: none"> ■ local ■ regional ■ state-wide 	<i>Principle 2</i>
Step 3	ASSESS MANAGEMENT OPTIONS TO MAXIMISE BENEFITS	Identify and assess current and potential management settings in delivering benefits to the community	Apply values to economic, social and environmental benefits of alternative uses. Assess which options deliver maximum benefit to the community.	<i>Principles 1, 3, 4, 5, 6 & 7</i>
Step 4	IMPLEMENT PREFERRED MANAGEMENT OPTIONS	Implement options that maximise overall benefits to the NSW community as a whole	Identify the most efficient and cost-effective management options. Design measurable performance indicators. <i>Develop strategic monitoring program to measure outcomes relative to the vision.</i>	<i>Principles 1 & 8</i>
Step 5	BE ACCOUNTABLE	Monitor, measure and report on performance <i>Review progress</i>	Report transparently to the community. Promote strategic research to inform management and enhance future outcomes. <i>Examine performance, including benefit, threat and risk status periodically.</i> <i>Review management arrangements for those not achieving adequate performance.</i>	<i>Principles 1, 9 & 10</i>

³ Adapted from Marine Estate Management Authority (2013), *Managing the NSW Marine Estate: Purpose, Underpinning Principles and Priority Setting*, NSW Marine Estate Management Authority, November.



2. The unique NSW Marine Estate: threats and benefits

The NSW Marine Estate is diverse in its natural resources and infrastructure. The resulting economic, social and environmental benefits make a major contribution to the wellbeing of the NSW community (see Figure 1).

The Estate is an 'open-access' resource, which means it can be used by anyone. This brings benefits to the community—such as swimming, fishing and boating. It can also bring problems, such as:

- **over-exploitation** of the Estate (leading to resource degradation)
- conflicts between competing users (**resource-use conflict**)⁴
- a **failure to optimise investment opportunities**.

Over-exploitation occurs when people's actions do not align with community interests; for example, dumping of rubbish or other pollution into waterways would be a threat to ecosystems and their resources.

Resource-use conflicts occur when the open-access nature of the Estate leads to conflicts between users and user groups; for example, the co-location of swimmers and jet skiers. Resource-use conflicts threaten the social and economic benefits derived from using the Estate.

Another potential problem is **failure to optimise investment opportunities**. Built infrastructure is part of the Estate, but there is little incentive for individuals to invest in something that anyone can use. The result is that government and community groups are often needed to invest in infrastructure on behalf of the NSW community.

Other threats to the benefits of the Estate are from **external factors**, such as climate change or high fuel prices. It will not be possible to manage these external threats directly if their causes are beyond the scope of NSW Government agencies and community groups. Even so, these threats must still be considered when developing management responses. For example, climate change could affect fish stocks in the future, which could make it necessary to modify management controls applying to recreational and commercial fishing.

The management arrangements for the Estate—including the administrative, policy and regulatory environment—can influence the extent to which benefits are realised and distributed. Any deficiencies in management arrangements are not considered 'threats' for the purpose of a threat and risk assessment. Management responses will be refined and improved once key threats have been identified through the threat and risk assessment process in MEMA's 5-step decision-making framework (Figure 2).

In summary, key threats to the NSW Marine Estate will generally relate to its open-access characteristics and include (i) various forms of resource degradation; (ii) direct and indirect threats to the benefits society obtains by use of the Estate, such as user conflicts; (iii) failure to realise infrastructure development opportunities; and (iv) the effects of external factors. The overarching objective is to manage these threats to deliver the suite of economic, social and environmental benefits from the Estate that maximise community wellbeing.

4 These two categories of problem can also be viewed as forms of 'market failure' that arise when the activities of individuals acting in their own interests impose costs (externalities) on others.



3. Threat and risk assessment guidelines

This threat and risk assessment framework is designed to:

- outline the conceptual framework that will be used to assess threats and risks associated with the NSW Marine Estate. It offers guidance about threat and risk assessment for agencies and the general public, but it is not intended to be a manual with step-by-step instructions
- provide transparency and an easy-to-understand outline of these concepts for community stakeholders.

The framework:

- draws on a range of credible information sources to ensure the best available evidence is used
- is scalable from state-wide to whatever geographic definition best aligns with the management problem being investigated
- accommodates levels of analysis that are 'fit for purpose', from broad, qualitative, 'scanning' assessments, to in-depth quantitative analyses, where more detailed assessments provide necessary further information for decision making.

The concept of applying this threat and risk framework is presented in Figure 3:

- In the top part of Figure 3, a colour-coded matrix shows the risk each threat poses to the benefits, with an overall risk to each benefit (the bottom row), and an overall risk of each threat (the far-right column).
- In the lower part of the figure, threats are distributed according to their likely timing and the geographic extent of their impact.



Figure 3: A framework for a threat and risk assessment matrix

THREATS	BENEFIT 1	BENEFIT 2	BENEFIT 3	BENEFIT 4	OVERALL RISK LEVEL
THREAT 1	HIGH	HIGH	MINIMAL	LOW	HIGH
THREAT 2	LOW	MINIMAL	MINIMAL	MINIMAL	MINIMAL
THREAT 3	MODERATE	LOW	LOW	MINIMAL	LOW
THREAT 4	MODERATE	MODERATE	MINIMAL	MODERATE	MODERATE
OVERALL RISK LEVEL	HIGH	HIGH	LOW	MODERATE	

Spatial and temporal effects

WHEN IS AN EFFECT LIKELY TO START?				WHAT IS THE LIKELY EXTENT OF THE EFFECT?
CURRENT OR NEXT 1–2 YEARS	NEXT 10 YEARS	NEXT 20 YEARS		
	THREAT 3 – LOW		BROADEST SCALE	
THREAT 4 – MODERATE			MID-SCALE	
	THREAT 1 – HIGH	THREAT 2 – MINIMAL	SMALLEST SCALE	

How to interpret the threat, benefit and risk tables in Figure 3

In the top table in Figure 3 (the colour-coded risk matrix), threat 1 has been assessed as posing a high overall risk to community wellbeing. This is the combined effect of threat 1 posing a high risk to benefits 1 and 2, a minimal risk to benefit 3, and a low risk to benefit 4.



In the second part of the figure (spatial and temporal effects), it is anticipated that the effects of threat 1 will be felt only at the lowest spatial scale being considered in the assessment, and it is assessed as a medium-term threat, rather than a current threat. The definition of relevant time scales at which effects will be observed will depend on the context in which the assessment is being carried out. In the example in section 4, later in this guide, time steps of 1 to 2 years, the next 10 years, and the next 20 years are used.

The right-hand overall risk column (the top table in Figure 3) relies on decision rules around:

- the relative importance to community wellbeing of each benefit
- the risk that threats pose to those benefits.

In practice, these will need to be developed on a case-by-case basis.

In deriving the colour-coded risk matrix (the top part of Figure 3), the following simple rules were applied:⁵

- all benefits were considered to be of equal value to the community
- if a threat posed a **high risk to even one benefit**, the threat was rated overall as a high risk to community wellbeing
- if a threat posed a **moderate risk to at least two benefits**, but it was not a high risk to any benefit, it was rated as a moderate risk overall
- a threat posed a **low or moderate risk to at least two benefits**, and not be a high risk to any benefit or a moderate risk to more than one benefit, to be rated as a low risk overall
- a threat that was **no more than a low risk to one benefit** was rated as a minimal threat overall.

If benefits were to be weighted differently in terms of their relative contribution to community wellbeing, more complex decision rules would need to be designed to add up the overall risk of a threat across all the benefits. For example, a threat to several 'low contribution' benefits might be required for a threat to be rated as an overall high risk to community wellbeing.⁶

Concerns about the overall level of risk posed to a particular benefit are informed by scanning down the columns in the first table in Figure 3. This information is useful for identifying **cumulative impacts** and the overall and relative significance of particular sources of risk to specific benefits.

As a result, if any single threat poses a high risk to even one benefit, the overall risk is high. Furthermore, exposure to several threats that are individually not high-risk threats could collectively place the benefit at high risk. Transparent decision rules relating to these factors will need to be developed for each risk assessment. (Note: The decision rule applied in Figure 3 was simply that the overall risk to a benefit was the highest risk posed to it by any threat.)

In Figure 3, benefit 1 has a high risk from threat 1 and a moderate risk from threats 3 and 4, whereas no threat poses more than a low risk to benefit 3.

The temporal and geographic scales over which the effects of a threat should be assessed will relate to the management context of the assessment. For example, MEMA has been asked to assess threats over a 20-year time horizon as part of a state-wide assessment.

5 There are many decision rule methods available, for example an aggregate scoring system e.g. minimal=1, low=2, moderate = 3 and high = 4. Add them up and compare to criteria e.g. 4-6 = minimal risk, 7 - 12 = low risk etc.

6 Multi-criteria analysis techniques could be relevant here.



Assessment strategy and scaling

The recommended approach is to assess the threats and risks in a hierarchical manner,⁷ starting with a qualitative or semi-quantitative analysis at the broadest possible scale; only then is the need for more detailed, finer scale, analysis considered. The purpose of that initial ‘screening’ assessment is to broadly rank threats and identify uncertainty so that the highest priority threats and knowledge gaps can be targeted for further investigation.⁸

The initial state-wide assessment by MEMA will draw upon the best available information from a range of sources: the aim is to identify priorities for further attention. These are likely to include threats for which the relevant NSW management agencies need a more detailed application of the framework.

A more detailed risk assessment is needed only when the additional information will improve our understanding of the threat and what can be done to manage it.

Detailed quantitative risk assessments might be needed in an area if important benefits, or threats to them, differ significantly to those identified in the state-level screening assessment. For example, effective management of a potential state-wide threat—such as water run-off and its impact on water quality in the NSW Marine Estate—could require a more detailed assessment of particular regional sources of water run-off, the associated contaminants, and their impacts on particular economic, social and environmental benefits in particular places.

All relevant and credible information sources should be used to identify the risk of a threat being realised. This is likely to include multiple sources of information, for example, scientific literature, scientists, local communities, industry, Aboriginal communities and other stakeholder groups. All of the evidence used in a threat and risk assessment should be transparent so that it is clear what evidence was used to form a judgment about the threats and risks.

Given the size and complexity of the NSW Marine Estate and the differing responsibilities of government agencies, it should be expected that assessments at multiple scales will be required to underpin efficient and effective management.

Cumulative impacts and interactive effects

Detailed risk assessments might also be required if the threat could interact or accumulate in a way that cannot be accurately evaluated at a broad scale. For example:

- A threat (for example, nutrient addition causing fish kills in an estuary) might have an impact on one benefit (for example, fish production).
- That same threat could also increase the risk of a different threat (for example, biological invasion), but this is possible only in certain parts of the Marine Estate (for example, in a particular estuary type).
- These impacts can accumulate and accentuate the overall risk ranking of individual threats to total community wellbeing.

In practice, few of the threats to the benefits of the NSW Marine Estate operate in isolation from one another.

⁷ Working Group for the Marine and Coastal Committee of the National Resources Management Committee (2010).

⁸ This structured approach is consistent with the risk assessment hierarchy outlined in AS/NZS ISO 31000:2009 and applications such as the Australian Government Tropical Rivers Inventory and Assessment Project (van Dam, R, Bartolo R and Bayliss P (2006), *Ecological Risk Assessments of Key Threats to Australia's Tropical Rivers*, Tropical Rivers Inventory and Assessment Project Internal Report 517, Department of the Environment and Heritage, Darwin).



Relating threats to benefits

Threat and risk assessment is often selective. For example, 'environmental' threat and risk assessments are often framed in terms of assessing **risk as the effect of uncertainty on particular physical environmental objective(s)** in isolation from all other benefits.⁹ An example would be to assess the risk of a particular activity (or threat) in a marine park sanctuary zone breaching the objective of *'not harming any animal or plant or causing any damage to or interference with natural or cultural features or any habitat.'*¹⁰

Defining risk in this way is appropriate if the full economic, social and other environmental dimensions of an issue have been considered, and a decision has been made that community wellbeing will be maximised when the specific objective is achieved.

Where this is not the case, limitations of this approach are its failure to:

- identify how those physical impacts could change overall community wellbeing
- recognise that threats to social and economic benefits of the Marine Estate do not arise through impacts on the environment alone.

For example, as noted in section 2, threats in the form of 'resource-use conflicts' between users can arise due to the open-access nature of the Estate. For example, a conflict between boats and divers might not affect Marine Estate ecology, but it could directly and substantially affect the respective economic and social benefits derived from boating and diving activities. The approach to threat and risk assessment must therefore be capable of dealing with these effects as well.

The management objective for the Marine Estate is to maximise community wellbeing. The role of threat and risk assessment is to help determine whether existing management controls maximise, in aggregate, the Estate's economic, social and environmental benefits. MEMA's threat and risk assessments are, therefore, more appropriately framed in terms of **risk being the effect of uncertainty on community wellbeing**, which comprises economic, social and environmental benefits to the community (see Figure 1).

While it will often be appropriate to first assess the potential impact of threats to environmental assets,¹¹ the next step should be to assess how these impacts reduce community wellbeing so any residual risk (where threats are not completely ameliorated) can be managed.¹²

In this way, the findings of threat and risk assessments using this approach will provide data on the likely magnitude and direction of change in benefits under existing management controls. This is vital information for any benefit–cost analysis of proposed management options¹³ in step 3 of the MEMA 5-step decision-making process.

9 See, for example, Currey, R, Boren L, Sharp B and Peterson D (2012), *A Risk Assessment of Threats to Maui's Dolphins*, New Zealand Ministry for Primary Industries and Department of Conservation, Wellington, September, and Great Barrier Reef Outlook Report 2014 (<http://www.gbrmpa.gov.au/managing-the-reef/great-barrier-reef-outlook-report>).

10 NSW Marine Parks (Zoning Plans) Regulation 1999.

11 These assessments can appropriately focus on trends from current status where a specific asset-level objective has not been defined.

12 For the purpose of valuing foregone benefits that may be of a non-market nature, such as many environmental benefits, MEEKP has prepared a Technical Paper titled *Methodologies to Value Benefits and Costs of Alternative Uses of the NSW Marine Estate*; see http://www.marine.nsw.gov.au/__data/assets/pdf_file/0008/521729/MEEKP-Technical-paper-1-Methodologies-to-Value-the-Benefits-and-Costs-of-Alternative-Uses-of-the-NSW-Marine-Estate.pdf.

13 Proposed management controls are known as 'risk treatments' in AS/NZ ISO 31000:2009 Risk Management – Principles and Guidelines. A full glossary of terminology can be found on the MEMA website <http://www.marine.nsw.gov.au/>.



Causal logic statements

The first task in a threat and risk assessment is to prepare a clear statement of causal logic; that is, a statement of exactly what the threat is, what its impacts over time will be, and what types of benefits will be affected. This transparency provides for external scrutiny and public accountability; it also mitigates against spurious or poorly founded claims about threats and their impacts. This statement is needed whether threat and risk assessment is done directly (by looking at the effects of threats to community wellbeing) or indirectly (by looking at environment impacts and then determining the associated loss of community wellbeing).

The causal logic statement should also describe whether the threat relates to the open access nature of the Estate or external factors (see section 2). It will also identify current management controls that are in place to mitigate the risks associated with specific threats. This will help everyone involved understand and assess the nature and extent of residual risks under current management controls.

These statements can also help early identification of uncertainty in regard to the understanding of causal relationships and whether further information is required before a meaningful assessment can begin.

Assigning risk rankings to threats

It is consistent with recommended NSW Government practice to assign relative risk rankings to identified threats. A table like Table 1 is needed, in which risk is a function of the 'likelihood' and 'consequence' of a threat actually being realised.^{14,15,16}

Table 1: Risk assessment matrix

LIKELIHOOD	LEVEL OF RISK				
ALMOST CERTAIN	MINIMAL	LOW	MODERATE	HIGH	HIGH
LIKELY	MINIMAL	LOW	MODERATE	HIGH	HIGH
POSSIBLE	MINIMAL	MINIMAL	LOW	MODERATE	HIGH
UNLIKELY	MINIMAL	MINIMAL	MINIMAL	LOW	MODERATE
RARE	MINIMAL	MINIMAL	MINIMAL	MINIMAL	LOW
CONSEQUENCE LEVEL	INSIGNIFICANT	MINOR	MODERATE	MAJOR	CATASTROPHIC

14 NSW Government (2014), *Guidance for Regulators to Implement Outcomes and Risk-Based Regulation*, NSW Department of Premier and Cabinet, Sydney, July. These guidelines are also consistent with AS/NZS ISO 31000:2009.

15 This is also consistent with the approach recommended in Beeton RJS, Buxton CD, Cutbush GC, Fairweather PG, Johnston EL and Ryan R (2012), *Report of the Independent Scientific Audit of Marine Parks in New South Wales*, NSW Department of Primary Industries and Office of Environment and Heritage, NSW, and the approach followed in major environment-related risk assessments such as the *Great Barrier Reef Marine Park Outlook Report 2014* (<http://www.gbrmpa.gov.au/managing-the-reef/great-barrier-reef-outlook-report>), the Australian Government Tropical Rivers Inventory and Assessment Project (op cit) and Currey R, Boren L, Sharp B and Peterson D (op cit).

16 Standards Australia (2012), *Risk Management – Guidelines on Risk Assessment Techniques*, Standards Australia Limited, Sydney.



Five categories of likelihood and consequence are usually defined, with the likelihood of a consequence occurring ranging from 'Almost certain' to 'Rare', and consequence ranging from 'Insignificant' to 'Catastrophic'. The outcome is the assignment of risk rankings from 'Minimal' to 'High' for each threat.

The likelihood of a level of consequence of a threat is determined by assessing the frequency and intensity at which the effects of the threat are likely to occur within a specified time period.

Estimating the consequence of a threat involves determining its actual or anticipated impact on particular benefits, which would include consideration of intensity and extent of the threat and the resilience and thresholds of the affected benefit.

The time periods and spatial scales used in the definitions of likelihood and consequence categories should relate to the management context of the assessment. Thus, for example, it would be appropriate for the likelihood and consequence categories in the initial MEMA assessment to be functions of a 20-year time horizon and state-wide scale, which is similar to that used in the 2014 Great Barrier Reef Marine Park assessment (see Table 2).

Table 2: Example of likelihood and consequence definitions

Risk parameters used by the Great Barrier Reef Marine Park Authority in the Great Barrier Reef Outlook Report 2014¹⁷	
LIKELIHOOD LEVEL	
Rare	Not expected to occur within the next 100 years.
Unlikely	Not expected to occur in a 10 year period but expected to occur in a 100 year period.
Possible	Not expected to occur annually but expected to occur within a 10 year period.
Likely	Not expected to be continuous but expected to occur one or more times a year.
Almost certain	Expected to occur more or less continuously throughout a year.
CONSEQUENCE LEVEL	
Insignificant	No impact or if impact is, or would be, present then only to the extent that it has no discernible effect on the overall condition of the ecosystem.
Minor	Impact is, or would be, not discernible at a wider level. Impact would not impair the overall condition of the ecosystem, sensitive population or community over a wider level.
Moderate	Impact is, or would be, present at a wider level. Recovery periods of 5-10 years likely.
Major	Impact is, or would be, significant at a wider level. Recovery periods of 10-20 years likely.
Catastrophic	Impact is clearly affecting, or would clearly affect, the nature of the ecosystem over a wide area. Recovery periods of greater than 20 years likely.

17 http://www.gbrmpa.gov.au/__data/assets/pdf_file/0018/3843/OutlookReport_Full.pdf.



Importantly, risk is assessed on the basis of existing management settings. Risk assessments inherently account for the effectiveness of existing management controls and identify significant residual or emerging risks. A stocktake of management activities already being used by government agencies and other stakeholders to address threats is an essential early step. Gaining an understanding of the effectiveness of these various existing measures will also be useful in informing the evaluation of potential responses to residual risks that would occur in step 3 of the MEMA decision-making framework.¹⁸

In focusing on high priority residual risks or emerging threats, care should be taken to not overlook opportunities to enhance the efficiency of management controls that target lower priority threats.

Likelihood and consequence can be assessed, and their outcomes integrated, using qualitative or quantitative analysis (or both); this then allows the overall level of risk to be characterised. Whichever way this is done, the methods and reasoning by which likelihood and consequence are assessed and the data used need to be transparent to enable external critique and to provide understanding and accountability to stakeholders.

While the output of the risk assessment process need not be a quantitative estimate of risk, sufficient information should be available for judgments to be made based on a weight-of-evidence approach. This could draw upon data and information from sources such as detailed scientific data and modelling, community information and local insights, and informed expert judgment. One of the ten overarching principles adopted by MEMA is to always use the best evidence available. Information gaps and identified inadequacies should also be explicitly recognised.

18 This is consistent with the approach followed, for example, by the Great Barrier Reef Marine Park Authority in Chapter 6 of the Outlook Report 2009 (http://www.gbrmpa.gov.au/__data/assets/pdf_file/0018/3843/OutlookReport_Full.pdf). A helpful approach to assessing existing management settings in this report was to structure them around activity themes related to the categories of identified community benefits e.g., biodiversity protection, water quality and ports and shipping.



4. Example of a threat and risk assessment

This section shows how a threat and risk assessment could be done. **This example was constructed only for demonstration purposes. It is not an actual threat and risk assessment of the NSW Marine Estate.**

For this example, the Marine Estate Community Survey¹⁹ was used to show how it is possible to characterise and assess threats to benefits at a state-wide screening level.

Step 1: Ask the community

The first step must always be to ask the community for its views about the NSW Marine Estate:

- What are the key benefits?
- What threatens those benefits?

Table 3 shows the types of answers a community survey might yield, using the results of the Marine Estate Community Survey. The social and economic benefits are often, but not always, positively associated with the environmental benefits derived from the Marine Estate.

Table 3: Key benefits and major threats identified in the Marine Estate Community Survey

Benefit category	Key benefits	Major threats to benefits
Economic benefits to the community	<ul style="list-style-type: none"> ■ Tourism ■ Fishing and fresh seafood ■ Trade route (ports and shipping) 	<ul style="list-style-type: none"> ■ Water pollution ■ Loss of natural areas ■ Increasing access constraints/costs ■ Declining levels of tourism
Social benefits to the community	<ul style="list-style-type: none"> ■ Enjoyment of natural beauty ■ Safe place for socialising ■ Encourages an active, healthy lifestyle ■ Cultural heritage for future generations ■ Source of scientific discoveries 	<ul style="list-style-type: none"> ■ Anti-social behaviour ■ Water pollution and littering ■ Overcrowding ■ Danger to swimmers from other users ■ Increasing access constraints
Environmental benefits to the community	<ul style="list-style-type: none"> ■ Clean waters ■ Abundant marine life ■ Unique biodiversity 	<ul style="list-style-type: none"> ■ Littering and marine debris ■ Water pollution, including run-off and oil/chemical spills ■ Coastal urban development ■ Mining of oil and gas ■ Climate change

19 Marine Estate Community Survey Final Report (July 2014) Sweeny Research, <http://www.marine.nsw.gov.au/key-initiatives/marine-estate-community-survey>.



Step 2: Find out more

What other information is available? In a real-world case, information from government agencies and technical experts would provide a more thorough and comprehensive understanding of the actual threats. Data could include habitat maps, fish catches, contaminant loads, human use data (including Aboriginal heritage and cultural use), threatened species distributions, shipping activity, current and projected land use, and economic valuations.

What is already being done? For the purposes of this example, it is assumed that there has already been a stocktake of existing management controls designed to ameliorate the identified threats, with the assessed levels of risk being residual to the impact of those controls.

Through this process, the descriptions of the benefits and threats would be refined to: (i) resolve differences of opinion; (ii) aggregate similar benefits and threats together; or disaggregate benefits and threats to a more appropriate listing; (iii) identify benefits and threats not obvious to community and interest groups; and (iv) identify any major areas of uncertainty and knowledge gaps.

Step 3: Characterise the risk

Risk is characterised in accordance with Tables 4 and 5. The descriptions in these tables are consistent with a hypothetical state-wide assessment with a 20-year management timeframe for threats to be realised.

Table 4: Likelihood levels—expected frequency of a given threat given current management

LIKELIHOOD LEVEL	Description
Rare	This threat is extremely unlikely to be realised at a level that would impact on the benefit within a 20-year period.
Unlikely	This threat is not expected to be realised at a level that would impact on the benefit in a 10-year period, but could be expected in a 20-year period.
Possible	This threat is not expected to be realised at a level that would impact on the benefit every year, but could be expected in a 10-year period.
Likely	This threat is not expected to be continuous, but could be expected to be realised at a level that would impact on the benefit every year.
Almost certain	This threat is expected to be realised at a level that would impact on the benefit frequently throughout a year or more-or-less continuously.

Table 5: Consequence levels—extent of the impact of current management

CONSEQUENCE LEVEL	Description
Insignificant	Realisation of this threat would not have a discernible impact on the benefit at a state-wide scale.
Minor	Realisation of this threat would have only a small or very temporary impact on the benefit at a state-wide scale.
Moderate	Realisation of this threat would significantly reduce the benefit over the medium term (5-10 years) at a state-wide scale, or have major consequences for a sensitive benefit at a regional level.
Major	Realisation of this threat would substantially reduce the benefit for an extended period (10-20 years), but not totally or permanently, at a state-wide scale, or would have catastrophic consequences for a sensitive benefit at a regional level.
Catastrophic	Realisation of this threat would effectively terminate delivery of the benefit either permanently or for a very extended period (>20 years) at a state-wide scale.



Step 4: Rank the risks

Tables 4, 5 and 6 show the risks to the economic, social and environmental benefits that the community listed as important in the initial survey. In a real-world example, more information would have been used, and the risk levels for some of the threats presented in these figures could well have differed.

A selection of the threats identified in the survey were assessed against the risk characterisation parameters in Tables 4 and 5 to determine the overall risk ranking.

For example:

- **Likelihood:** A threat was rated as 'Rare' if it was unlikely to be realised at a level that would have an impact on the benefit within a 20-year period.
- **Consequence:** A rating of 'Insignificant' was given to threats that would not have a discernible impact on the relevant benefit at a state-wide scale.
- **Risk:** The combination of a likelihood rating of 'Rare' and a consequence rating of 'Insignificant', gave a risk ranking of 'Minimal'.

This process was followed for each benefit and threat combination to generate the threat assessment matrices provided in Figures 4, 5 and 6, with an aggregated ranking of selected threats across all benefits (Figure 7).

Survey respondents were not asked to identify or rank benefits or threats at anything below a state scale, and therefore the allocation of threats to 'regional' and 'local' scales shown in these tables is hypothetical. In a real-world example, relevant regions below the state scale could include bio-regions, the management regions used by a government agency, Local Land Services regions, local government areas, estuaries, fishery management zones, or marine parks and associated zone boundaries.

Step 5: Assess the implications of the risk scores

Are there any threats identified as posing a high risk to community wellbeing? Such threats would be a flag for management agencies that the issue needs further attention.

In this example, water pollution is a high risk to several benefits (Figure 7), and this would be a trigger for the relevant management agency to analyse the issue in more detail:

- It might identify more regional or local water quality issues to which the threat and risk assessment framework should be applied (scaled down).
- The targeted assessment could identify the threat as localised storm water pollution and fish kills in estuaries and coastal lakes following flooding at certain times.
- The next step would be to prepare a detailed impact and risk assessment of the threat that storm water run-off poses to the environment at a local scale and valuation of the associated benefits foregone.

Existing management controls could change, but only if the management agency identified weaknesses in current arrangements, such that there were significant residual risks to key benefits that could be effectively addressed through enhanced or alternative response measures (step 3 of the MEMA decision process).



Figure 4: Example of a threat assessment matrix—economic benefits to the community

THREAT	ECONOMIC BENEFITS TO THE COMMUNITY			OVERALL RISK LEVEL
	TOURISM	FISHING & FRESH SEAFOOD	TRADE ROUTE (PORTS & SHIPPING)	
WATER POLLUTION	HIGH	HIGH	MINIMAL	HIGH
LOSS OF NATURAL AREAS	MODERATE	LOW	MINIMAL	LOW
INCREASING ACCESS CONSTRAINTS/COSTS	MODERATE	MINIMAL	MODERATE	MODERATE
DECLINING LEVELS OF TOURISM	LOW	MINIMAL	MINIMAL	MINIMAL
OVERALL RISK LEVEL	HIGH	HIGH	MODERATE	

Spatial and temporal effects

WHEN IS AN EFFECT LIKELY TO START?				WHAT IS THE LIKELY EXTENT OF THE EFFECT?
CURRENT OR NEXT 1–2 YEARS	NEXT 10 YEARS	NEXT 20 YEARS		
WATER POLLUTION – HIGH	LOSS OF NATURAL AREAS – LOW		STATE-WIDE	
	DECLINING LEVELS OF TOURISM – MINIMAL		REGION	
		INCREASING ACCESS CONSTRAINTS/COSTS – MODERATE	LOCAL	



Figure 5: Example of a threat assessment matrix—social benefits to the community

THREAT	SOCIAL BENEFITS TO THE COMMUNITY					OVERALL RISK LEVEL
	ENJOYMENT OF NATURAL BEAUTY	SAFE PLACE FOR SOCIALISING	ENCOURAGES AND ACTIVE, HEALTHY LIFESTYLE	HERITAGE FOR FUTURE GENERATIONS	SOURCE OF SCIENTIFIC DISCOVERIES	
ANTI-SOCIAL BEHAVIOUR	MODERATE	HIGH	MODERATE	MINIMAL	MINIMAL	HIGH
WATER POLLUTION AND LITTERING	HIGH	MODERATE	MODERATE	MINIMAL	MINIMAL	HIGH
OVERCROWDING	MODERATE	MINIMAL	MODERATE	MINIMAL	MINIMAL	MODERATE
DANGER TO SWIMMERS FROM OTHER USERS	MODERATE	LOW	MODERATE	MINIMAL	MINIMAL	MODERATE
INCREASING ACCESS CONSTRAINTS	LOW	MINIMAL	LOW	MINIMAL	MINIMAL	LOW
OVERALL RISK LEVEL	HIGH	HIGH	MODERATE	MINIMAL	MINIMAL	

Spatial and temporal effects

WHEN IS AN EFFECT LIKELY TO START?				WHAT IS THE LIKELY EXTENT OF THE EFFECT?
CURRENT OR NEXT 1–2 YEARS	NEXT 10 YEARS	NEXT 20 YEARS		
ANTI-SOCIAL BEHAVIOUR – HIGH			STATE-WIDE	
WATER POLLUTION AND LITTERING – HIGH			REGION	
DANGER TO SWIMMERS FROM OTHER USERS – MODERATE	OVERCROWDING – MODERATE INCREASING ACCESS CONSTRAINTS - LOW		LOCAL	



Figure 6: Example of a threat assessment matrix—environmental benefits to the community

THREAT	ENVIRONMENTAL BENEFITS TO THE COMMUNITY			OVERALL RISK LEVEL
	CLEAN WATERS	ABUNDANT MARINE LIFE	UNIQUE BIODIVERSITY	
LITTERING AND MARINE DEBRIS	HIGH	MODERATE	MODERATE	HIGH
WATER POLLUTION	MODERATE	MODERATE	MODERATE	MODERATE
COASTAL URBAN DEVELOPMENT	MODERATE	LOW	LOW	LOW
MINING OF OIL AND GAS	LOW	LOW	LOW	LOW
CLIMATE CHANGE	LOW	LOW	LOW	LOW
OVERALL RISK LEVEL	HIGH	MODERATE	MODERATE	

Spatial and temporal effects

WHEN IS AN EFFECT LIKELY TO START?					WHAT IS THE LIKELY EXTENT OF THE EFFECT?
CURRENT OR NEXT 1–2 YEARS		NEXT 10 YEARS	NEXT 20 YEARS		
LITTERING AND MARINE DEBRIS – HIGH	WATER POLLUTION – MODERATE		CLIMATE CHANGE – LOW	STATE-WIDE	
		COASTAL URBAN DEVELOPMENT – LOW		REGION	
		MINING OF OIL AND GAS – LOW		LOCAL	



Figure 7: Example of a screening-level state-wide assessment of threats to community wellbeing of the NSW Marine Estate

THREAT	COMMUNITY WELLBEING			OVERALL RISK TO COMMUNITY WELLBEING
	ECONOMIC BENEFITS TO THE COMMUNITY	SOCIAL BENEFITS TO THE COMMUNITY	ENVIRONMENTAL BENEFITS TO THE COMMUNITY	
WATER POLLUTION, INCLUDING RUN-OFF AND OIL/CHEMICAL SPILLS	HIGH	HIGH	MODERATE	HIGH
LOSS OF/DAMAGE TO NATURAL AREAS, E.G., URBAN DEV'T	LOW	LOW	MODERATE	LOW
INCREASING ACCESS CONSTRAINTS/COSTS	MODERATE	LOW	MINIMAL	LOW
ANTI-SOCIAL BEHAVIOUR	MINIMAL	HIGH	MINIMAL	HIGH
CONFLICT BETWEEN USERS AND OVER-CROWDING	MINIMAL	MODERATE	MINIMAL	LOW
LITTERING AND MARINE DEBRIS	LOW	HIGH	HIGH	HIGH
CLIMATE CHANGE	MODERATE	MINIMAL	LOW	LOW
OVERALL RISK LEVEL	HIGH	HIGH	HIGH	

Spatial and temporal effects

WHEN IS AN EFFECT LIKELY TO START?				WHAT IS THE LIKELY EXTENT OF THE EFFECT?
CURRENT OR NEXT 1–2 YEARS	NEXT 10 YEARS		NEXT 20 YEARS	
WATER POLLUTION – HIGH			CLIMATE CHANGE – LOW	
	LOSS/DAMAGE TO NATURAL AREAS/HABITAT – LOW	INCREASING ACCESS CONSTRAINTS/COSTS – LOW		REGION
LITTERING AND MARINE DEBRIS – HIGH	ANTI-SOCIAL BEHAVIOUR – HIGH			LOCAL
	CONFLICT BETWEEN USERS/USES – LOW			



Conclusions

As outlined in the Principles Paper, MEMA's threat and risk assessment framework will continue to be refined on the basis of experience and feedback. Importantly, it is a framework to help guide the process of prioritising threats to the many benefits provided by the NSW Marine Estate. Equally important is its ability to be easily understood and to engage the NSW community in a 'conversation' about risk assessment and threat management.

This framework is also consistent with other MEMA principles, such as the need to:

- value the impacts of threats so trade-off decisions can be made
- make all aspects of threat and risk assessments transparent to the NSW community
- use the best available information for trade-off decisions.

While this framework enables the ranking of threats, it is important to appreciate that it is not intended to answer the question of whether a threat is of sufficient importance to warrant new management controls. This issue is taken up in step 3 of MEMA's decision-making framework, in which techniques such as benefit-cost analysis are applied to identify preferred management responses.

Having the right policies and programs in place is also made challenging by factors such as:

- the changing nature of threats and risks to the Estate
- uncertainty in relation to causal relationships between benefits and threats and the effectiveness of management controls.

While these problems present unique challenges, they should not be viewed as a reason for inaction. Instead, they indicate the need for an adaptive management framework, where benefits and threats are monitored, where management responses are continuously tailored and improved, and uncertainty is strategically minimised through well-targeted information, research and monitoring.



Marine Estate
Management Authority