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The Capacity of the Legal System to Manage Environmental Risk Through Environmental Impact Assessment ('EIA'): A Study on Natural Gas Fracking.

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This thesis is submitted for the purpose of total fulfilment of the PhD (Law) degree; the research for this thesis was carried out in The University of Melbourne's Faculty of Law.

Abstract

The demand for energy has motivated the expansion of natural gas hydraulic fracturing ('fracking') in recent years in many countries across the globe, including the United States ('US') and Australia. Natural gas, large reserves of which can be tapped through fracking, tends to be viewed as a 'bridging fuel', linking the carbon-intensive past with a more sustainable future – one that complies with the *Paris Agreement*'s goal of reducing global warming to well below two degrees Celsius above preindustrial levels. Although a fossil fuel, natural gas has been heralded as being less emissions-intensive than coal. Yet natural gas, which is primarily comprised of methane, is nonetheless an important contributor to greenhouse gas emissions, and its extraction poses a real risk to water resources and hydrological systems.

Fracking presents an issue for societies and their governments, as it calls for a balancing of risks with benefits; effective and just resolution cannot be pursued without an assessment of interests and values including how those interests and values are distributed over geographic space and over time, nor without an assessment of the environment likely to be impacted. Not all values will be quantifiable, and not all will be known. The fracking issue thus exposes a complex relationship between energy and water – a nexus that affects a broad and diverse range of stakeholders, and which ultimately raises the question as to whether energy security can be achieved in the near-term future without jeopardising clean water and aquatic ecosystems. It involves – and is likely to affect – interconnected social, ecological, and social-ecological systems, including subsystems like the economy and the law.

This thesis examines how the legal system can manage the environmental risks of fracking through the particular tool of environmental impact assessment ('EIA'), and in the context of potentially conflicting social and economic matters. Taking an interdisciplinary and systems-focussed approach, it concentrates on identifying key gaps in Australian federal EIA law, and the implications of those gaps for protecting the environment from adverse impacts. It looks to the US as a foreign jurisdiction which has dealt with the same issue in its own unique context, and which may be able to provide valuable comparative insights in terms of how Australia's EIA system could be better equipped to manage fracking risks.

Contributing to the topical and at times fervent debate on fracking, this thesis offers a novel perspective: it focuses on EIA law, and it does so in a manner that has not been adopted before either in the context of EIA or in the context of fracking. Systems thinking and interdisciplinarity are overlayed upon doctrinal and comparative analyses, operating as lenses through which the complex issues that arise from the thesis' subject matter can be viewed. In particular, the thesis engages the life sciences by examining environmental and flow-on social impacts through a study of literature from toxicology, pharmacology, ecology, hydrology and other scientific disciplines. A contribution to the theoretical and philosophical discussions on the nature of the law and how it operates within the context of ecological and social-ecological systems to manage risk is ultimately accompanied by practical recommendations to manage identified gaps and problems in the fracking context.

Declaration

The thesis comprises only my original work towards the PhD (Law). Due acknowledgement has been made in the text to all other material used. The thesis is fewer than the maximum word limit (100,000 words) in length, exclusive of tables, the bibliography, and the appendices.

Preface

The following published articles draw on but do not reproduce the material in this thesis:

- 'Australian Climate Change Law After the Adani Coal Mine Case' (2017) 11 *Carbon and Climate Law Review* 64
- 'Environmental Decision-Making in the Anthropocene – Challenges for Ecologically Sustainable Development and the Case for Systems Thinking' (2017) 34 *Environment and Planning Law Journal* 179

The following presentations were based upon the material in this thesis:

- 'Australian and US Federal EIA Law – Focusing on Fracking' presented at Columbia University, New York, November 2016
- 'Fracking – Legal, Scientific and Social Dimensions' presented at the Environmental Frontiers Colloquium, Hobart, Tasmania, February 2018

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List of Frequently Used Abbreviations

CO_2e	Carbon dioxide equivalent
CSG	Coal seam gas
EIA	Environmental impact assessment
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth) (Australia)
ESD	Ecologically sustainable development
GHG	Greenhouse gas
Minister	Australian federal Minister for the Environment and Energy (or the Minister for the relevant environment portfolio at the applicable time – note that the portfolio title changed during the course of the PhD from Minister for the Environment)
MNES	Matter of national environmental significance
NEPA	*National Environmental Policy Act of 1969* 42 USC §§ 4321 et seq (United States)
NSW	New South Wales
SES	Social-Ecological System
US	United States of America

Frequently cited cases may be referred to by a short title; where this is done, the full citation is provided the first time that the case is cited in each chapter.

Chapter 1: Introduction

Environmental risk – or the risk that adverse impacts on the environment will materialise – has become an accepted and expected corollary of development projects such as those that provide infrastructure, food, water, and energy to the Earth's human population. The balancing – or, ultimately, decoupling – of development projects and environmental risk is a long-term goal whose achievement will be gradual, and may never be absolute. This goal is often referred to as the goal of sustainable development.

Environmental impact assessment, or 'EIA', is a tool used in hundreds of legal jurisdictions around the world to generate information about the environment and about the impacts which may be occasioned to it in light of a particular source of risk, such as a development project. That information can help to inform decision-making on the approval of projects such that environmental risk might be managed and minimised. It is not the only tool able to minimise risk, but it is an important one, typically being the key tool used in the context of single, individual projects.

Hydraulic fracturing ('fracking') projects are a type of development project linked with the provision of energy. Fracking releases natural gas (or oil, depending on the formation) from within deep layers of rock through a combination of drilling and fluid injection.[1] The ultimate ability of EIA to manage and minimise risks from fracking projects will greatly influence whether or not adverse environmental impacts occur in jurisdictions that allow fracking. As Australia prepares for an expansion of its onshore natural gas industry – the Northern Territory having just lifted a moratorium in early 2018 and with only two of seven states and territories now prohibiting the practice of fracking – the capacity of Australia's legal system to manage risk must be a critical point of focus. This thesis offers a critical analysis of the issue of fracking in Australia, arguing that the capacity of the legal system to manage risk from fracking through EIA is constrained in crucial areas. It adds novel insights to the literature on relevant topics, which are outlined in this and the following two chapters.

This introductory chapter presents the thesis' research questions and articulates its scope (Part I), describes the methodology employed to answer these questions (Part V), and highlights the contribution that the thesis makes through its novelty and significance (Part II). It explains the foundational concepts of environmental decision-making (Part III) and EIA (Part IV), including how the linkage between them is understood. In key areas relevant to this thesis, literature is either lacking, or has not been synthesised and translated for legal audiences. The thesis reviews relevant literatures in Part IV below with respect to EIA, and in Chapters 2 and 3 with respect to systems, sustainable development, and fracking. Part VI overviews these and the remaining chapters, linking the research questions with the chapters that investigate them.

I RESEARCH QUESTIONS AND SCOPE

The key research questions that were addressed in composing this thesis are:

(1) Taking an interdisciplinary, systems-based approach, what are the environmental risks associated with the fracking process?
(2) How well is federal Australian law equipped to minimise or otherwise manage environmental risks from fracking through EIA?

[1] For a detailed discussion, refer to Chapter 3.

(3) Which specific gaps or weaknesses in the present legal framework for EIA in Australia need to be addressed from the perspective of minimising risk or reducing the chance of adverse impacts from fracking, and how might that be achieved?

This thesis adopts a general and broad definition of risk which captures exposure to harm, loss, damage or degradation, and a general and broad definition of the environment as being the natural (as opposed to built) human environment, including geographic places and regions such as protected areas, ecological systems, biomes, and individual species or populations.[2] The chosen definition of risk suits this particular analysis, which focuses on project approval decisions. The EIA process does not seek to quantify in a precise manner the chance of harm for the purposes of those decisions, but rather to identify and describe it in general terms (such as 'likely to be significant').[3] The EIA process, as will be seen, allows for a degree of uncertainty – the risk of a given harm, therefore, does not need to be calculated in an exact manner. EIA involves assessing prospective impacts which may or may not occur, thus a negative or adverse prospective impact is essentially representative of a risk of harm.

The scope of the analysis of EIA is largely limited to the federal level in Australia. A federal-level analysis is important, because: (i) two of the most critical risks of fracking (identified and explored in Chapter 3) - impacts to water resources and climate change impacts - need to be assessed at the federal level on account of their national significance (as Chapters 4 and 5 respectively discuss), and (ii) federal-level EIA law encompasses much of Australia's most fragile and cherished environmental matters, in relation to which Australia has international protection obligations. State/territory-level EIA laws are also important; reference is made to these laws as appropriate. Further, the US context – which has faced similar environmental risks from fracking within a federal regulatory context – is drawn upon for comparison and in discussing how the Australian system might be improved.

In both the US and in Australia, *fracking regulation* is principally addressed at the state level, and in the case of the US in particular, also at the local level. Decisions to ban or suspend fracking are usually made at state and local levels, and so are permitting and siting decisions. The lack of federal coverage in this regard is a further reason why a federal-level analysis of *EIA* is important, especially given that nationally significant environmental matters are at risk – that is, the impacts of fracking are not always localised to within the bounds of the state or local-level jurisdiction. A summary of each Australian state or territory and US state's present fracking stance is presented in Chapter 3, which provides the necessary background information on fracking and which contextualises EIA in terms of other laws that regulate fracking.

II NOVELTY AND SIGNIFICANCE OF RESEARCH

This research addresses a significant environmental protection problem that has not received sustained attention in the literature, at a time when the need for protection is particularly critical. The aspects of the environment upon which the thesis focuses – water resources and the climate system

[2] This thesis does not grapple with the conceptual issue of whether humans should be considered as part of 'the environment', but rather adopts the practical stance of including humans within discussions of social systems rather than environmental systems. Social systems could, on this approach, be considered as nested within environmental systems, but need not be.

[3] Two useful works (among many) for understanding risk in the context of environmental problems are Ulrich Beck, *World at Risk* (Polity Press, 2007) and Elizabeth Fisher, *Risk Regulation and Administrative Constitutionalism* (Oxford, 2007).

– quite literally sustain human life, and are under threat from fracking projects, compounded by other stressors.

The broad-scale expansion of fracking paired with horizontal drilling is relatively recent, and scientific studies are plagued by uncertainty and a lack of adequate, reliable data.[4] Fracking is thus a topical and important example to focus on, and it is one that also signifies the difficult contemporary challenges in energy policy in the context of the transition between historic reliance on carbon-intensive energy generation and future-oriented low-carbon sources of energy. In Australia, that transition is happening slowly, and natural gas exploration and extraction is being actively pursued in most state and territory jurisdictions.

The fracking debate exists in many forms. It is a debate among scientists (can fracking be done safely?), a debate among policy-makers (should fracking be pursued, balancing all considerations?), a debate among lawyers (can fracking be effectively controlled by regulation, and if so, how?), and a debate among members of the public (is it in our interest to support fracking?) – to name a few. It is a pertinent debate, as Chapter 3 further articulates, as the future of the energy sector is being deliberated more fiercely than ever before under increasing pressure to reduce considerably contributions to climate change.

A novel contribution to this issue and to the literature is made by looking to EIA as an important tool in assisting the better management of fracking-induced risk. In relation to the broad question of how fracking risks can be managed, both generally and specifically with reference to the law, EIA has not been a point of focus. The fracking debate that preoccupies lawyers and the legal academy has tended to be closely linked with policy (how can the law best implement particular policy decisions?), and in the US context especially, has also focused on the appropriate level of regulatory control (local, state, or federal?).[5] This thesis addresses fracking by looking at risk of harm from the perspective only that harm should be minimised within the parameters of the tool studied (EIA). In this sense, it makes a contribution to the broader, ultimate question of how to manage fracking risks, by discussing the narrower issue of how fracking risks can be managed through EIA law.

Just as fracking has not been viewed in the literature through an EIA lens, neither has EIA been looked at through a fracking lens. Literature on EIA has been relatively dormant in recent years, particularly from a law perspective. The existing literature on EIA has debated its utility, effectiveness, and purpose (as Part IV below highlights), but commentary has not adopted the approach of looking at EIA as a risk management tool in a particular context and examined that context holistically with the view to suggesting reforms and amendments that would reduce risk. Research on EIA in the context of energy projects more generally is also lacking. Thus, both the approach and the focus on the example of fracking offer novel contributions to the literature. What this thesis offers is an applied study of the EIA system in a practical context, which is able to highlight important problems and gaps likely to adversely affect the environment.

Each chapter of the thesis addresses subsidiary questions which add to the literature in answering the three research questions. Chapter 5 discusses the question of how climate change could be better incorporated into federal-level EIA-based decision-making, and advances a new climate system 'trigger' that has not been considered by commentators to date. A 'trigger' is an issue listed under

[4] See Chapter 3.

[5] See, eg, Amanda C Leiter, '*Fracking, Federalism, and Private Governance*' (2015) 39 *Harvard Environmental Law Review* 107; see also the interesting paper by Hari M Osofsky and Hannah J Wiseman which focuses on fracking but which calls for a more dynamic and holistic view of energy systems more broadly: 'Dynamic Energy Federalism' (2013) 72 *Minnesota Law Review* 773.

Australia's federal *Environment Protection and Biodiversity Conservation Act 1999* (Cth) ('EPBC Act') which enlivens the operation of the EPBC Act's EIA provisions (this is explained further below). It also presents an interpretation and application of the most recent federal climate change case, the *Adani* case,[6] whose appeal decision was handed down in 2017. Chapter 6 explores new EIA law definitions, considering whether they could assist in helping the EPBC Act to be better equipped to manage cumulative impacts, and offers the first analysis to draw on the US system to suggest improvements for Australia in the cumulative impact and EIA context. Chapter 4 draws upon the 2017 federal government review of the water trigger to consider whether the trigger should be expanded to better encompass fracking and be able to minimise fracking risk. Chapter 7 focuses on social and economic impacts through a perspective that has broadly been overlooked: by considering whether the inclusion of these kinds of impacts in EIA-based decision-making might influence the ability to manage environmental risk.

Finally, an important contribution of this thesis to environmental law and environmental problem-solving more broadly is that it demonstrates how interdisciplinary and systems-focused research can be used to address complex environmental problems. In its articulation of various challenges associated with approaching issues within the confines of systematic or disciplinary thought and knowledge paradigms – particularly, law – it illustrates why legal research needs to be more interdisciplinary, and the benefits of viewing problems through an interdisciplinary lens. It shows how systems thinking might be useful for environmental lawyers in connecting multiple disciplines, diverse stakeholders, and interactions of cause and effect. The approach taken in the thesis reveals how looking at law – a specialised area of study strongly associated with its own set of unique rules and procedures – through a systems lens might lead to positive outcomes such as an improved capacity to minimise risk. Engaging with the systems that the law affects and thinking about cause-and-effect relationships within and outside the legal system (for example, to environmental systems) can help to make the law more robust and better able to achieve environmental goals. Although in this thesis legal methodologies are employed, and the focus is principally on the law, incorporating wider interdisciplinary and systems lenses is a first step towards environmental systems research ultimately being more fully integrated into legal research, which may be a useful approach for future research projects in environmental law.

III ENVIRONMENTAL DECISION-MAKING

Environmental decision-making is an important term in this thesis, since the term ***EIA***, when used in a law context, is often actually referring to environmental decision-making. In particular, 'EIA' can refer to the decision-making process based on an EIA or equivalent assessment.[7] The term 'EIA-based decision-making' is used throughout the thesis, to avoid confusion.

Environmental decision-making can be understood to be decision-making that impacts or has the capacity to impact the environment. EIA-based decision-making is predominantly a political or 'administrative' category of environmental decision-making. This means decisions are made by members of the executive government, such as ministers and agencies. EIA-based decision-making

[6] *Australian Conservation Foundation Inc v Minister for the Environment* [2016] FCA 1042 ('*Adani*').

[7] Andrew Macintosh, for example, has defined EIA as involving 'the identification, prediction, evaluation and mitigation' of environmental impacts. Evaluation and mitigation relate to the assessment decision, whereas identification and prediction relate to the assessment. See Andrew Macintosh, 'Best Practice Environmental Impact Assessment: A Model Framework for Australia' (2010) 69 *Australian Journal of Public Administration* 401.

refers to the approval of project proposals by the executive government, via the EIA process prescribed by the law.

The law governs environmental decision-making in the sense that the law may prescribe a particular process according to which a decision has to be made, or otherwise simply 'empower' a specified political actor to make the decision. The law may also set substantive standards that need to be met or substantive goals that need to be referenced in decision-making. In administrative law, of which EIA law is a subset, decisions that are made beyond the limits of the power of the decision-maker in his, her or its executive capacity are *ultra vires* and can be challenged in court.[8] Not following the required process is typically deemed to be acting beyond power.[9]

The approval of development projects and other types of undertakings and activities that are likely to impact the environment significantly is a key environmental decision-making capacity afforded to decision-makers in Australia. In each jurisdiction, ministers and other representatives or delegates are given the power to accept proposals, approve licenses, and issue permits for actions that might cause adverse environmental effects – as well as affect other stakeholders – in potentially harmful and destructive ways. Government decision-makers are thus, in a sense, arbiters of risk, but the law is able to mitigate these risks.

The 'separation of powers' doctrine requires the three arms of government – executive, legislative and judicial – to remain distinct.[10] With respect to EIA, it emphasises that the executive or administrative decision-maker remains separated from the parliament which is responsible for legislating relevant policies, and also separated from the courts which make judicial determinations. For example, it is not for a decision-maker to use the EIA process to effectively create policy on a matter such as climate change, while it is not usually[11] for the judiciary to stand in the metaphorical shoes of the decision-maker and determine that his, her or its political decision that a large fossil fuel project that might threaten the country's ability to meet its climate change obligations should be approved was the 'wrong' one. This concept will continue to be relevant throughout the following chapters and will help in understanding the defined roles of particular actors in the EIA process and the way in which they interact. It explains why federal environmental decisions cannot necessarily be reviewed on their merits, but rather only to the extent that a decision-maker acted beyond the powers prescribed to them by legislation.

IV ENVIRONMENTAL IMPACT ASSESSMENT

The reference to the assessment of impacts that is implied by the term EIA links environmental decision-making with the procedural process prescribed by the law which ensures that, for example, certain salient factors are taken into consideration before an approval is issued. EIA law, as it is so understood, can – but does not necessarily – require an actual 'scientific' impact assessment (ie, one

[8] Stephen Gageler, 'The Constitutional Dimension' in Matthew Groves (ed) *Modern Administrative Law in Australia* (Cambridge, 2014) 165, 167.

[9] Administrative law offers grounds for review where a decision-maker fails to consider a relevant consideration, or considers a matter that was not relevant: *Administrative Decisions (Judicial Review) Act 1977* (Cth).

[10] For a useful discussion which compares the US constitutional context to Australia's, see Peter Cane, *Controlling Administrative Power: An Historical Comparison* (Cambridge, 2016) ch 4.

[11] Except in the context of merits review, which is not available at the federal level.

undertaken by scientific experts).[12] As alluded to above, in legal literature, EIA has sometimes taken on a meaning that incorporates a multi-step process of screening or triggering, scoping and assessment, weighing and balancing factors, and ultimately the making of an approval decision on whether or not a proposal shall be approved.[13] Technically, however, the above steps collectively describe the process of *environmental decision-making* undertaken on the *basis* of an environmental assessment, or EIA-based decision-making.

This may be somewhat confusing, particularly to those from other disciplines including scientific disciplines, for whom environmental impact assessment may mean only the process of assessing the environment through samples and measurements rather than also the process of integrating that information (or not) into the decision-making process. In other words, scientists might see impact assessment as only a limited aspect of the broader process referred to in the legal context, and impact assessment is not always considered to be something that must be linked with a legal process at all.[14]

EIA as a legal process can be traced back to US law – specifically, the *National Environmental Policy Act of 1969* ('NEPA').[15] This legislation requires federal US agencies to report on the environmental impacts, unavoidable adverse effects, and irreversible commitments of resources pertaining to proposed major federal actions.[16] In doing so, agencies must also report on any alternatives.[17] NEPA does not 'dictate decisional outcomes'; rather, it establishes a decisional process.[18]

NEPA was a response to 'the profound impact of man's activity on the interrelations of all components of the natural environment',[19] including resource extraction.[20] It was relatively progressive for its time – a time when 'environmental law' barely existed as a distinct branch of law. The overall purposes of NEPA are stated as being to 'encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; [and] to enrich the understanding of the ecological systems and natural resources important to the [US]'.[21] Described as the 'world's most emulated law', many countries have implemented their own EIA processes following this pioneering piece of legislation.[22]

EIA was recognised as a key principle of sustainable development in the 1990s. Principle 17 of the 1992 *Rio Declaration*[23] states that EIA as a national instrument shall be undertaken regarding proposed activities that are likely to have a significant adverse impact on the environment and are subject to a

[12] Decision-making under the EPBC Act can be assessed through a number of different methods: EPBC Act, pt 8.
[13] These steps, not unique to Australian law, are outlined by Nick Harvey and Beverley Clarke, *Environmental Impact Assessment in Practice* (Oxford, 2012).
[14] See, eg, Luis Sanchez and Ross Mitchell, 'Conceptualizing Impact Assessment as a Learning Process' (2017) 62 *Environmental Impact Assessment Review* 195; Christopher Wood, *Environmental Impact Assessment: A Comparative Review* (Routledge, 2014).
[15] 42 USC §§4321 et seq.
[16] NEPA §102 [42 USC §4332].
[17] Ibid.
[18] *Sierra Club v US Army Corps of Engineers*, 803 F 3d 31, 36–37 (DC Cir, 2015).
[19] NEPA §101 [42 USC § 4331].
[20] Ibid.
[21] Ibid, §2 [42 USC §4321].
[22] Charles H Eccleston (ed), *NEPA and Environmental Planning – Tools, Techniques and Approaches for Practitioners* (CRC Press, 2008), xlii.
[23] *Rio Declaration on Environment and Development*, UN Doc A/Conf.151/26 (vol I); 31 ILM 874 (1992) ('*Rio Declaration*').

decision of a competent national authority. Following the 2010 decision by the International Court of Justice ('ICJ') in the *Pulp Mills* case, it is also now generally accepted that the obligation to conduct an EIA in cases where there is a risk of significant harm to a shared resource in a transboundary context has become a principle of general international law.[24] In that case, involving a river boundary dispute between Argentina and Uruguay, the obligation to conduct an EIA was considered to be an implied procedural element of the substantive duty not to cause environmental harm under the relevant agreement between the parties that governed their conduct in relation to the river.

EIA is not unlimited in scope: although environmental, social and economic impacts and their flow-on effects can continue into the future indefinitely, the EIA process must have an end point in terms of the extent to which it can manage these impacts. As the thesis explains, particularly in Chapter 6, both the Australian and US legislative contexts take similar approaches by employing a notion of 'reasonableness' to limit the scope of the impacts that an EIA can manage. Additionally, with respect to given impacts, EIA can only manage these impacts for the time period up until the approval decision. While an approval decision may include conditions that apply throughout and after the life of the project, the EIA process does not operate to monitor compliance. Instead, other laws – such as planning laws – may govern the project and its impacts on the environment during this time.

Australia's federal EIA-based decision-making process is embedded within its principal piece of environment legislation, the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) ('EPBC Act'). As mentioned, EIA laws also exist at the state/territory level.[25] The EPBC Act contains a mechanism for 'bilateral agreements' allowing state and territory-level assessments and/or approvals to be accredited at the federal level.[26] For each state and territory that has a relevant bilateral agreement in place, only one assessment needs to be conducted in respect of a given project. Under an assessment bilateral, the federal decision-maker, the Environment and Energy Minister ('Minister'), draws on the state/territory assessment in making an approval decision.

A *Legislative Process*

In Australia, federal EIA law (ie, the EPBC Act) is triggered where an 'action' – a term which incorporates projects, developments, undertakings, and activities[27] – is proposed on Commonwealth land or by a Commonwealth agency, and in all other cases where environmental matters considered to be of national importance are implicated in the sense of being likely to suffer a significant impact. The EPBC Act sets out procedural requirements that must be followed by the Minister when he or she is making a decision on the approval of a proposed action that is likely to have a significant impact on protected aspects of the environment. 'The environment' is defined broadly and inclusively in the EPBC Act as comprising (*inter alia*) ecosystems and their constituent parts, including people,[28] natural and physical resources, and values.[29] However because the EPBC Act's requirements are only enlivened where Part 3 of the Act is implicated, it is necessary to understand what is contained within

[24] *Pulp Mills on the River Uruguay* (Argentina v Uruguay) (Judgment) [2010] ICJ Rep 204. See also *Certain Activities Carried out by Nicaragua in the Border Area* (Costa Rica v Nicaragua) and *Construction of a Road in Costa Rica along the San Juan River* (Nicaragua v Costa Rica) (Joined Judgment) [2015] ICJ Rep 2015.
[25] For a summary of state and territory level EIA instruments, see Harvey and Clarke, above n 13.
[26] EPBC Act ch 3.
[27] EPBC Act s 523, subject to the exceptions in ss 524-524A.
[28] Although the definition explicitly includes humans, impacts to people are not referred to as environmental impacts but rather social impacts, at least with respect to EIA. See s 136 and Chapter 7 of this thesis.
[29] s 528.

Part 3 – Part 3 essentially acts as the principal screening or triggering mechanism that limits the EPBC Act's scope of operation.

Presently, there are nine 'matters of national environmental significance' ('MNES') in Part 3 which can trigger the EPBC Act if there are likely to be significant impacts from an action on those matters. These are:

1. ***world heritage properties*** (in particular, the world heritage values of such properties);
2. ***national heritage places*** (in particular, the national heritage values of such places);
3. wetlands of international importance or '***Ramsar wetlands***' (listed under the *Ramsar Convention*; in particular, the ecological character of such wetlands);[30]
4. listed ***threatened species and ecological communities***;
5. listed ***migratory species*** (protected under various migratory species agreements);
6. ***Commonwealth marine areas*** (in particular, an impact to the environment from an action taken in such an area);
7. the ***Great Barrier Reef Marine Park*** (in particular, an impact to the environment from an action taken in that Park);
8. ***nuclear actions*** (more accurately, an impact to the environment from such actions); and
9. ***water resources*** (in particular, an impact of an action on such resources that involves coal seam gas development or large coal mining development).

In sum, the EPBC Act provides general environmental protection where the Commonwealth is involved. If the Commonwealth is not involved, either because the proponent is a private person or company rather than a federal agency, or because Commonwealth land will not be affected, then the environment is only protected at the federal level to the extent that it relates to one of the above nine MNES. The term '***controlled action***' is used in the EPBC Act to indicate an action that is likely to have a significant impact on one of the Part 3 triggering or 'controlling' provisions that encapsulate the MNES.[31]

The terms '***likely***' and '***significant***', with respect to a proposed impact, are thresholds which are not defined. However, they have been interpreted by courts and government administrative guidance has been issued which together give 'likely' the meaning of a real or not remote chance or possibility (not necessarily greater than 50%),[32] and 'significant' the meaning of important, notable, or of consequence, having regard to context or intensity.[33]

The EPBC Act can best be understood by breaking it down into its parts, although not all 22 parts are relevant to EIA-based decision-making.

- Part 3, just described, functions as a screening or ***triggering mechanism***. It filters out proposals that are not 'actions',[34] actions that do not implicate the Commonwealth or a MNES, and actions that are not likely to be significant. By contrast, it triggers the decision-making process where proposals that are actions, do implicate the Commonwealth or a MNES, and are likely to have a significant impact.

[30] *Convention on Wetlands of International Importance Especially as Waterfowl Habitat*, opened for signature 2 February 1971, 996 UNTS 245 (entered into force 21 December 1975).
[31] EPBC Act s 67.
[32] Australian Government Department of the Environment, *Matters of National Environmental Significance - Significant Impact Guidelines 1.1* (Commonwealth of Australia 2013), 3.
[33] Ibid 2; *Booth v Bosworth* [2001] FCA 1453, 105.
[34] because they do not meet the definition in s 523 or are an excepted on account of s 524 or s 524A.

- Part 7, relatedly, sets out the requirements for deciding whether the approval of an action is required, and links with Part 3. An important provision in Part 7 allows the Minister to have 'call-in power' to draw proposals within the ambit of the EPBC Act's requirements at his or her discretion.[35] Also within Part 7 is the option for the Minister to decide that an approval is not required because the proposal is 'clearly unacceptable'.[36]
- Part 8 functions as the ***scoping mechanism***, establishing requirements for assessing actions which have been deemed as needing approval. Part 8 requires the Minister to determine what the relevant impacts of the proposal are,[37] and what assessment approach will be required.[38]
- Part 9 functions as the ***weighing and balancing*** and ***approval mechanism***, establishing requirements for making an approval decision.

Table 1.1, *The EPBC Act's EIA Process*

Step	Relevant questions	Relevant provisions
Screening/Triggering	Is there an action being proposed that is likely to have a significant impact on either the environment generally (where the Commonwealth is implicated) or one of the specific nine MNES?	Part 3; Part 7
Scoping/Assessment	What are the relevant impacts that need to be investigated?[39] What assessment approach should be taken?	Part 8
Weighing and Balancing	With respect to the relevant impacts and the information revealed about those impacts via the chosen assessment approach, how should various specific matters and factors be taken into consideration, and weighed and balanced against one another?[40]	Part 9 (s 136)
Approval	Should the proposed action be approved? If so, should any conditions be attached to that approval, and what should they be? Has the precautionary principle been considered?	Part 9; Part 16 (s 391)

NEPA also contains similar procedural steps. It is triggered when there is a 'major federal action', a term which is defined in NEPA's Regulations.[41] Essentially, some kind of 'federal nexus' must be established.[42] Unlike the EPBC Act, NEPA is not triggered by private proposals that do not involve a

[35] s 70.
[36] ss 74B-74D.
[37] ss 81-84.
[38] pt 8, div 3.
[39] This question involves determining whether a given impact is too remote to consider, as well as what impacts are relevant to the specific state/territory or federal level.
[40] Note that while the EPBC Act specifies which matters and factors need to be taken into account, it does not provide advice on how to weigh and balance these matters. That is generally considered to be a political, or administrative decision and afforded discretion.
[41] 40 CFR §1508.18.
[42] For further explanation, see Charles H Eccleston, *The NEPA Planning Process – A Comprehensive Guide with Emphasis on Efficiency* (John Wiley & Sons, 1999), 8.4; Michael B Gerrard and Sheila R Foster (eds), *The Law of*

federal agency or federal lands in any circumstances. Some categories of impact (or 'effects') are 'categorically excluded' from EIA – these categories depend on the particular agency.[43] If the agency that is making the decision determines that there is no exclusion, then it must prepare an environmental assessment ('EA'), which will either result in an environmental impact statement ('EIS'), in cases where significant impacts are identified, or a finding of no significant impact ('FONSI'). Specifics of what must be included and which steps must be taken are incorporated within the provisions of NEPA and, particularly, its regulations.[44]

Table 1.2, *NEPA's EIA Process*

Step	Screening/triggering		Scoping/Assessment		Approval
Process	Major federal action that is not categorically excluded →	EA →	significant impact →	EIS →	Approval decision
			no significant impact →	FONSI →	

B *Does EIA Have a Substantive Goal?*

One might deduce that laws whose goal is to ensure that procedure is followed are effective if procedure is, in fact, followed. Yet how to judge whether or not EIA is 'effective' has proved a difficult question to answer, and one upon which commentators have not agreed.[45] Partly, this is because there is no consensus as to what 'effective' means, which in turn can be explained by suggesting that EIA laws are probably *not* purely procedural in aim. There will always be some point to undertaking a process, and thus the goal in undertaking EIA is not simply to do so without regard to the end, but to achieve something more substantive. Procedural success is typically seen in EIA literature as only one component of effective EIA.[46]

Australian environmental law scholar and barrister, Chris McGrath, has supported evaluating the effectiveness of an environmental law system by looking at how it achieves its objectives.[47] In his PhD

Environmental Justice: Theories and Procedures to Address Disproportionate Risks (American Bar Association, 2nd ed, 2008) ch 9.

[43] 40 CFR §1508.4.

[44] See, eg, 40 CFR §1502.

[45] See, eg, Maria Rita Raimundo e Almeida and Marcelo Montaño, 'The Effectiveness of EIA Systems in São Paulo and Minas Gerais States' (2017) 20 *Ambiente e Sociedade* <scielo.br/scielo.php?script=sci_arttext&pid=S1414-753X2017000200077> (English), and the references therein.

[46] Ibid, and see references therein.

[47] Chris McGrath, *Does Environmental Law Work? – How to Evaluate the Effectiveness of an Environmental*

thesis and resulting book, he acknowledged that EIA is part of a broader law system and as such did not seek to define an *EIA system's* effectiveness specifically. Yet, an argument could be made that an EIA system's effectiveness could be evaluated with the broader goals of the EIA legislation in mind, on the basis that EIA has a utility function: it is a tool employed to help in the achievement of those goals.

The EPBC Act's objectives, listed in section 3, are to protect the environment and promote the conservation of biodiversity and heritage, as well as to promote ecologically sustainable development ('ESD') and a co-operative, multi-stakeholder approach to environmental protection and management. NEPA's objectives were described above as including to encourage harmony between people and their environment, to promote efforts that will minimise environmental damage and stimulate people's health and welfare, and to enrich understanding of ecological systems and natural resources.[48]

Any measure of effectiveness against these substantive goals is likely to be qualitative rather than quantitative in nature, and at least to some extent subjective,[49] primarily due to the counterfactual nature of EIA-based analysis.[50] Measurement of EIA effectiveness is also not something which courts are likely to engage in, on the basis of the political and administrative nature of EIA-based decision-making and the doctrine of the separation of powers. Rather, EIA legislation can draw decision-makers' attention to – and require them to consider – substantive concepts, goals and principles by embedding those within the legislation. For example, in the EPBC Act context, decision-makers are required to consider the so-called 'principles of ESD' when making approval decisions – but they are not compelled to go so far as making decisions that will further sustainable development in any mandatory sense.[51] Under NEPA, agencies are required to identify and record alternative options to each proposal, and state which options are environmentally preferable with reference to NEPA's codified *raison d'être* (congressional declaration),[52] however, they do not have to reject less preferable options.

A concept gaining prominence, particularly in management and policy literature, is that of 'net gain'. The idea is that environmental decisions should have a net-positive effect on the environment, ie, the environment should experience an overall gain as a result of the decision.[53] This clearly substantive goal would be difficult to measure and enforce. However in the manner just described, the law could require that net-positive alternatives to proposals be identified, and also require a justification in the case that such alternatives are not adopted. This process might help in the formation of approval conditions such as those specifying allowable project locations, requiring species translocation, or

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Legal System (Lambert, 2010) 49.

[48] 42 USC §4321.

[49] Christopher Wood, *Environmental Impact Assessment: A Comparative Review* (Routledge, 2nd ed, 2014); P Christensen et al, 'EIA as Regulation: Does it Work?' (2005) 48 *Journal of Environmental Planning and Management* 393. Cf Rowan K Machaka, 'The Method, Rights and Resources Model for Evaluation of the Effectiveness of Environmental Impact Assessment Systems' (2017) 5 *African Evaluation Journal* a200 <https://doi.org/10.4102/aej. v5i2.200> in which a new model for assessing effectiveness against the substantive goal of environmental protection is put forward.

[50] Andrew Macintosh, 'The Australian Government's Environmental Impact Assessment (EIA) Regime: Using Surveys to Identify Proponent Views on Cost-Effectiveness' (2010) 28 *Impact Assessment and Project Appraisal* 175, 178.

[51] EPBC Act s 3A; for a detailed discussion of the principles of ESD in Australian courts see Brian Preston, 'The Judicial Development of Ecologically Sustainable Development' (Presented to the *Environment in Court* IUCNAEL Colloquium, 22 June 2016, Oslo, Norway).

[52] 40 CFR 1505.2(b); NEPA, 42 USC §4331.

[53] See, particularly, Stephen Jay et al, 'Environmental Impact Assessment: Retrospect and Prospect' (2007) 27 *Environmental Impact Assessment Review* 287.

requiring carbon or native vegetation offsets.[54] It might also encourage proponents to minimise net environmental harm when designing projects. Recently, aiming for 'net gain' was employed as a principle of a new piece of river protection legislation in Victoria.[55]

Two further categories of measures of EIA effectiveness have been put forward in the literature. The first is 'normative' or 'transformative' effectiveness, and the second, 'transactive'. Effectiveness from a normative perspective means that values and behaviours have responded to the EIA, ie, some kind of learning has occurred, which might happen simply because the EIA regime exists – for example, a proponent modifying its proposal so as to avoid sensitive areas in the knowledge that the law would scrutinise the proposal more harshly or that EIA would be triggered if the proposal affected those areas.[56] Effectiveness from a transactive perspective can be evaluated by looking at whether the assessment process was cost-efficient.[57] These measures are arguably able to be considered alongside substantive effectiveness, especially where the goals or objectives of the legislation explicitly (or implicitly) include improved decision-making that is cost-efficient.

Various authors have suggested indicators that might be used to gauge EIA's effectiveness, with the most influential being Wood's 'indicators of robustness'. These point to features of legislation, such as public participation, that are embedded within the required processes.[58] Harvey and Clarke surmised that that 'most of [Wood's] requirements for robust EIA systems are in place in all Australian jurisdictions'.[59]

Craik argues that 'broad public oversight is necessary to ensure that [EIA-based] decisions are reflective of, or at least account for, public values and priorities'.[60] This point raises another final aspect of effectiveness, which is that EIA might be considered to be effective where it facilitates decisions to be made that are in the public interest. Some EIA systems explicitly make reference to the public interest, for example, New South Wales (NSW),[61] but the EPBC Act does not. EIA decision-makers are political actors, and should thus in theory be representing the interests of the public who elected their party (in a democratic system of governance). The extent to which the EIA system is able to further political priorities and also facilitate public participation and incorporate the views of the public could be a lens through which to assess effectiveness. Again, such an assessment would be both qualitative and somewhat subjective.

In posing and addressing research question two, the capacity of the legal system to minimise risk of adverse harm through EIA, there is no implicit assumption that harm minimisation or risk avoidance *need be* the objective of EIA. The thesis is not asking the question of whether the EIA system is broadly effective, as doing so would require effectiveness to be defined, and the enquiry would accordingly

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[54] Note that the federal government has an EPBC Act offsets policy: *EPBC Act Environmental Offsets Policy* (Commonwealth of Australia, 2012). The validity of the offsets concept is highly debated however: see, eg, Martine Maron et al, 'Locking in Loss: Baselines of Decline in Australian Biodiversity Offsets Policies' (2015) 192 *Biological Conservation* 504.

[55] *Yarra River Protection (Wilip-gin Birrarung murron) Act 2017* (Vic), s 9(4).

[56] Macintosh, above n 50; Matthew Cashmore, Alan Bond and Dick Cobb, 'The Role and Functioning of Environmental Assessment: Theoretical Reflections Upon and Empirical Investigation of Causation' (2008) 88 *Journal of Environmental Management* 1233.

[57] Barry Sadler, 'Environmental Assessment in a Changing World: Evaluating Practice to Improve Performance' (International Study of the Effectiveness of Environmental Assessment, Final Report, 1996) 65.

[58] Wood, above n 49, 12.

[59] Harvey and Clarke, above n 13, 219.

[60] Neil Craik, *The International Law of Environmental Impact Assessment: Process, Substance and Integration* (Cambridge, 2008), 36.

[61] *Environmental Planning and Assessment Act 1979* (NSW) s 79C(1)(e)

not be able to be limited to looking at risk management unless that was synonymous with effectiveness. Nonetheless, aligning the broad concepts of robust decision-making with substantive objectives such as environmental protection, biodiversity conservation and sustainable development, risk minimisation would seem a fitting purpose for EIA, or at least a useful means to evaluate its effectiveness.

V METHODOLOGY

In approaching the research questions, a mixed method is utilised which centres around:

1. ***Doctrinal legal analysis*** – namely, an analysis and interpretation of legislation and case law; accompanied by
2. ***Comparative analysis*** – focusing on the US and lessons that may be learned from that jurisdiction.

In addition, ***systems thinking*** and ***interdisciplinary thinking*** are applied as lenses through which the problems raised by the research questions are viewed, and as conceptual approaches to assist with the analyses.

Being a law thesis, the centrality of legal methodologies allows the thesis to engage in and respond to the discipline of law. The ***doctrinal analysis*** that is the core methodological component assists in studying the law's provisions and their operation in both a theoretical and applied manner. A doctrinal analysis is an appropriate way to analyse how particular legislative provisions and their wording have certain practical effects. In particular, for this thesis, doctrinal analysis facilitates connecting EIA law with environmental outcomes and risk materialisation, through looking at the law's operation.

A ***comparative analysis*** enables a relevant foreign context to be drawn upon for the purposes of better understanding the challenges and opportunities for another. In the case of this thesis, the US is referenced for the purposes of identifying key lessons and opportunities for Australia. In law, a comparative analysis typically means a comparison of two or more laws (in a doctrinal sense) or legal systems (more broadly including legal cultures).[62] However, including the wider social, political, economic and environmental context within the comparison, in an interdisciplinary sense, can be beneficial. Each of Chapters 3-6 include a reference to the US context, specifically with respect to EIA as well as more broadly, for the purposes of assisting in predicting the impacts that might be likely to affect Australia. In addition, the comparison is made in order to better understand the problems and gaps in Australia's EIA law with a view to ascertaining commonalities and differences that might facilitate lessons for Australia.

As the home of fracking's broad-scale expansion, the US has had far more experience with fracking than other countries. This is relevant in terms of learning what impacts could and are likely to manifest, and in being able to observe the effects of different regulatory and management control strategies. Of interest from a legislative perspective, the US' principal federal EIA law served as the model upon which Australia's federal EIA law was based and, though rarely acknowledged, some of the exact same wording is used in both jurisdictions, the implications of which are explored in future chapters. Court decisions in recent years have confirmed that fracking is not usually likely to implicate federal-level EIA in the US, which could be on account of NEPA's restricted scope to only federal actions, but this does not mean that the federal provisions cannot be meaningfully compared.

Systems thinking can be applied by adopting a view of a problem context that sees stakeholders and other actors and elements within a holistic system, analysing how constituent parts of the system interrelate, and what the flow-on implications of those interactions are. As Chapter 2 further explains, systems thinking derives from systems theory. As an approach, systems thinking can broadly assist with understanding and addressing problems in a practical, integrated and rounded way without concentrating on ontologically defining and analysing systems functioning from a more removed,

[62] See, eg, the writings of van Hoecke, including Mark van Hoecke (ed), *Methodologies of Legal Research: What Kind of Method for What Kind of Discipline?* (Oxford, 2011).

theoretical perspective. It can also help to identify the scope of a problem and the broad range of actors, institutions and stakeholders involved.

If the system of interest is an interdisciplinary system, including a social-ecological system ('SES', explained in Chapter 2), systems thinking is able to highlight where different disciplines might need to be called upon – for example, science, to explain impacts and help understand risks and consequences; law, to understand the existing regulatory context and the likely implications of the laws and the gaps within them. In this manner, systems thinking can help to broaden the scope of disciplinary enquiry, and facilitate interdisciplinary research.

Incorporating a systems approach has relevance to each research question, in order to help understand the complex interactions that lead to fracking impacts, and to facilitate a holistic analysis of the way in which the law influences environmental risk (and in turn how gaps in the law have specific effects). Adopting a systems approach means considering and describing environmental impacts not as discrete happenings or products of simple cause-and-effect relationships, but rather as complex phenomena with multiple interacting causal pathways and chains of indirect or flow-on effects – sometimes latent, sometimes cumulative, and sometimes emergent. Drawing on concepts used in systems thinking, such as resilience, complexity and emergence, can assist in understanding key problems and thinking about possible solutions or reforms.

Interdisciplinary thinking can be applied by looking at disciplinary traditions, such as the production of scientific knowledge though the scientific method, or legal methods and reasoning, and considering the way in which different disciplines might come together at the interface between different conceptual structures.[63] In the context of legal research, interdisciplinary thinking can help to identify how the law interacts with or could better interact with other fields of enquiry extraneous to the law, and also how the law regulates subjects such as the natural environment, or people and communities. Decision-making in the face of scientific uncertainty is a good example relevant to this thesis of where interdisciplinary science-law thinking is helpful in articulating issues and thinking about solutions.

Interdisciplinarity is as a methodology difficult to define, to the extent that it is probably better referred to as an approach, particularly in the context of this thesis. Similarly to the thesis' approach to systems thinking, the intention is not to discuss interdisciplinarity from a theoretical or normative perspective, but rather, to adopt an interdisciplinary approach to answering the research questions within the context of the legal analysis. Adopting an interdisciplinary approach alongside more traditional methods of legal research means drawing on the methods used in different disciplines as well as the knowledge generated from different disciplines (for example, published literature) in order to provide greater depth and more holistic insight into the problems being addressed. An interdisciplinary approach can facilitate a better understanding of a problem context – here, the nature and risks of fracking, the complexities of the law and its impacts on people and their environment, the interface between science and law, and the economic and political benefits and risks of major energy projects – and ultimately respond to it.

Reference to those disciplines that seek to understand and predict impacts to the environment is necessary in order to know how the law can help to achieve environmental protection goals and minimise the risk of adverse environmental impacts. These include, in the fracking context, geology, hydrology, ecology, and toxicology. Because EIA law requires the weighing and balancing of environmental, social and economic impacts, expert knowledge about each of these impacts is

[63] R Bromme 'Beyond One's Own Perspective: The Psychology of Cognitive Interdisciplinarity' in P Weingart and N Stehr (eds) *Practising Interdisciplinarity* (University of Toronto Press, 2000) 115.

required to be acquired by the decision-maker, and this knowledge is thus integral to EIA. In addition to the above scientific disciplines, a suite of other disciplines such as economics and political sciences are relevant to EIA. Collating and integrating material from those disciplines is a way to analyse EIA in a holistic, systems-focused way.

Drawing on each of the outlined methodological approaches and lenses helps to illuminate different issues relevant to the research questions. Using any approach as a singular methodology or using legal methodologies without also thinking more broadly would have had limitations which a mixed method approach helps to address. While the value of interdisciplinary and mixed method research in law has increasingly gained acceptance in recent years,[64] this thesis' specific approach is nonetheless novel.

The focus *beyond* doctrinal analysis in future chapters is important because it is rooted in an identified need for environmental law to engage more effectively with disciplines such as science, politics and economics and to adopt more flexible, systems-oriented ways of thinking. This is a need which is evident from environmental legislation (which acknowledges science- and ecosystem-based approaches, recognises uncertainty, flags equitable concerns and calls for improved valuation and pricing, for example),[65] but which is not being properly satisfied.[66]

Addressing the contemporary problems that are emerging as critical challenges for life on Earth in future cannot be approached only by looking at the law in isolation – even if the goal is to examine how the law can help. The law, which always has impacts on people, places, and systems external to the law, can be modified, reformed, and evolved, to change the way in which impacts manifest. It can thus be a very important focal point for change. But in order to best appreciate the law's capacity in this sense, an expansion of legal research beyond purely legal methods, sources and subject-matter is required.

The approach taken in this thesis helps to identify and understand the problems with the EIA process in a more holistic way than if a purely doctrinal law approach had been relied upon in isolation, without looking at the problem context in terms of fracking and its environmental impacts. It enables the thesis to show how EIA law affects environmental systems through the decision-making that it regulates, and that this link is critical in determining how EIA can manage risk. The approach also supports the thesis in demonstrating that EIA law is an important tool in managing fracking risks, and how, through a focus on the interactions between the law, the decision-maker, and the environment.

VI OVERVIEW OF CHAPTERS

Chapter 2 presents a literature review and explanatory summary of foundational concepts relevant to the systems and interdisciplinary lenses applied throughout the remaining chapters. It explores systems theory and how it relates to systems thinking, both in law and with respect to the law's interaction with other disciplines. It also explores the concept of sustainable development in terms of its relationship to law and to the questions posed in this thesis, as well as how it connects and transcends disciplines.

[64] Martha Minnow, 'Archetypal Legal Scholarship – A Field Guide' (2013) 63 *Journal of Legal Education* 65.
[65] See, eg, EPBC Act s 3A.
[66] Australian Government Department of the Environment and Energy, *State of the Environment Report 2016* (Commonwealth of Australia, 2016).

Chapter 3, drawing on literature from different disciplines, presents a picture of what 'fracking' is, and highlights its main impacts. Adopting a systems approach, it also considers flow-on implications, and places fracking in the context of relevant systems – ecosystems and social systems impacted by fracking, political and economic systems which drive fracking, and the legal system which has the potential to regulate it. Chapter 3 considers where the law fits within the matrix of factors relevant to fracking such as scientific and economic concerns, highlighting the governance difficulties posed by complex issues like reducing fossil fuel dependency to combat climate change, or reducing water pollution to sustain biological and human life. It is the principal chapter directed at ***research question one***, which asks what the impacts of fracking are.

Chapter 4 addresses water impacts, applying systems thinking to help conceptualise water resources within the context of the hydrological cycle, using a doctrinal analysis to look at the way in which the EIA system treats water impacts at the federal level, and referring to the US context, and the treatment of water resources by NEPA, as a comparison. Identifying that water impacts are only partially covered with respect to the fracking context in Australia, it advocates for a broader triggering provision in the EPBC Act. ***Research question two***, which asks how well the EIA system is equipped to manage fracking risks, is addressed through the argument that water impacts from unconventional gas other than coal seam gas is a major category of risk not managed effectively by the EPBC Act. ***Research question three***, which seeks to identify potential solutions for any gaps, is addressed through the suggestion of a modified provision.

In a similar vein, Chapter 5 addresses climate change impacts, using interdisciplinary and legal research to discuss climate change in the law context, and a doctrinal analysis to examine how the EIA system currently treats climate change, both in the Australian and US contexts. Responding to ***research question two***, the way in which climate change risk is dealt with by the EPBC Act is presented and analysed. Employing systems thinking, Chapter 5 advocates for a new climate system trigger within the EPBC Act, offering this suggestion for the purposes of ***research question three***.

Chapter 6 specifically tackles a critical problem with EIA generally which is exemplified by fracking: the incorporation of cumulative impacts. Rather than focusing on specific aspects of the environment as Chapters 4 and 5 did, Chapter 6 focuses on a characteristic of the *nature of environmental impacts* – namely, that they are often caused in a cumulative way. Project-specific EIA decision-making has difficulties in recognising cumulatively caused harm, and Chapter 6 explains why this is problematic, drawing on primary legal analysis and commentary, as well as systems thinking. It identifies cumulative impacts as a relevant gap for the purpose of ***research question two***. Suggestions are made as to how the law might be more effective in recognising cumulatively caused harm, so as to facilitate decision-making that is better equipped at minimising risk. This aspect addresses ***research question three***. Chapter 6 finds that the US context is helpful, as the relevancy of cumulative impacts to decision-making is much more clearly defined in that jurisdiction than in Australia.

Chapter 7 focuses on economic and social impacts, building on the historical account of international law and policy developments in the sustainable development context from Chapter 2 to explain why these types of impacts are incorporated as relevant to environmental decision-making in national law contexts. A critical legal analysis reveals how economic and social matters are able to influence decision-making, and even outweigh environmental impacts under the law. Economic and social matters are important to consider in understanding the limitations and opportunities of EIA law with respect to being able to minimise environmental risk. In exploring these limitations, this is the final chapter that seeks to answer ***research questions two and three***. Developments in the field of environmental economics, already influential in the US, are drawn upon in order to make suggestions

as to how the consideration of economic and social matters in Australia might be improved with respect to managing adverse fracking impacts.

Finally, Chapter 8 summarises the key findings and recommendations of the thesis and discusses future applications. Its ultimate conclusion is that federal EIA law does have the capacity to minimise the environmental harms of fracking. However, when considering that proposals are, in practice, typically accepted in spite of likely harm (and that acceptance upheld by courts), and also that key gaps need to be remedied before the capacity is able to be fully realised, it is unlikely that federal-level EIA law will be effective in preventing risks of adverse harm to MNES from fracking at this stage. In order to be more effective at reducing risk, legislative changes are required, and this thesis considers what might be needed. A broader, systems-focused approach to considering environmental impacts and their flow-on implications, and to decision-making generally, is recommended as a way to improve decision-making.

Chapter 2: Systems Thinking and Sustainable Development

Chapter 1 introduced EIA law and Australia's federal EIA legislation, the EPBC Act.[1] It outlined the three research questions of the thesis which link EIA with the particular example of fracking. In addressing the research questions through the chosen legal methodologies and through systems and interdisciplinary lenses, it is important first to review the literature on fracking, which is dealt with in Chapter 3, and to introduce and analyse two other key concepts: systems, and sustainable development, which are the foci of this Chapter.

Part I links together law, the natural environment, and systems theory. It explains how law has been conceptualised as a system which some have even viewed as 'autopoietic' like the system that comprises a biological cell. Although not subscribing to this view, Part I articulates the value in nonetheless looking at law in systems terms through the mindset of systems thinking – thinking about the legal system as one that interacts with its environment, including the natural environment, and with people, including scientific experts, and the general public. It then introduces the concept of and literature regarding 'social-ecological systems' ('SES'), as a paradigm for conceptualising the legal system together with natural systems influenced by the law – like the hydrosphere and the climate system. This is a useful precursor to the discussions in following chapters, which centre around EIA law but which also refer to the environmental systems with which the law interacts. Chapters 4 and 5 in particular demonstrate how EIA law, on account of EIA-based decision-making, interacts with the natural environment through its function in managing environmental impacts.

Part II reviews literature concerning the concept of sustainable development – one which is central to environmental law and which arguably provides substantive content to EIA law. Part II adopts an interdisciplinary approach, focusing not only on the law relating to sustainable development, but also on fundamental principles and paradigms, including the global Sustainable Development Goals ('SDGs') – targets that cover all sectors of the economy and which are relevant within and across disciplines. This discussion reviews the concept of a 'doughnut model' for conceptualising sustainable development derived from the fields of science and economics, and which links with systems thinking. In Chapter 1, the goal of balancing or decoupling development projects from environmental risk was described as broadly associated with the goal of sustainable development. The intention of this Part is to provide the foundations for arguments about environmental risk in future chapters by exploring how development is linked with the environment and with environmental risk, how people are linked with the environment, and how systems and systems limits tie these together.

I LAW, ENVIRONMENT AND SYSTEMS

The law – including the actors and institutions that help to draft, uphold and enforce it – is often referred to in systems terms ('the legal system'), but rarely is it studied using systems theory or analysed by applying systems thinking. Those who *have* studied the law as a system have tended to focus on ontological aspects, seeking to define the legal system in terms of its boundaries and characteristics (discussed below). This thesis does *not* seek to define the legal system in such terms; rather, it explores the interactions within the 'legal system' (as that system is commonly understood)[2]

[1] The operation of EIA is reviewed in more depth in the following chapters, particularly Chapters 4-7.

[2] The legal system is commonly understood as a civil, common, Roman or other code source of principles and practices, which may include a constitution, primary legislation (statutes and laws), subsidiary legislation (eg,

and also looks at the connections between law and other systems, while at the same time acknowledging that together both types of systems could also be conceptualised as comprising a single system.

The natural environment – including the species, communities and habitats that comprise it – is often referred to in systems terms too ('ecosystems'). Scientists have long studied ecosystems, but analysis of how ecosystems connect with the legal system that seeks to protect them (and which can also operate to destroy them) is limited,[3] at least from a systems perspective.

There is an emerging body of literature which centres around the idea of hybrid SES which could unite law and environment within a systems thinking framework. SES, explained further below in Subsection C, are essentially 'human-environment' systems. If the law is a part of the broader human social system, and the environment that is impacted is part of the broader ecological Earth system, environmental law can be understood and analysed by employing SES thinking that looks at the overlap (which in turn might be defined around a particular problem that needs to be regulated). Within that new sphere, the interactions between the law and the environment can be studied.

As explained in Chapter 1, this thesis adopts a perspective which sees the law in the context of society and its environment in systems terms, without delving into ontological, technical or definitional aspects, but rather with the purpose of addressing each research question laterally and holistically. This approach – one which looks at the elements and interactions within and between systems, and the consequences of such actions – is particularly useful for contemporary EIA law. The benefit for EIA-based decision-making is that it allows the legal, social and scientific dimensions of a problem to be viewed together in a way that is connected rather than fragmented, facilitating interdisciplinary, holistic analysis rather than a piecemeal consideration of diverse factors.

A *Systems Theory*

A 'system', in basic terms, is simply a whole comprised of interacting parts or elements. Early systems theorist Ludwig von Bertalanffy described a system as 'a complex of elements in interaction'.[4] Systems theory can best be conceptualised by reference to a key counterpoint – reductionism. Reductionism seeks to break a whole into its parts and to analyse those parts, and has been the prevalent paradigm for many of the physical sciences over the course of history to date.[5] Systems theory and, by extension, systems thinking (which is the theory employed in an applied, analytical context)[6] places importance on the way in which the parts of a whole interact, and on the functioning of the whole.

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bylaws), and traditional practices upheld by courts. It may include judicial, legislative and executive arms of government at federal or national as well as sub-national (state/territory) levels. See Bryan A Garner (ed) *Black's Law Dictionary* (Thomson Reuters, 10th ed, 2014).

[3] But see Froukje Maria Platjouw, *Environmental Law and the Ecosystem Approach: Maintaining Ecological Integrity Through Consistency in Law* (Routledge, 2016).

[4] Ludwig von Bertalanffy, 'Zu Einer Allgemeinen Systemlehre' (Bertalanffy papers, 1945) in Manfred Drack, 'Ludwig von Bertalanffy's Early System Approach' (2009) 26 *Systems Research and Behavioural Science* 563.

[5] The idea of moving from reductionism to a more systems-oriented way of looking at the world was discussed at the 1968 Alpbach Symposium *Beyond Reductionism*, where early systems theorists argued that life-related phenomena were too complex to be described through reductionist paradigms and that points of connection and overlap between life sciences disciplines could aid in mapping out how disciplinary knowledge could be combined without being reduced: Katharine Farrell, Tommaso Luzzati and Sybille an den Hove, *Beyond Reductionism - A Passion for Interdisciplinarity* (Routledge, 2013), 2.

[6] For a simplified discussion of what 'systems thinking' means see Ross Arnold and Jon Wade, 'A Definition of Systems Thinking: A Systems Approach' (2015) 44 *Procedia Computer Science* 669 and references therein.

Von Bertalanffy was a biologist, and through his work on systems he argued that '[t]he characteristic of life does not lie in a distinctiveness of single life processes, but rather in a certain *order* among all the processes'.[7] He articulated a distinction between 'open' and 'closed' systems. Open systems, though as with all systems having the property of a 'boundary' (which might be physical or conceptual but in biology is typically physical), permit metabolic exchanges across boundaries, whereas closed systems do not. The concept of *Fließgleichgewicht*, or 'flux equilibrium', describes an equilibrium where energy and matter remain in balance but are still moving in and out across a system's boundary. A second important concept discussed by von Bertalanffy was *Gestaltheit*, which has been interpreted as meaning that dynamic interactions in a system give rise to order.[8] This relates to the idea of the whole, but also to the 'emergent' properties of complex systems.

Cyberneticists Humberto Maturana and Francisco Verala were instrumental in the continued development of systems theory and its translation to fields outside of biology and the life sciences. They are credited with the concept of autopoiesis. 'Autopoiesis' has Greek origins - 'αὐτο- (auto-)', meaning self, and 'ποίησις (poiesis)', meaning creation or production. An autopoietic system is one whose components are produced by the system itself, and by reference to itself (rather than by reference to the system's environment). Autopoietic systems do not communicate with their environment, though they can communicate about it - an autopoietic system only 'knows its environment in knowing itself'.[9] Ross Ashby, a critical participant in the dialogue on autopoietic systems in cybernetics, viewed autopoietic systems as open to energy, as with other systems, but closed to information and control.[10] Later, this idea would be translated to the legal context, with two influential social science researchers – Niklas Luhmann and Gunther Teubner – arguing that the legal system is an autopoietic, operationally closed system that may be open to norms, but is closed to information.[11]

B *Law as a System*

The transposition of systems theory from physical to social sciences happened in Germany around the 1980s, with Luhmann and Teubner formulating and promulgating what has been described as a 'new sociological and legal paradigm'.[12] Luhmann in particular expounded the idea that the elements of social systems are communications rather than things. Thus, people could be part of physical systems but their communications were part of social systems, and the legal system was comprised of communications (judgments, laws, etc), but not of the actors or institutions that produce those communications (judges, courts, parliaments, lawmakers).[13]

Teubner, influenced by Luhmann, continued the conversation on law in systems terms through many theory-based papers. He saw the 'differentiated functional system of law' as being 'autopoietically

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[7] Ludwig von Bertalanffy, 'Wandlungen des Biologischen Denkens' (1934) 10 *Neue Jahrbuecher fuer Wissenschaft und Jugendbildung* 339. 'Life processes' is the literal translation of a German word 'Lebensvorgaenge', one which perhaps does not, like much of the systems language that has evolved in Germany, have an exact English equivalent.

[8] Drack, above n 4, 566.

[9] Jean-Pierre Dupuy, 'On the Supposed Closure of Normative Systems' in Gunther Teubner (ed), *Autopoietic Law: A New Approach to Law and Society* (Walter de Gruyter & Co, 1987), 55.

[10] Ross Ashby, *Introduction to Cybernetics* (Chapman & Hall, 1956).

[11] See Niklas Luhmann, 'The Self-Reproduction of the Law and its Limits' in Gunther Teubner (ed), *Dilemmas of Law in the Welfare State* (de Gruyter, 1985), 113-114.

[12] Dupuy, above n 9.

[13] Katayoun Baghai, *Social Systems Theory and Judicial Review - Taking Jurisprudence Seriously* (Ashgate, 2015), 14; see also Niklas Luhmann, *The Differentiation of Society* (Columbia University Press, 1982), 70.

organised within the autopoietic system of society'.[14] Essentially, he saw the law as a system with a unique function and as an autopoietic (self-referential and autonomous) system within a broader autopoietic social system.[15] Teubner explained that the legal system can, 'forced by the uproar [of noise] outside…vary its internal 'order' until relative quiet returns', [16] but in other senses, it is quite independent of its environment. In other words, he saw the law as a closed system which could respond to its environment but he did not think that the legal system included communications from other systems. Instead, the legal system could translate and re-use communications from other systems but in such cases those communications needed to be separated from their existence within the originating system, wherein they had a precise and distinct meaning.[17] For example, they could do this through the creation of legislation, which is an instrumental tool that can transform non-legal communications into legal ones.[18] A law on the environment might thus function to bring communications about the environment within the purview of the legal system.

This is not how most people, indeed most legal theorists, think about or conceptualise the legal system, but Luhmann and Teubner's work made an important contribution to systems theory. Jürgen Habermas, for example, shared many of Luhmann's views, but was uncomfortable with the idea that the law is a closed system, because of its important 'mediating' function with the *Lebensweld* (values, norms and patterns which allow communications to take place).[19] He also understood that particular uncommunicated premises underlie all attempts to communicate, and that communication *between people* creates meaning, rather than systems deriving meaning from interpreting communications themselves (as Luhmann understood).[20] Those doing the communicating were thus important to the system.

Francois Ost, a Belgian systems theorist, has expressed scepticism about the idea that social systems are autopoietic, and noted, too, that it would have been at best 'doubtful' that Maturana and Verala would have condoned the transfer of their systems theory across to social sciences,[21] a point which Maturana himself has confirmed.[22] Ost asserted that systems can be 'autonomous' without being operationally closed or autopoietic, and considered the autopoiesis theory to be insufficient to explain reality because it does not allow for interactions between subsystems and does not account very well for overlapping systems. He stressed that a system can be at the same time several systems and one only, and one system in many;[23] that system boundaries are not always neat;[24] and that 'the element

[14] Gunther Teubner, 'Evolution of Autopoietic Law' in Teubner, above n 9, 221.
[15] John Mingers, 'Law as an Autopoietic System', in *Self-Producing Systems: Contemporary Systems Thinking* (Springer, 1995) 153.
[16] Gunther Teubner, 'Social Order from Legislative Noise?' in Gunther Teubner (ed), *State, Law, Economy as Autopoietic Systems* (de Gruyter, 1987).
[17] Richard Nobles and David Schiff, *Observing Law Through Systems Theory* (2013, Hart), 15.
[18] Ibid 20.
[19] Mathieu Deflem, 'The Legal Theory of Jürgen Habermas' in Reza Banakar and Max Travers (eds) *Law and Social Theory* (Hart, 2nd ed, 2013) 70.
[20] See, Juergen Habermas, *Theory of Communicative Action Volume One: Reason and the Rationalization of Society* (1984, translated by Thomas McCarthy, Beacon Press); Juergen Habermans, *Theory of Communicative Action Volume Two: Liveworld and System: A Critique of Functionalist Reason* (translated by Thomas McCarthy, Beacon Press, 1987).
[21] Francois Ost, 'Between Order and Disorder: The Game of Law' in Teubner, above n 9, 73.
[22] F Verala, H Maturana and R Uribe, 'Autopoiesis: The Organisation of Living Systems, its Characterisation, and a Model' (1974) 5 *Biosystems* 187.
[23] Francois Ost, 'A Game Without Rules? The Ecological Self-Organization of Firms' in Gunther Teubner, *Environmental Law and Ecological Responsibility - The Concept and Practice of Ecological Self-Organization* (John Wiley & Sons, 1994), 340.
[24] Ibid 341.

or subsystem does not exist as an autarkic identity: it is at the same time a "total part", an image of the system as a whole, and a virtual part, never fully actualized'.[25] Ost introduced his own theory, a 'game theory' to the systems literature. Ost's game theory focuses on the players as observers of and participants in the system. In this game theory (not to be confused with economic game theory), the player is critical, and is just as much the player as the played;[26] 'there is no game except where there is *play*'.[27]

Katayoun Baghai has also been sceptical, arguing that theoretical developments in systems theory in the law context have had little practical utility, and noting that 'despite inspiring fruitful debates in legal scholarship, social systems theory has had little influence on sociological research', as well as that attempts 'have been hampered by the theory's high level of abstraction, complex conceptual architecture and radical departure from common epistemological premises of empirical social science.'[28] She poses the challenge now of 'employ[ing] systems-theoretic distinctions and concepts in empirical investigation without hollowing out their meanings or sacrificing their integrative function and epistemological ground'.[29]

On the contemporary state of legal systems theory, Nobles and Schiff have commented that

> 'there is no obvious consensus on what it means for law to operate as a system, how its systematic qualities are generated or maintained, or even that law operating as a system has a distinct character that could be distinguished from, or distinguish itself from, any other part of society'.[30]

In this thesis, the law is viewed as a system that is a subset of the social system (and so for example Australian law is a subset of the Australian social system, etc). It is understood to be a system of communications *and* actors. Importantly, drawing on the sentiments expressed by Ost, it is seen a system which overlaps with other systems. This overlap, which might itself be described as a SES, can be viewed through a systems lens by considering how components of the legal system including its actors (the legislature, the judiciary, and the executive decision-maker) interact with the natural environment, through the process of EIA.

C *Social-Ecological Systems ('SES')*

SES are, as mentioned above, essentially human-environment systems. In definitional terms, they are complex, adaptive systems that consist of a 'bio-geophysical unit and its associated actors and institutions'.[31] The boundaries of a SES might be defined as 'an ecosystem and its problem context'.[32] For example, a SES could include a predator and its prey species, the other species that rely upon particular predation patterns remaining stable, park rangers and managers, hunters, recreators, and regulators, all linked to the problem of managing the reintroduction of a top predator into a park.[33] The entire planet and its human population could be conceived of as a SES – a human-environment

[25] Ibid 340.
[26] Jaques Ehrmann, 'L'homme en Jeu' (1969) *Critique* 456.
[27] Ost, above n 23, 341.
[28] Baghai, above n 13, xiv.
[29] Ibid.
[30] Nobles and Schiff, above n 17, 1.
[31] Marion Glaser et al, *Human-Nature Interactions in the Anthropocene: Potentials of Social-Ecological Systems Analysis* (Taylor and Francis, 2012) 4.
[32] Ibid.
[33] This example was adapted from the one described by Per Angelstam et al, 'Solving Problems in Social–Ecological Systems: Definition, Practice and Barriers of Transdisciplinary Research' (2013) 42 *Ambio* 254.

system in its broadest sense – though most research in this field, both theoretical and applied, focuses on more local and regional scales.[34]

SES literature has emerged over the past 10-15 years, with SES theory having now become central to the discussions on human-nature interactions.[35] It sees society as embedded within nature,[36] a paradigm that is fitting at the time of the advent of the 'Anthropocene' – the geological epoch in which humans are driving environmental change, and are having a distinctly measurable effect on their natural surroundings that will leave a scar on the Earth.[37] SES *theory* has been touted as an 'interfacing language between disciplines';[38] SES *thinking* could provide a useful analytical approach to adopt in interdisciplinary research, and a means to address complexity. This could be helpful for dealing with 'wicked', post-normal environmental problems[39] (such as the types of problems which might be linked with major projects including fracking projects – for example, climate change, and cumulative water resource pollution).

Critical concepts in SES theory important in understanding this 'language' include ***resilience*** and ***emergence***. These are both concepts that exist within broader complex adaptive systems literature, but which have taken on a special role in shaping the conversations around SES. Resilience is 'the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks.'[40] Resilience has been used as an approach or lens through which to study SES,[41] and it has also been adopted as a focus for contemporary environmental governance.[42] The emergence of traits that can be described as 'unexpected' because they cannot be reduced to the properties of the individual parts of the system[43] is a feature of complex systems which justifies the study of systems at a broad, whole-of-system scale. Emergent traits or situations would be missed by looking only at the level of the individual parts.

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[34] Glaser et al, above n 31, 194.
[35] Ibid 37.
[36] Ibid 194.
[37] University of Leicester Press Office, 'Anthropocene Working Group' (Media Note, 29 August 2016); Subcommission on Quaternary Stratigraphy, Working Group on the 'Anthropocene', *What is the 'Anthropocene'? – Current Definition and Status* (2016) Quaternary Stratigraphy <quaternary.stratigraphy.org>; Will Steffen, Paul J Crutzen and John R McNeill, 'The Anthropocene: Are Humans Now Overwhelming the Great Forces of Nature?' (2007) 36 *AMBIO* 8; Colin N Waters et al, 'The Anthropocene is Functionally and Stratigraphically Distinct from the Holocene' (2016) 351 *Science* 6269.
[38] Glaser et al, above n 31, 196.
[39] For an explanation, see the seminal paper: Horst W J Rittel and Marvin M Webber, 'Dilemmas in General Theory of Planning' (1973) 4 *Policy Sciences* 155.
[40] Brian Walker et al, 'Resilience, Adaptability and Transformability in Social-Ecological Systems' 9 *Ecology and Society* 5, 5. Holling's seminal paper on ecosystem resilience provides a good introduction to resilience theory: C S Holling, 'Resilience and Stability of Ecological Systems' (1973) 4 *Annual Review of Ecology and Systematics* 1. See also Carl Folke, 'Resilience: The Emergence of a Perspective for Social-Ecological Systems Analyses' (2006) 16 *Global Environmental Change* 263.
[41] Folke, above n 40.
[42] Ahjond S Garmestani and Melinda Harm Benson, 'A Framework for Resilience-Based Governance of Social-Ecological Systems' (2013) 18 *Ecology and Society* 9. In this paper the authors argued that adaptive governance requires the capacity to learn, and to manage for resilience, and contended that institutional arrangements that do not have such capacity are not appropriate for managing for SES.
[43] Gregoire Nicolis and Catherine Nicolis, *Foundations of Complex Systems – Emergence, Information and Prediction* (World Scientific, 2nd ed, 2012) 3-4.

Other relevant terms are ***panarchy***, which is a model that accounts for different scales and cross-scale dynamics,[44] and which can be useful when looking at cross-scale governance[45] and management of complex problems such as climate change,[46] and ***polycentrism***, which describes multiple interdependent centres within a whole, for example, governance units at multiple scales,[47] such as in a federal system of governance. Polycentrism has been discussed in the legal context by Chief Justice Brian Preston, who in the NSW Land and Environment Court explained the role of the decision-maker in EIA in the context of 'polycentric problems' which involve complex and interdependent issues, and a network of relationships (for example, between stakeholders) with interacting points of influence.[48]

Marion Glaser et al have proposed that SES thinking will increase the social understanding of human-driven bio-geophysical dynamics which, in turn, will, they contend, contribute to the improvement of governance systems.[49] Emerging research, still very limited in volume, on the role of governance in the SES context has focused on 'adaptive governance', based on the notion that governance systems must be flexible and able to adapt when governing dynamic systems.[50] In 2006, Lebel et al asked how certain attributes of governance function in society to enhance the capacity to manage resilience.[51] They found that features such as participation and deliberation were important aspects of governance, and that polycentric governance systems with multiple layers, levels and institutions were preferable. They did not specifically look at any laws or present a doctrinal analysis in their paper, and thus they focused more on the decision-making process rather than the content of laws prescribing and regulating that process. To date, SES analysis has not drawn on a specific law (such as an EIA law) with the view of understanding how that law affects SES and could be reformed to improve SES management or risk to SES' resilience capacities.

A core reason for studying SES and complex adaptive systems theory more generally is that it can help to understand 'uncertainty and surprise'.[52] Uncertainty and surprise are key challenges faced by the legal system, particularly in the environmental law and EIA context. The better uncertainty and surprise are managed, the more likely environmental risk is to be avoided. Thus, an approach that facilitates a better understanding of what environmental, social and economic impacts are likely to occur in a given scenario will necessarily be beneficial to EIA in terms of its ability to minimise risk.

This thesis is not attempting to participate in the dialogue by adding a theoretical contribution to systems *theory*, but rather to utilise this dialogue in order to demonstrate a way of thinking about environmental law, to encourage doctrinal analysis to be undertaken in conjunction with applying broader lenses that look outside the law, and to encourage lawyers to build their literacy in SES and systems thinking. This could be a productive move forward for interdisciplinary environmental law, which so many seek to engage in but which, as a field of study, does not have a set of clear

[44] Grofman et al, 'Ecological Thresholds: The Key to Successful Environmental Management or an Important Concept with No Practical Application?' (2006) 9 *Ecosystems* 1.
[45] Garmestani and Benson, above n 42.
[46] Walker et al, above n 40.
[47] Eleanor Ostrom, 'Beyond Markets and States: Polycentric Governance of Complex Economic Systems' (2010) 100 *American Economic Review* 33.
[48] *Bulga Milbrodale Progress Association Inc v Minister for Planning and Infrastructure and Warkworth Mining Limited* [2013] NSWLEC 48.
[49] Glaser et al, above n 31, 195-196.
[50] See, eg, Carl Folke et al, 'Adaptive Governance of Social-Ecological Systems' (2005) 30 *Annual Review of Environment and Resources* 441.
[51] Louis Lebel et al, 'Governance and the Capacity to Manage Resilience in Regional Social-Ecological Systems' (2006) 11 *Ecology and Society* 19.
[52] Folke, above n 40, 263.

methodologies. It seeks at the same time to encourage the SES literature to start embracing law by looking at law in a doctrinal-analytical manner that aims to discover the ability of law (and specific laws, in particular) to govern SES.

D *Systems Approach to EIA*

A systems approach can be applied to the EIA-based decision-making process, which could be referred to as a 'decision-making system'. The EIA decision-making system is created by the law (in the Australian context, the EPBC Act; in the US context, NEPA), being also a subset of the relevant (Australian or US) legal system, in turn a subset of the Australian and US social systems. On a view of systems that is broad (one that incorporates actors as well as their communications – the player as well as the play), the decision-making system incorporates political actors such as government ministers, agencies, departments and portfolios; stakeholders such as members of the public or companies, including the proponent of the project which is being assessed; and specialists such as scientists engaged to conduct EIA. The system includes the knowledge generated by these specialists, opinions generated by the public, values held by the public and by political representatives, and the manner in which these are communicated to other actors within the system.

Throughout the thesis, focus is placed holistically on the decision-making process in this manner. The purpose is to encourage a broad, non-linear perspective that allows EIA to be conceptualised as the procedure-driven decision-making system which guides approval decisions and which draws upon EIA as a means of encompassing information about the environment and the nature of likely risks. EIA law, which comprises a mixture of legislation and case law, regulates the way in which decisions are made and gives the system its basic architecture.

A project's proponent is driven by reasons such as economic prospects to propose the project (drivers in the fracking context are discussed further in Chapter 3), but restricted by the law from proceeding without adhering to EIA law's requirements. Strong drivers (such as high profits) will operate positively on the likelihood of a proponent proposing a project, whereas cumbersome (costly, timely) legal requirements will operate negatively in a balancing loop.

Legal provisions also influence the behaviour of the decision-maker, as do political priorities. If the decision-maker's goal is to make a decision that aligns with political priorities, then a set of provisions which allow for a significant degree of discretion is more likely to lead to a decision that corresponds directly with those political priorities, than a set of tight, robust provisions that direct decision-making behaviour in alignment with other factors that conflict with those priorities.[53] A set of provisions which requires comprehensive consideration of all relevant factors is more likely to minimise the risk of adverse impacts, whereas a set of provisions which contains gaps is more likely to lead to risks that were not required to be considered materialising and causing harm.

It is helpful to think about EIA in this broader, systems-based context rather than simply as a legislated checklist, as this broad conceptualisation links provisions and situations with consequences, and draws attention to actors in terms of what they are likely to be influenced by and what the results of their actions are likely to mean. This focus on interactions can facilitate better understanding and therefore ultimately lead to improved effectiveness – however that is measured.[54]

[53] (Provided there are options for review and requirements for transparency such as the need to provide reasons for a decision).
[54] See the discussion in Chapter 1.

E *Uncertainty and the Role of Science*

As has been alluded to, systems thinking can help to facilitate interdisciplinarity, and an important topic at the interface of law and science is uncertainty. Environmental lawyers who work with uncertainty and risk are interested in approaches for managing and responding to threats of harm whose magnitude or probability, or both, are not able to be calculated. A conservative way to respond to uncertainty and risk is to take a precautionary approach. The exercise of precaution is incorporated into the EPBC Act by references to the 'precautionary principle', which is further defined and discussed in Chapter 5. An EIA system that is effective in managing risk should include mechanisms that facilitate, or at least allow, a precautionary approach (in whatever form) to be adopted. Chapter 5 demonstrates how the 'precautionary principle' is incorporated in Australian law in an attempt to help guide the decision-making process, but highlights the difficulties faced with applying this principle in practice.

Uncertainty is relevant to the fracking context, because the impacts of fracking have not yet been conclusively established.[55] At the time that fracking started to boom, and still today, important risks including the nature of likely harm are not able to be predicted with certainty. The scientific uncertainty that is associated with many of fracking's impacts must be dealt with by regulators and legislators in each jurisdiction (and has led to the variety of responses including bans and moratoria), but also by decision-makers attempting to determine the likely effects of one particular project within a given regulatory context.

The role of science is important to areas of law that require, or could benefit from, scientific expertise to establish facts.[56] Science has a valuable place in environmental law, and EIA is a particular example which seeks to discover and be potentially influenced by scientific information. According to Ulrich Beck, risk is 'invisible' – a social construct which requires the perception of science in order to be 'seen'.[57] This will be generally evident in the discussions throughout the following chapters. Chapter 4, particularly, prompts the consideration of the role of scientific expertise in EIA by discussing the role of an independent scientific committee established to make decisions on coal seam gas fracking and coal mining in influencing fracking decisions. Chapter 3 summarises the scientific information on fracking available to date, while Chapter 6 looks at how a concept important in environmental science – cumulative impacts – is dealt with by the law.

From a systems perspective, the role of science in law is a matter of the knowledge produced by the scientific method and via scientists interacting with the law system. On a Luhmann view, science communications would have to be translated to legal communications for this to occur, but it is sufficient to simply think about how scientists and scientific institutions interact with the EIA process as required by the law, and what the challenges and implications of this interaction might be.

II SUSTAINABLE DEVELOPMENT: PEOPLE, PLANET AND PROSPERITY

Environmental lawyers, academics and practitioners alike regularly operate under what has essentially become an assumption that social, environmental and economic factors (sometimes referred to at the

[55] See Chapter 3.

[56] See the works of Sheila Jasanoff, a key contributor to this topic; in particular, 'Serviceable Truths: Science for Action in Law and Policy' (2015) 19 *Texas Law Review* 1723, 1733, where she discusses expert advisory committees as 'mediators between facts and values'.

[57] Ulrich Beck, *Risk Society* (Sage, 1992).

international level as the three 'Ps': 'people', 'planet' and 'prosperity')[58] form the three relevant pillars or categories of sustainable development, under which adverse impacts and benefits associated with a project proposal might fall. This happens without much consideration of how these factors emerge from their systemic underpinnings, whether they are separate but interrelated or in fact are inseparable, or whether they are (and should be) of equal importance and relevance to environmental decision-making. The balance between the factors is typically seen as a political matter; acceptance of such has left a minimal role for the law to intervene. However, the law is not altogether silent on what values should be treated as important and how conflicting values might be managed.

A *The Evolution of Sustainable Development*

In general, projects are not proposed unless it is envisioned that there will be an economic benefit to someone or some economy more broadly. In some cases, projects might be subsidised economically (by a relevant government) on the basis of a justifiable social benefit to someone or some group, or on the basis of an environmental benefit. Amongst the potentially relevant matters connected with a proposal, some will be central to a project's justification by its proponents, while others will be corollary. For example, a fracking project will be proposed by a fracking company who is in the business of natural gas for economic reasons, even though it might also have broader economic benefits, environmental benefits, and social benefits, and at the same time be likely to impose economic, environmental and social costs.

In the EIA environmental law literature,[59] 'sustainable development' has been the central discourse around which value discussions that integrate social and economic values with environmental values have centred. More broadly, too, sustainable development has essentially become a conundrum which in many ways defines the challenges of life on Earth post industrial revolution.

The case for sustainable development was first formally internationally recognised in the 1979 *Stockholm Declaration*, which recognised that humans are both 'creature[s] and moulder[s]' of their environment; that in the 'long and tortuous evolution of the human race' a stage has been reached where humans have 'acquired the power to transform' their environment on an unprecedented scale; and at the same time that the natural environment is essential to human well-being, the fulfillment of basic human rights, and economic development throughout the world.[60]

The first principle of the *Rio Declaration on Environment and Development* ('*Rio Declaration*'),[61] a global agreement articulated to address the sustainable development issue some 20 years later, states that

> 'Human beings … are *entitled* to a healthy and productive life in harmony with nature'[62] (emphasis added).

[58] See *Transforming Our World: The 2030 Agenda for Sustainable Development*, GA Res 70/1, 70th sess, Agenda Items 15 and 16, UN Doc A/RES/70/1 (21 October 2015).
[59] Chapter 1 introduced some of the main authors in the EIA literature, including Neil Craik, Barry Sadler, Nick Harvey, Beverley Clarke, Christopher Wood, Andrew Macintosh, and Chris McGrath.
[60] *Declaration of the United Nations Conference on the Human Environment*, UN Doc A/Conf.48/14/Rev.1 (1973); 11 ILM 1416 (1972), 1-2.
[61] UN Doc A/Conf.151/26 (vol I); 31 ILM 874 (1992) ('*Rio Declaration*').
[62] Ibid, principle 1.

The *Rio Declaration* was based on a series of principles linking the environment with human rights and specifically with 'development'. That humans are entitled to develop is assumed,[63] whereas protection of the environment is recognised as a high priority if development is to occur in a sustainable way.[64] The prioritisation of human 'rights' (as defined over time) and human needs and desires over those of other aspects of environmental systems has characterised modern civilizations, and remains the pervasive approach even in the context of contemporary sustainability discourses.[65] The *Rio Declaration* relatedly also claims that '…development and environmental protection are interdependent and indivisible'.[66]

Agenda 21, a non-binding document that emerged from the same conference as did the *Rio Declaration* and which recognises the 'continuing deterioration of the ecosystems on which we depend for our well-being',[67] divides its many hundreds of paragraphs into sections entitled, 'social and economic dimensions'; 'conservation and management of resources for development'; 'strengthening the role of major groups'; and 'means of implementation'. All of these are explicitly focused on human social and economic systems, and on exploring the links with environmental systems against such a backdrop. Similar linkages are central to other environmental law and policy documents.[68]

Sustainable development was formally recognised by an international court in the *Gabčíkovo-Nagymaros* case,[69] where the International Court of Justice ('ICJ') referred to it as an important concept relevant to the case. Justice Weeramantry, in a separate opinion, regarded it as not merely

[63] See, eg, *Rio Declaration*, above n 61, principle 3: '[t]he *right to development* must be fulfilled so as to equitably meet developmental and environmental needs of present and future generations' (emphasis added); the 'right to develop' was recognised in the *Declaration on the Right to Development*, GA Res 41/128, UN GAOR, 41st sess, 97th plen mtg, UN Doc A/Res/41/128 (4 December 1986) annex.

[64] Principle 4 of the *Rio Declaration*, above n 61, states that environmental protection shall constitute an 'integral part' of the development process, and that sustainable development should not be considered in isolation from environmental protection.

[65] Note however recent developments recognising legal personhood, and rights held by non-human aspects of the environment: see, eg, *Mohd. Salim v Uttarakhand & ors,* Writ Petition (PIL) No 126 of 2014 (20 March 2017) (High Court of Uttarakhand) in which the Ganges and Yamuna rivers in India were awarded legal rights; *Ruruku Whakatupua Te Mana o Te Awa Tupua* and *Ruruku Whakatupua Te Mana o Te Iwi o Whanganui* <whanganui.govt.nz/our-district/whanganui-river-settlement/Pages/default.aspx>, which are agreements granting legal rights to the Whanganui River in New Zealand.

[66] Principle 25. See also *Arbitration Regarding the Iron Rhine ('Ijzeren Rijn') Railway (Belgium v Netherlands) (Award*) ICGJ 373 (PCA 2005), 67, which recognised the need to integrate environmental protection with development; *Pulp Mills on the River Uruguay (Argentina v Uruguay) (Judgment)* [2010] ICJ Rep 14, also regarding this balance.

[67] *Agenda 21: Programme of Action for Sustainable Development*, GA Res 44/228, UN GAOR, 46th sess, Agenda Item 21, UN Doc A/Conf.151/26 (14 June 1992) ('*Agenda 21*'), 1.1

[68] For example, the *Ramsar Convention* begins by recognising 'the interdependence of Man and his environment' and the fact that wetlands 'constitute a resource of great economic, cultural, scientific, and recreational value, the loss of which would be irreparable' (opened for signature 2 February 1971, 996 UNTS 245 (entered into force 21 December 1975)); the *Convention on Migratory Species* recognises that wild animals should be conserved 'for the good of mankind' and is conscious of the 'ever-growing value of wild animals from…social and economic points of view' (opened for signature 22 June 1980, 1651 UNTS 333 (entered into force 1 November 1983)); the *World Heritage Convention* refers to 'the world heritage of mankind' (opened for signature 16 November 1972, 107 UNTS 151 (entered into force 15 December 1975)); the *Paris Agreement* recognises the threat of climate change 'to human societies' and also specifically recognises human rights (FCC/CP/2015/L.9 (12 December 2015), art 2); even the *Convention on Biological Diversity* has as a central component 'sustainable use' of the components of biodiversity (opened for signature 5 June 1992, 1760 UNTS 79 (entered into force 29 December 1993), art 1).

[69] *Gabčíkovo-Nagymaros Project (Hungary v Slovakia) (Judgment)* [1997] ICJ Rep 7, 85.

a concept but as a principle with normative value.[70] The case concerned a dispute over a joint dam and intended hydroelectricity project between Hungary and what was then Czechoslovakia. The Court, recognising that '[t]hroughout the ages mankind has, for economic and other reasons, constantly interfered with nature' found that sustainable development should be taken into consideration and given proper weight both with respect to the contemplation of new activities as well as with respect to continuing activities that began in the past.[71]

Justice Weeramantry added:

> [w]hen a major scheme, such as that under consideration in the present case, is planned and implemented, there is always the need to weigh considerations of development against environmental considerations, as their underlying juristic bases - the right to development and the right to environmental protection - are important principles of current international law.[72]

Recognising the important positive welfare benefits offered by the project for the people of Czechoslovakia on the one hand, and the negative environmental consequences for Hungary, on the other, His Honour said in relation to the 'law of development' and the 'law of the environment' that:

> Both these vital and developing areas of law require, and indeed assume, the existence of a principle which harmonizes both needs. To hold that no such principle exists in the law is to hold that current law recognizes the juxtaposition of two principles which could operate in collision with each other, without providing the necessary basis of principle for their reconciliation. The untenability of the supposition that the law sanctions such a state of normative anarchy suffices to condemn a hypothesis that leads to so unsatisfactory a result.[73]

A key question relevant to sustainable development is how much, or what, exactly, humans are entitled to, given the increasing recognition of the extent to which development, or fulfilment of human needs, is presently linked to environmental degradation – particularly with an expanding population. Applying this question to the *Gabčíkovo-Nagymaros* case, the issue could be phrased as: did the right to develop extend to a right to construct the dam notwithstanding the conflicting need for environmental protection from the negative impacts of the dam? Applying it to a fracking case: does the right to develop extend to a right to extract natural gas for energy when there are other methods of extracting energy that are less harmful to the environment, albeit potentially more economically costly in the short term?

There are multiple ways to 'develop', or in other words to satisfy needs.[74] Some of these ways will inherently have a greater adverse impact on environmental systems than will others. This is a question that EIA law grapples with when development projects come before decision-makers required to make value determinations, because projects subject to EIA represent a specific way to satisfy the needs and desires of some proportion of the population, with particular environmental trade-offs. The case-by-case decision-making governed by the EIA system is an important application of – or perhaps

[70] Ibid (Vice-President Weeramantry) <http://www.icj-cij.org/docket/files/92/7383.pdf>.
[71] *Gabčíkovo-Nagymaros Project (Hungary v Slovakia) (Judgment)* [1997] ICJ Rep 7, 85, 140.
[72] Ibid (Vice-President Weeramantry) <http://www.icj-cij.org/docket/files/92/7383.pdf>.
[73] Ibid.
[74] See Manfred Max-Neef, who has argued about the importance of the distinction between needs and ways to satisfy needs, which he calls 'satisfiers': *Human Scale Development – Conception, Application, and Further Reflections* (Apex Press, 1991), 16-17. Max-Neef discusses needs as a non-hierarchical system, contrasting Maslow's popular 'hierarchy of needs'.

vehicle for – sustainable development.[75] It is a much more targeted application than general policies, though general policies (for example policies on fracking in a particular jurisdiction) could provide important guidance as to how the conflicting principles of promoting the environment and at the same time development should be reconciled in a given case.

Of course, sustainable development is not the only paradigm, or discourse, related to environmental protection. Other more eco-centric discourses do not so centrally prioritise humans, valuing instead the conservation of nature over that of human society; for example, the deep ecology perspective values the intrinsic worth of nature regardless of its utility to humans.[76] Eco-centrism is not the dominant paradigm at least as far as Australian law is concerned, though contemporary instruments increasingly tend to be less overtly anthropocentric than do earlier instruments.[77] Isolated case examples *outside* of the Australian context also demonstrate a greater prioritisation of the natural environment.[78]

Throughout the thesis, the way in which environmental factors are taken into consideration vis-à-vis economic and social factors will become relevant, and this balance is particularly important in the fracking context. These discussions culminate in Chapter 7, which specifically focuses on how economic and social matters are brought into the EIA-based decision-making process and how their influence in that process affects the ability to manage risk. It will become apparent that the Australian EIA system is not a particularly eco-centric system, because beneficial economic and social impacts are allowed to – and frequently do – balance against and outweigh adverse environmental impacts. The sole question is *not* whether there is an environmental risk and if so, how it can be avoided; rather, EIA is an inquiry about a suite of factors relevant to the more mainstream conceptions of sustainable development.

B *Sustainable Development Principles and Goals: An Expression of Conflict*

Twenty-five years after the *Rio Declaration*, most instruments of international environmental law recognise the links between people and the environment, and the dependency of people (and their social and economic systems) on the environment.[79] In a document produced at the 20 year anniversary of the conference that produced the *Rio Declaration*, entitled *The Future We Want*, the United Nations' members 'acknoweldg[ed] the need to further mainstream sustainable development at all levels, integrating economic, social and environmental aspects and recognizing their interlinkages, so as to achieve sustainable development in all its dimensions.'[80] The economic, social

[75] See, eg, Clive Georgea, 'Testing for Sustainable Development Through Environmental Assessment' (1999) 19 *Environmental Impact Assessment Review* 175; Hugh Wilkins, 'The Need for Subjectivity in EIA: Discourse as a Tool for Sustainable Development' (2003) 23 *Environmental Impact Assessment Review* 401.

[76] A detailed examination of different environmental discourses lies beyond the scope of this thesis; for an introduction to deep ecology, see, eg, George Sessions (ed) *Deep Ecology for the 21st Century – Readings on the Philosophy and Practice of the New Environmentalism* (Shambhala, 1995). See also (and generally) the fields of wild law and earth jurisprudence, eg, Cormac Cullinan, *Wild Law: A Manifesto for Earth Jurisprudence* (Siber Ink, 2003).

[77] For example, the EPBC Act incorporates not sustainable development but 'ecologically sustainable development' and does not centre around nature's utility to 'man', as does its older US counterpart. See also Lee Godden and Jacqueline Peel, *Environmental Law: Scientific, Policy and Regulatory Dimensions* (Oxford, University Press, 2009).

[78] See the two cases mentioned at above n 65.

[79] See above n 68.

[80] *The Future We Want*, GA Res 66/288, UN GAOR 66th sess, Agenda Item 19, UN Doc A/Res/66/288 (27 July 2012), 3.

and environmental aspects of sustainable development are treated as the 'three dimensions' of sustainable development in this document.[81]

Three particular principles of sustainable development relevant to the consideration of economic and social impacts which arose from the *Rio Declaration* and which have arguably only increased in relevance since that time should be specifically mentioned. These are the 'polluter pays principle', the 'principle of intergenerational equity' and the 'public participation principle'. The former relates to the economic dimension of sustainable development, and the latter two, the social. Each are reflected in Australian domestic law and can be connected directly to the EIA-based decision-making process, which is explored in Chapter 7.

The 'polluter pays principle' is expressed in Principle 16 of the *Rio Declaration*:

> National authorities should endeavour to promote the internalization of environmental costs and the use of economic instruments, taking into account the approach that the polluter should, in principle, bear the cost of pollution, with due regard to the public interest and without distorting international trade and investment.

This principle responds to the problem of market failures. In the absence of policy instruments to correct market failures, entities are able to cause environmental harm without economic ramifications – particularly if such harm is latent, occasioned downstream of its source, and diffused across social and environmental systems. Steps can be taken to internalise costs by using policy instruments such as taxes and incentive measures, but also the EIA system, which allows costs to be forecast (through impact analysis) and which can lead to decisions that allocate costs to be assumed by the proponent (through either a project's refusal or by imposing conditions on the proponent that require it to bear the burden of mitigating and potentially remedying any harm). For the EIA system to be utilised in this manner, economic costs and benefits need to be well articulated.

The 'intergenerational equity principle' is found in Principle 3:

> The right to development must be fulfilled so as to equitably meet developmental and environment needs of present and future generations.

Intergenerational equity requires management of the biosphere in such a way as to 'yield the greatest sustainable benefit to present generations whilst maintaining its potential to meet the needs and aspirations of future generations';[82] it underpins the famous 'Brundtland' definition of sustainable development, which is development that 'meets the needs of the present without compromising the ability of future generations to meet their own needs'.[83] In the EIA context, intergenerational equity requires that when a project's beneficial and adverse economic, social and environmental attributes are weighed and balanced, irreversible and long-term impacts should be considered alongside short-term impacts, so that the needs of future generations can be accounted for.

The 'public participation principle' is found in Principle 10:

> Environmental issues are best handled with the participation of all concerned citizens, at the relevant level. At the national level, each individual shall have appropriate access to information concerning the environment that is held by public authorities, including

[81] Ibid, 19.

[82] IUCN, *World Conservation Strategy: Living Resource Conservation for Sustainable Development* (IUCN-UNEP-WWF, 1980), 1.4 < https://portals.iucn.org/library/efiles/documents/wcs-004.pdf>.

[83] World Commission on Environment and Development, *Our Common Future* (Oxford University Press, 1987) ('Brundtland Report').

> information on hazardous materials and activities in their communities, and the opportunity to participate in decision making processes. States shall facilitate and encourage public awareness and participation by making information widely available. Effective access to judicial and administrative proceedings, including redress and remedy, shall be provided.

Public participation is an important way in which economic and social matters can be identified and managed, because participation provides channels for people to express their interests, perceptions, fears and concerns. As well as being a means to highlight important social matters, it is also a means for environmental and economic matters to be understood from a social perspective. In turn, the EIA system offers a forum through which information about the likely impacts of projects can be conveyed to the public. Obtaining a so-called 'social license' – ie, the acceptance of the public – can be just as critical as obtaining more formal approvals.[84]

These three principles are an expression of values important to the parties – members of the international community – who agreed upon them. Their translation into national and state or local laws in turn evinces the importance of the values embodied in the principles to national and lower-level governments. When incorporated into law, they can play an important role in influencing political and administrative decision-making.

The most recent expression of what sustainable development means, focusing on more concrete targets, is the global Sustainable Development Goals ('SDGs').[85] These include, most relevantly for this thesis, the goals of ensuring access to 'affordable, sustainable and modern energy for all', promoting 'sustained, inclusive and sustainable economic growth', taking 'urgent action to combat climate change and its impacts', ensuring 'availability and sustainable management of water and sanitation for all,' and protecting, restoring and promoting the sustainable use of terrestrial ecosystems, as well as halting and reversing land degradation and biodiversity loss.[86] They are intended to be seen as interrelated and interdependent,[87] though it has been argued that confronting the goals with a holistic and systems-focussed outlook will be challenging in the context of the institutional fragmentation that is pervasive in international environmental law.[88]

The SDGs just mentioned each have social, economic and environmental dimensions. An important issue, also an issue with the *Rio* Principles, is that the goals appear to be conflicting when considered in the context of the combination of issues associated with accessing affordable modern technology, and the political and economic difficulties associated with mobilising change from the status quo. For example, fossil fuels are not ecologically sustainable and pursing their extraction is not consistent with either the need to take urgent action to combat climate change, or to ensure water sanitation and availability – yet renewable energy is not yet affordable, reliable or accessible on a global scale,

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[84] Neil Gunningham, Robert A Kagan and Dorothy Thornton, 'Social License and Environmental Protection: Why Businesses Go Beyond Compliance' (2004) 29 *Law & Social Inquiry* 307.

[85] See *Transforming Our World: The 2030 Agenda for Sustainable Development*, GA Res 70/1, 70th sess, Agenda Items 15 and 16, UN Doc A/RES/70/1 (21 October 2015)('SDGs'); <sustainabledevelopment.un.org>. For a discussion of goal setting as a method of global governance, see Norichica Kanie and Frank Biermann (eds) *Governing Through Goals: Sustainable Development Goals as Governance Innovation* (MIT Press, 2017).

[86] SDGs, above n 85.

[87] Ibid, para 5; Ingrid Boas, Frank Biermann and Norichica Kanie, 'Cross-Sectoral Strategies in Global Sustainability Governance: Towards a Nexus Approach' (2016) 16 *International Environmental Agreements: Politics, Law and Economics* 449.

[88] Rakhyun E Kim, 'The Nexus Between International Law and the Sustainable Development Goals' (2016) 25 *Review of European Community & International Environmental Law* 15, 18; see also Rakhyun E Kim and K Bosselmann, 'International Environmental Law in the Anthropocene: Towards a Purposive System of Multilateral Environmental Agreements' (2013) 2 *Transnational Environmental Law* 285.

although significant progress is being made. Renewable energy projects offer a much more sustainable alternative to fossil fuel projects, but may still have impacts to biodiversity conservation and may contribute to land degradation.

The above demonstrates the idea that Justice Weearamantry articulated, namely that sustainable development is itself a principle aimed at reconciling the conflict between environment and development. Thus sustainable development principles and goals are inherently likely to reflect the conflict by conflicting themselves. It is submitted that sustainable development, including in the way it is articulated though goals and principles, is as much still an *expression of conflict* as it is an offer for *resolution* of conflict. This presents difficulties in the EIA context, as will be seen throughout this thesis. Recognition of the conflict is the first step to resolving it – though there is no clear way to do this yet at a global scale when all aspects of development and all aspects of environmental harm are considered, alongside technical, social and economic barriers.[89] Progress may be made sector-by-sector, area-by-area, and perhaps even jurisdiction-by-jurisdiction depending on varied national capacities to overcome these barriers.

Sustainable development is still at the forefront of new legal agreements. The draft *Global Pact for the Environment*, released in 2017, proposes that '[e]very person has the right to live in an ecologically sound environment adequate for their health, well-being, dignity, culture and fulfilment',[90] and asks that parties 'pursue sustainable development.'[91] But without a more tangible way to understand what sustainable development means, or what acceptable parameters are, this will be difficult. The final discussion in this Part, below, draws on interdisciplinary literature to suggest a possible reference point, and boundaries within which the law might attempt to constrain the cumulative impacts of development activities, including fracking.

C *Ecological Limits and a Social Floor*

The seminal 1972 book *Limits to Growth* postulated that by the mid to late 21st Century, societal collapse could be possible, depending on trends in the growth in population, industrialisation, resource depletion and food production and in the context of available technology.[92] The essential argument was that economic and population growth cannot continue unchecked with finite resource supplies; this argument was explored through scenario modelling. Forty years later, an academic study concluded that the predictions in the original book 'are becoming increasingly more worrisome as reality seems to be following closely the curves that the ... scenario had generated'.[93] The concept of 'limits', reflecting the notion that unchecked growth is not sustainable unless decoupled from irreversible environmental degradation, has persisted and has become an increasing priority for researchers and policymakers.

In 2009, scientists Johan Rockström and his colleagues defined specific planetary boundaries, or 'biophysical thresholds', the crossing of which could, according to their research, cause disastrous

[89] Kim comments that the Sustainable Development Goals provide 'little guidance as to where the balance lies': Rakhyun E Kim, 'The Nexus Between International Law and the Sustainable Development Goals' (2016) 25 *Review of European Community & International Environmental Law* 15, 20.
[90] *Global Pact for the Environment* (draft, 24 June 2017) art 1.
[91] Ibid, art 3.
[92] Donatella H Meadows et al, *Limits to Growth* (Universe Books, 1972).
[93] Ugo Bardi, *The Limits to Growth Revisited* (Springer, 2011), 3.

consequences for humanity and which, therefore, can be considered as preconditions for human development.[94] These 'boundaries', which were updated in 2015, relate to:

1. Climate change
2. Change in biosphere integrity (biodiversity loss and species extinction)
3. Stratospheric ozone depletion
4. Ocean acidification
5. Biogeochemical flows (phosphorus and nitrogen cycles)
6. Land-system change (for example deforestation)
7. Freshwater use
8. Atmospheric aerosol loading (microscopic particles in the atmosphere that affect climate and living organisms)
9. Introduction of novel entities (eg organic pollutants, radioactive materials, nanomaterials, and micro-plastics).[95]

The boundaries, and the associated limits, together represent a 'Holocene-like' state for the Earth System, which is said to best support human life. The authors argued that only within the boundaries did a 'safe operating space for humanity' exist.[96] In 2009, three global scale limits had already been breached (those relating to climate change, biodiversity loss, and the nitrogen cycle).

The ecological boundary concept developed by Rockström and his colleagues has been highly influential to the sustainability science field, being cited broadly and further developed and defined within science, social science and integrative disciplines.[97] For example, Steffen and his colleagues took the concept and attempted to quantify the boundaries at the sub-global level.[98] Others have assisted in the articulation of a second set of boundaries – social boundaries.

Economist Kate Raworth for example argued that Rockström and his colleagues' 'safe operating space' should be conditioned upon a 'social floor' comprised of social boundaries which, she argued, must not be breached. This combined 'the imperative of ensuring every person's claim to life's essentials' with 'the need to situate the global economy within environmental limits',[99] and thus defining a 'safe *and just* operating space'.[100] Visually, Röckstrom and his colleagues' environmental limits and Raworth's social limits can be overlayed so as to create a 'doughnut' shape, with the inner circle representing the social limits (floor) and the outer circle representing the environmental limits (ceiling). The parameters of Raworth's social foundation or floor are food, water, income, education, resilience, voice, jobs, energy, social equity, gender equality, and health.[101] These might be defined

[94] Johan Rockström et al, 'A Safe Operating Space for Humanity' (2007) 461 *Nature* 472; Johan Rockström et al, 'Exploring the Safe Operating Space' 14 *Ecology and Society* (online) <ecologyandsociety.org/vol14/iss2/art32/>.
[95] Will Steffen et al, 'Planetary Boundaries: Guiding Human Development on a Changing Planet' (2015) 347 *Science* 1259855. For a discussion see also Will Steffen et al, 'The Anthropocene: From Global Change to Planetary Stewardship' (2011) 40 *AMBIO* 739, 753.
[96] Rockström et al, above n 94 (both articles).
[97] According to Google Scholar, Rockström et al's two papers at above n 94 have together been cited close to 7,000 times in published works; their concept has also been a key subject of numerous papers, for example Steffen et al, above n 95, and Raworth, below n 46.
[98] W Steffen et al (2015), above n 95.
[99] Kate Raworth, 'Defining a Safe and Just Space for Humanity' in The Worldwatch Institute, *State of the World 2013: Is Sustainability Still Possible?* (Island Press, 2013), 31.
[100] Ibid.
[101] Ibid, 33.

by, for example, reference to the Sustainable Development Goals mentioned above, in conjunction with international principles and with human rights laws, or other social indicators.[102]

The doughnut integrates economics, physical sciences and social sciences such that it ultimately transcends disciplinary thought paradigms to represent multidimensional limits within which the economy needs to operate if sustainable development is to be achieved on the terms of present generations of humans, with future generations in mind. It thus embodies the sustainable development agenda, and could potentially be used to guide the development of international and national laws and policies tasked with implementing this agenda. The doughnut, and its inner and outer circles, could be a useful reference point around which to orient thinking about the goals of different systems represented via politics, science, economics and law (as well as interdisciplinary fields) in the future. Other commentators and researchers have thought about the 'safe and just' duality, and expanded upon Raworth's doughnut framing.[103] The theory's influence is growing, but it has not been discussed in detail in the law context.

In the near future it would be valuable for commentary to emerge on how this Holocene-like global state which equitably houses the human race might be maintained or regulated by the law – perhaps a law-based framework for the consideration of national and subnational-level legislators and policymakers. The law, for example, influenced and shaped by the other disciplines discussed above from which existing works have been generated, might play a role in helping to maintain the safe and just operating space through human rights law, through environmental protection laws, through integrative (sector-specific) policies, and through an EIA system which integrates the social, economic and environmental aspects of the impacts likely to result from individual project proposals in a manner that can incorporate interactions between potentially affected systems and stakeholders.

Framing problems in the limits and boundaries language helps to visualise the important trade-offs. And, as the *Paris Agreement*'s 1.5-2 degree limit[104] has led to a suite of quantification exercises, like the carbon budget, the next step may be to use the articulated boundaries to assess what other budgets are useful to formulate. This would then facilitate a consideration of individual activities' impacts in light of the available environmental resources (before limits are reached), and thus whether less intensive alternatives might be preferable. For example, how much freshwater can be consumed by human activity globally (and what does this mean regionally, such as in the context of fracking activities)? Or, how much more land conversion is allowable before that limit is reached? Then, what, relative to that amount, impact will a particular proposed project have, and is it justifiable given alternatives?

This might seem like an approach that is insufficiently ambitious, when the aim should arguably be not to approach the limits. It might seem too difficult given scientific uncertainty. However, the status quo is causing critical limits to be breached and environmental systems to head toward crisis point. Vague and uncertain notions of ecologically sustainable development ('ESD') and generic goals of environmental protection have not proved to be rigorous enough to keep cumulative harm in check.

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[102] See Daniel W O'Neill et al, 'A Good Life for All Within Planetary Boundaries' (2018) *Nature Sustainability* 88, who defined 11 social indicators.

[103] See, eg, J Heitzig et al, 'Topology of Sustainable Management of Dynamical Systems with Desirable States: From Defining Planetary Boundaries to Safe Operating Spaces in the Earth System' (2015) 7 *Earth System Dynamics* 21; John Dearing et al, 'Safe and Just Operating Spaces for Regional Social-Ecological Systems (2014) 28 *Global Environmental Change* 227; Häyhäa et al, 'From Planetary Boundaries to National Fair Shares of the Global Safe Operating Space — How Can the Scales be Bridged?' (2016) 40 *Global Environmental Change* 60.

[104] Paris Agreement, FCC/CP/2015/L.9 (12 December 2015)('*Paris Agreement*'), art 2.

Above, the issue of conflicting values, goals and principles was raised – an issue central to the pursuit of sustainable development, however that be envisaged. When decision-makers in the EIA context are faced with such conflicts, they can essentially apply their discretion to 'resolve' the conflicts by choosing to prioritise – or give greater weight to – some values, goals or principles over others. The principle of inter-generational equity with respect to energy security might outweigh biodiversity conservation in a given scenario, for example, as it did in one Australian case.[105] Scale is a key factor likely to change the importance attributed to various values and risks – time scales and geographic scales of impact are two important examples.

Quantifiable or at least easily definable social and environmental limits might help in acting as a caution on the repeated exercise of discretion that favours, for example, social and economic development over environmental protection, or which prioritises short-term benefits over long-term risks. The limits concept has promising applications for law including EIA law, which could adopt a normative goal: to keep humanity and its economy within the 'safe and just operating space' by operating case-by-case to balance environmental, economic and social matters with a view to ultimately reducing the risk of cumulative environmental harm and maintaining a social baseline. This is not dissimilar to the goal of sustainable development or ESD, but is preferable because it is a clearer expression of these notions that is closely linked with the physical sciences from the outer limits perspective and the social sciences regarding the inner limits. Additionally, and perhaps most importantly, the safe and just operating space is not a representation of conflict, but rather a guide to how the conflict can be resolved.

Applying the limits concept to a dichotomy raised numerous times in this thesis, it could be argued that fracking may help to achieve the social baseline because of the links between natural gas and energy security. At the same time, fracking may also, when considered in a cumulative sense, threaten the boundaries that relate to freshwater use, climate change, and chemical pollution in particular, with indirect effects on the biodiversity loss and ocean acidification boundaries. Decision-makers could ask whether approval of a given fracking project, in the context of others and the energy and economic landscape more broadly, would facilitate or hinder the ability to keep within the safe and just operating space.

III CONCLUSION

This Chapter has extended Chapter 1's review of key EIA literature to include a review of systems thinking and the central instruments and commentary relating to sustainable development. Both systems thinking and sustainable development are important starting points for this thesis' analysis of how federal Australian law can minimise or otherwise manage environmental risks from fracking through EIA. They are each also important to the interdisciplinary lens adopted throughout the thesis.

EIA law attempts to ensure that development cannot proceed without a proper assessment of how a development project is likely to harm the environment – a process which is inherently linked to risk minimisation and to broad notions of sustainable development, as Chapter 1 expressed. However, EIA law operates without an adequate reference point as to what might render a development project, or rather, a development project in the context of its environment, not sustainable. Concepts such as the limits concept introduced in this Chapter are not incorporated into the EPBC Act, which instead, as Chapter 1 also explained, relies on a decision-maker to be able to determine when the impact of a

[105] *Taralga Landscape Guardians Inc v Minister for Planning and RES Southern Cross Pty Ltd* [2007] NSWLEC 59.

single project is likely to be 'significant'. Chapters 4 and 5 explore significance further as it applies to water resources and to the climate system, and through these Chapters it will become clear that significance will be difficult to ascertain without reference to environmental systems and SES holistically, and to cumulative context. Chapter 6 addresses the important question of how an impact and its significance depend on the context of other impacts. Cumulative impacts are highly relevant to sustainable development, because it is multiple development contributions over space and time rather than one contribution which will tip an environmental system beyond its limits and potentially cause serious or irreversible environmental harm. The sustainable development paradigm as it manifests in EIA law is, finally, the focus of Chapter 7, which explores in detail how environmental, economic and social matters are weighed and balanced in final approval decisions.

The outcomes of EIA-based decision-making depend on a single decision-maker, who, being a political figure or agency, is more likely to be held immediately accountable for the tangible, short-term impacts of a decision than for its contribution to furthering or hindering the collective and cumulative long-term path towards sustainability. This is an issue that links EIA and development decisions with the sustainability of environmental systems, and one which is imperative to environmental risk management. It may arise in the fracking context, where political decision-makers might, through EIA-based decision-making, attempt to respond to a short-term policy context rather than prioritising the wider context of the long-term health of environmental systems and the social and economic systems that rely upon them. The next chapter offers a literature review of scientific and other materials relating to fracking, in order to situate the thesis' following investigations into federal EIA law and the mitigation of environmental risks in the fracking context.

Chapter 3: Natural Gas Fracking

The aim of this Chapter is to provide the reader with a summary of those aspects of natural gas fracking that are pertinent to this thesis. This includes aspects relating to the process of fracking, risks of adverse impacts, and the drivers which influence whether, how and when fracking is likely to take place.[1] The primary intention is to establish a foundation for the further development of arguments that particular types of environmental impacts must be incorporated as relevant under EIA law if fracking is to proceed with minimal risk. It serves as a precursor to Chapters 4-7, but warrants a separate discussion which can be used as a useful reference point when considering arguments about fracking both within this thesis and more broadly. Whereas this Chapter defines the relevant impacts, analyses risk factors and explains the significance of these risks based on current scientific knowledge, the later chapters of the thesis address the issue of how to manage these impacts by reducing risk though the legal system and through EIA law in particular.

The science of fracking impacts is a rapidly developing area, with new research and new policy and legislative responses continually emerging. The majority of the literature and other material cited in this Chapter, including a major global scientific report on climate change,[2] a key study of impacts to water resources by the US Environmental Protection Agency ('US EPA'),[3] and a compendium on health impacts by concerned medical professionals,[4] was published after the research on this thesis began. Since that time new legislation has also come into effect including bans and moratoria in states, territories and local municipalities within the US and Australian jurisdictions considered. In April 2018, the Northern Territory lifted its moratorium on fracking. That uncertainty nonetheless remains – and, to a degree, characterises – the present state of knowledge about fracking (and the ability to predict its impacts in a reliable way) is important and must be acknowledged. The way that the law responds to uncertainties will be of interest in future chapters.

In this Chapter, Part I explains the fracking process and its drivers, Part II summarises fracking's environmental impacts, and Part III positions EIA within fracking's overall regulatory and policy context. This is done by mapping the legal requirements and policy goals likely to apply to fracking projects, situating EIA within a fragmented array of potentially relevant areas of law. This is not a thesis which attempts to look at how fracking as a practice or industry is controlled by law in a general sense, but rather, how the EIA system of environmental decision-making applies to the fracking context and what this might teach about the strengths and weaknesses of that system with respect to minimising the negative impacts of fracking. Parts I and II employ interdisciplinary and systems-based thinking in their review of scientific and technical literature, and Part III builds upon this context by

[1] The focus of this thesis is on fracking for natural gas, although fracking can also be used to extract oil, particularly in shale formations. Key impact categories are similar – oil is a fossil fuel and thus is linked with the impact of climate change, and as the fracking process is largely analogous, oil fracking poses similar risks to water resources and geological structures.

[2] R K Pachauri and L A Meyer (core writing team eds), *Climate Change Synthesis Report 2014* (IPCC Fifth Assessment Report, 2014).

[3] US EPA, *Hydraulic Fracturing for Oil and Gas: Impacts from the Hydraulic Fracturing Water Cycle on Drinking Water Resources in the United States*, EPA-600-R-16-236Fa (US EPA Office for Research and Development, 2016).

[4] Concerned Health Professionals of New York*, Compendium of Scientific, Medical, and Media Findings Demonstrating Risks and Harms of Fracking* (Unconventional Gas and Oil Extraction) (4th ed, 2016) <concernedhealthny.org>.

exploring how the legal system relates to the physical systems that determine the impacts of the fracking process.

Part III acknowledges that EIA does not operate in a vacuum, however, in the fracking context or with respect to any given type of project. Projects are likely be subject to a plethora of policies and regulations which might operate to create incentives, disincentives or controls on the way in which the project will ultimately proceed. These regulations are likely to influence a proponent, in most cases *before* a proposal is put forth for assessment and approval under EIA, and do not necessarily need to bear on the largely political decision of whether or not a project should be approved. Through Part III, this thesis contributes to an area of environmental law that has been recognised as being lacking: the study of major projects and their regulatory context, as opposed to the study of a particular regulatory scheme.[5] Part III highlights the multi-layered regulatory context of a particular type of project (fracking), demonstrating the complexity of the legal regime in which EIA operates.

I DRIVERS AND PROCESS

'Fracking' refers to a technique used to stimulate rock formations so that natural gas[6] held within those formations can be brought to the Earth's surface and collected. Rock formations are stimulated by drilling into the rock, and then injecting fluid into the formation at high pressure. Modern fracking tends to involve horizontal or directional (in addition to vertical) drilling.[7] The use of fracking techniques to extract natural gas has boomed in recent years on a global scale, with the US, particularly, being a pioneer.[8] Accidents impacting the environment, people and communities – or 'fraccidents' as they are sometimes dubbed – have caused widespread concern, especially for foreign jurisdictions deciding whether or not to support the practice, and how to regulate it. Australia is one such jurisdiction.

A reference to fracking often implies the fracking of shale or coalbed rock formations – typically, shale formations in the US context, and coalbed formations in the Australian context (at present). Shale and coalbed formations are two types of rock formations: 'shale fracking' involves fracking in shale rock, and 'coalbed' or 'coal seam' fracking involves fracking in coalbed formations. In turn, shale gas comes from shale formations and coal seam gas ('CSG'), comes from coalbed formations. Gas can also be fracked from 'tight' formations (tight gas). Each of these types of gas can be together referred to as 'unconventional gas'.

Shale, coalbed and tight rock formations each exist and contain technically recoverable gas reserves in both the US and Australia. Major shale plays in the US include the Marcellus Shale in Pennsylvania, New York, Ohio, Maryland, and West Virginia; the Barnett Shale in Texas; and the Bakken Shale in

[5] Natasha Affolder, 'Why Study Large Projects? Environmental Regulation's Neglected Frontier' (2011) 44 *University of British Columbia Law Review* 521.
[6] Or oil, see above n 1.
[7] See Michael D Holloway and Oliver Rudd, *Fracking: The Operations and Environmental Consequences of Hydraulic Fracturing* (Scrivener, 2013); Ching H Yew and Xiaowei Weng, *Mechanics of Hydraulic Fracturing* (2nd ed, Elsevier, 2014).
[8] For a broader and more general background on the advent of modern fracking, see, eg, Russell Gold, *The Boom: How Fracking Ignited the American Energy Revolution and Changed the World* (Simon & Schuster, 2014).

North Dakota and Montana, though there are many others.[9] Major CSG reserves in Australia are in NSW and Queensland, in the Surat and Bowen Basins.[10] Shale gas reserves also exist throughout Australia, particularly in Western Australia and the Northern Territory,[11] and are the main focus of new exploratory activity.

A primary difference between CSG and shale gas is that CSG is typically found much closer to the Earth's surface than is shale gas.[12] Additionally (and as a result), fracking is essentially always used to extract gas from shale formations but does not always need to be used to extract gas from coalbed formations. However, a recent study has demonstrated that there is significant variation, and a lack of public information, about fracking depths.[13]

Following any exploratory and preliminary activities, the main stages of the fracking process or cycle are as follows:

- Creation of well infrastructure (the well usually has a steel and concrete casing);[14]
- Water acquisition (water may be extracted from a freshwater source or be recycled from a previous operation);[15]
- Drilling (vertical, directional, horizontal);
- Chemical mixing (to create the 'frack fluid') and well injection;
- Gas and flowback recovery (flowback is the frack fluid mixed with other elements and salts that might have been dissolved from the rocks once it comes back to the surface);
- Wastewater (the flowback fluid) treatment and storage or disposal; and
- Gas storage/transport (eg, through a pipeline).

After the final transport step of the fracking process, the gas is then combusted for energy at its final destination, which may be in a different jurisdiction from that in which the fracking took place. For example, Australia largely exports its natural gas to Asia.[16]

The fluid used in a fracking operation typically contains water, chemicals, and a 'proppant' to prop open the fractures once they are formed and allow the gas to flow out of the fractures.[17] The gas then flows up through a 'production well' (or simply 'well').[18] Prior to the adoption of contemporary fracking technology, natural gas was collected without fluid injection, and without horizontal drilling,

[9] US Energy Information Administration, *Energy in Our Nation – US Energy Mapping System* (select natural gas layers) <eia.gov/state/maps.php?v=Fossil%20Fuel%20Resources>; US Geological Survey, *Energy Maps of the United States* (interactive) <certmapper.cr.usgs.gov/data/energyvision/>.
[10] See, eg, Australian Government Department of Industry and Science, *Energy White Paper 2015* (Commonwealth of Australia, 2015).
[11] US Energy Information Administration, *Technically Recoverable Shale Oil and Shale Gas Resources: Australia* (US Energy Information Administration, 2015).
[12] R B Jackson et al, 'The Depths of Hydraulic Fracturing and Accompanying Water Use Across the United States' (2015) 49 *Environmental Science & Technology* 8969; Rob Jordon, 'Shallow Fracking Raises Questions for Water, New Stanford Research Shows' (Stanford Report), 21 July 2015.
[13] Ibid.
[14] Holloway and Rudd, above n 7.
[15] See US EPA, above n 3, for more detailed information on the water aspects of fracking.
[16] Australian Petroleum Production and Export Association, *Export Revenue* <appea.com.au>.
[17] Holloway and Rudd, above n 7.
[18] Ibid.

and it can still be collected in this way if the gas is not too deeply held within rock layers. Technological advancements have facilitated an expansion in fracking by allowing previously inaccessible unconventional sources to be tapped, and technology has thus been a critical driver of fracking.[19]

More fundamentally, though, fracking has primarily been motivated by the desire to attain energy security. Security refers to not being at risk of having no or reduced access to energy supplies. This desire manifests in two key ways: through the global demand for energy, and through a preference for domestic production to provide domestic markets. Security of domestic energy supply may be incentivised by government policies attempting to promote domestic capacity to reduce the reliance on international trade, [20] and to bring down domestic prices. [21] This has influenced fracking in countries which have natural gas supplies but which import energy, including the US, which has historically been (and is still) reliant on the Middle East. The global demand for energy means that fracking operations in countries rich in natural gas can sell extracted gas on international markets to countries wanting to import it.

The demand for energy can be met by drawing on numerous different energy sources and usually, a given country will rely on a suite of different sources to differing extents over time. Particular variables associated with different fuel sources (coal, oil, natural gas, renewable energies) influence the relative contributions of each fuel source to the overall energy market in a given jurisdiction. Key variables are price, availability, contribution to local pollution, and contribution to climate change. [22] These factors operate differently in differing policy and regulatory environments. For example, if, due to the values and priorities of a particular government, fossil fuels are heavily subsidised while investment in renewables is low, this will encourage investment in fossil fuels and manipulate how expensive and available fossil fuels are compared with other sources. Conversely, government policies may also manipulate markets to incentivise preferences for lower polluting sources and correct pollution/climate change-related 'externalities'.[23] Regulation and regulatory risk also influence energy choices – heavy regulation that is costly to comply with will discourage investment, while regulatory risk may also discourage investment.

[19] See Holloway and Rudd and Yew and Weng, both above n 7.

[20] Note that securing reliable international trade pathways is also a measure towards ensuring domestic security, although as Jasmin Cooper, Laurence Stamford and Adisa Azapagic note, a high dependency on imports tends to mean high energy prices: 'Shale Gas: A Review of the Economic, Environmental, and Social Sustainability' (2016) 4 *Energy Technology* 772.

[21] For a discussion of domestic price implications linked to shale gas fracking, see Cooper, Stamford and Azapagic, above n 20.

[22] This is somewhat simplistic, as energy markets are complex, but useful for present purposes. Different energy consumers, governments, bodies and groups may express different preferences in terms of which of these factors is more important relative to the others, based on differing values. Governments can create incentives through economic and legal measures which manipulate prices in order to reflect other values. For more information on energy markets in this context, see, generally, International Energy Agency, *World Energy Outlook 2017* (IEA, 2017); International Energy Agency, *World Energy Investment 2017* (IEA, 2017); in the Australian context, Australian Energy Regulator, *State of the Energy Market May 2017* (Commonwealth of Australia, 2017) <aer.gov.au>; Alan Finkel (chair) et al, *Independent Review into the Future Security of the National Electricity Market* (Commonwealth of Australia, 2017); Rosemary Lyster and Adrian Bradbrook, *Energy Law and the Environment* (Cambridge University Press, 2006).

[23] Governments might wish to do this because there are environmental and social costs associated with pollution and climate change not necessarily reflected in markets; policies that manipulate markets to favour choices that contribute less to pollution and climate change and thus reduce these costs can be thought of as policies which internalise an externality, or correct a market failure.

The reason that gas fracking has been seen as politically, economically and even environmentally attractive in some jurisdictions is that natural gas, although a fossil fuel like coal and oil, is viewed as a 'bridging fuel' between historical and present markets that are reliant on coal and oil, and future markets that are more dependent on renewables.[24] The bridging fuel argument depends on the premise that natural gas production and combustion is lower in greenhouse gas intensity (measurable by the unit tonnes of carbon dioxide equivalent, or 'CO_2e') than coal. However, new information, discussed below in Part II, Section C, suggests that natural gas may contribute more than initially anticipated to climate change, primarily on account of higher than predicted 'methane leakage' or 'fugitive emissions' rates, and a greater global warming potential of methane than was initially thought. The bridging fuel argument also depends on the premise that it is not feasible to transition immediately to renewables (otherwise, no 'bridge' would be required).

II ENVIRONMENTAL IMPACTS

The most significant environmental risks associated with fracking are water pollution, altered hydrological regimes, and fracking's contribution to climate change. Flow-on (secondary) environmental risks associated with these primary risks include impacts to biodiversity as a result of contaminated water sources and altered flows, and all of the downstream impacts associated with climate change (such as changes in habitat quality for biodiversity resultant from ocean acidification, altered weather patterns, sea level rise, desertification, etc).[25] Flow-on social/economic risks include the health risks associated with polluted drinking and recreational water sources, public fear and distrust, contamination of agricultural land and water sources used for agriculture,[26] and, again, all of the downstream impacts associated with climate change (such as displacement of people and communities, loss or change in livelihood, risk of loss associated with extreme weather events, etc).[27] These risks are explored in the discussions below. Section A examines water contamination, Section B altered hydrology, and Section C climate change. Section D deals specifically with the issue of uncertainty.

The type and likelihood of an environmental impact materialising as a result of a particular fracking project will depend on a number of factors specific to that project – for example its operator, its environment, the sensitivity of that environment, the timing of the project, and whether there are any other projects in the area. Both primary, direct and downstream, indirect impacts can, prima facie, be captured by the law through EIA – an issue that following chapters will explore.

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[24] See generally, John C Dernbach and James R May (eds), *Shale Gas and the Future of Energy – Law and Policy for Sustainability* (Edward Elgar, 2016).

[25] See, generally, Celine Bellard et al, 'Impacts of Climate Change on the Future of Biodiversity' (2012) *Ecology Letters* 365; Christopher B Field and Viccente R Barros (eds) *Climate Change 2014 – Impacts, Adaptation and Vulnerability* (IPCC Fifth Assessment Report, 2014), chs 3-6.

[26] See Elizabeth Royte, 'Fracking Our Food Supply' *The Nation* (online), 28 November 2012; M Bamberger and R E Oswald, 'Impacts of Gas Drilling on Human and Animal Health' (2012) 22 *New Solutions: A Journal of Environmental and Occupational Health Policy* 51; Lindsey Konkel, 'Salting the Earth – The Environmental Impact of Oil and Gas Wastewater Spills' (2016) 124 *Environmental Health Perspectives* 230; Bruce Finley, 'Colorado Faces Oil Boom "Death Sentence" for Soil, Eyes Microbe Fix' *The Denver Post* (Denver, Colorado), 4 May 2014.

[27] Field and Barros, above n 25, chs 7-13.

The process of fracking can induce seismological events or 'seismicity' (earthquakes) as a result of drilling/extraction, and/or as a result of the underground injection of wastewater.[28] The latter is considered more likely to induce seismicity than the former.[29] If the magnitude of a seismic event is sufficiently intense, it may have environmental, social and economic consequences. Concerns typically centre around the risk of damage to housing and infrastructure, however, and there is little evidence regarding significant risks to biodiversity from fracking-induced seismicity. As damage to housing and infrastructure is a social/economic risk rather than an environmental risk, seismological impacts are not explored further in the below discussions. It is not understood to be the norm for a fracking operation to trigger a seismic event that can be felt by humans or cause damage to property, although effects may be latent,[30] and the risk of a high-magnitude seismic event will increase where there are multiple operations contributing cumulatively.[31] A study of earthquakes in six fracking states in the US noted that there is an inherent risk of seismic activity from both extraction and underground wastewater injection, meaning the taking of due care will not eliminate seismic risk.[32] Seismic activity can occur from CSG as well as shale operations.[33]

Other environmental impacts include those resulting from land clearance and land use change required to construct fracking wells and associated infrastructure, including pipelines; impacts from the drilling and mining process; and impacts from the transport process (for example vehicle roads, vehicle emissions). Such impacts include land degradation,[34] local air pollution,[35] noise pollution, and changes in habitat quality including as a result of habitat fragmentation.[36] These impacts are important and may certainly be considered by decision-makers in deciding whether to approve a fracking project, but they are not particularly unique to the fracking context, and are not discussed further.

A *Water Contamination*

Contaminants that pose a risk to water resources include fracked gas, the frack fluid used to extract the gas, and naturally occurring but potentially toxic elements mobilised by the fracking process (which would otherwise remain embedded in rock formations).

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[28] See, eg, Serge A Shapiro, *Fluid-Induced Seismicity* (Cambridge University Press, 2015); T H W Goebel et al, 'Wastewater Disposal and Earthquake Swarm Activity at the Southern End of the Central Valley, California' (2016) 46 *Geophysical Research Letters* 1; Xuewei Bao and David W Eaton, 'Fault Activation by Hydraulic Fracturing in Western Canada' (2016) 354 *Science* 6318; P Segall and S Lu, 'Injection-Induced Seismicity: Poroelastic and Earthquake Nucleation Effects' (2015) 120 *Journal of Geophysical Research* 5082.

[29] US Geological Survey, *Induced Earthquakes*, <earthquake.usgs.gov>; M Weingarten et al, 'High-Rate Injection is Associated with the Increase in US Mid-Continent Seismicity' (2015) 348 *Science* 1336.

[30] Anna Kuchment, 'Drilling for Earthquakes' *The Scientific American* (online) 28 March 2016 <scientificamerican.com>.

[31] Concerned Health Professionals of New York, above n 4, particularly regarding incidents in Oklahoma; Matthew J Hornbach, 'Ellenburger Wastewater Injection and Seismicity in North Texas' (2016) 261 *Physics of the Earth and Planetary Interiors* 54.

[32] Blake A Watson, 'Fracking and Cracking: Strict Liability for Earthquake Damage Due to Wastewater Injection and Hydraulic Fracturing' (2016) 11 *Texas Journal of Oil, Gas and Energy Law* 1.

[33] J L Rubinstein et al, 'The 2001-Present Induced Earthquake Sequence in the Raton Basin of Northern New Mexico and Southern Colorado' (2014) 104 *Bulletin of the Seismological Society of America* 2162.

[34] B W Allred et al, 'Ecosystem Services Lost to Oil and Gas in North America' (2015) 348 *Science* 401.

[35] From diesel particulate matter, hydrogen sulfie, toxic chemicals and other volatile hydrocarbons, and smog. With respect to impacts on biodiversity, see generally J R Barker and D T Tingey (eds) *Air Pollution Effects on Biodiversity* (Springer, 1992); G M Lovett et al, 'Effects of Air Pollution on Ecosystems and Biological Diversity in the Eastern United States' (2009) 1162 *Annals of the New York Academy of Sciences* 99.

[36] Allred et al, above n 34.

Available data indicates that potentially harmful chemicals are routinely used in fracking operations.[37] Common examples of types of fracking additives include hydrochloric acid, biocides, breakers, clay stabilisers, corrosion inhibitors, crosslinkers, friction reducers, gelling agents, iron controls to prevent the precipitation of metal oxides, non-emulsifiers, pH adjusting agents, scale inhibitors, and surfactants.[38] Use of toxic chemicals as or in these additives heightens the magnitude of risk with respect to spills, leaks and improper disposal compared with use of fluid that is more toxicologically benign. Numerous studies have confirmed the regular use of environmental contaminants and highly toxic substances, including reproductive toxicants,[39] BTEX chemicals[40] and naphthalene, which can and have made their way into environmental systems.[41]

While disclosure laws vary in terms of whether or not frack fluid constituents must be made public,[42] companies are increasingly revealing the chemicals used in their fracking operations. Previously, the chemical constituents of frack fluids were largely not disclosed by fracking companies, based on the argument that they were a 'trade secret'. This has caused delays in critical studies, meaning that information on toxicity is still being collected.[43] The Australian Petroleum Production and Exploration Association ('APPEA') has released a list of chemicals used in fracking operations in Australia, which are largely similar to those used in the US.[44]

Australian energy and fracking company Santos states on its website that '[t]he chemicals [used in its fracking operations] are not unique to the oil and gas industry and are found in many household

[37] For a list see US House of Representatives, *Chemicals Used in Hydraulic Fracturing* (Committee on Energy and Commerce, 2011). Energy companies which mandatorily or voluntarily disclose what chemicals they use may also publish a list of chemicals on their website.

[38] FracFocus Chemical Disclosure Registry, *What Chemicals are Used?* <fracfocus.org>; Holloway and Rudd, above n 7; and see above n 37.

[39] E G Elliott et al, 'A Systematic Evaluation of Chemicals in Hydraulic-Fracturing Fluids and Wastewater for Reproductive and Developmental Toxicity' (2017) 27 *Journal of Exposure Science and Environmental Epidemiology* 90.

[40] 'BTEX' refers to benzene, toluene, ethylbenzene and xylene. See US EPA, above n 3; Julie Cart, 'High Levels of Benzene Found in Fracking Waste Water' *Los Angeles Times* (online) 11 February 2015; Kim Honan, 'AGL Suspends Coal Seam Gas Project After Traces of Chemicals BTEX Found in Water Supplies' *ABC News* (online) 28 January 2015.

[41] See, eg, J S Harkness et al, 'Iodide, Bromide, and Ammonium in Hydraulic Fracturing and Oil and Gas Wastewaters: Environmental Implications' (2015) 49 *Environmental Science and Technology* 1955; Z L Hildenbrand et al, 'A Comprehensive Analysis of Groundwater Quality in the Barnett Shale Region' (2015) 49 *Environmental Science and Technology* 8254; Garth T Llewellyn et al, 'Evaluating a Groundwater Supply Contamination Incident Attributed to Marcellus Shale Gas Development' (2015) 112 *Proceedings of the National Academy of Sciences* 6325.

[42] In the US, public disclosure under the EPA's Toxic Release Inventory is not required by the gas extraction industry, pursuant to the *Emergency Planning and Community Right to Know Act of 1986* §313 42 USC §11001 et seq, however, information on which chemicals are being used may be required to be supplied to state agencies; in addition, different states have different laws on public disclosure. Some of the typical chemicals used must be reported if they are released into the environment pursuant to the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* ('CERCLA') 42 USC §9601 et seq – for example, hydrochloric acid. Australia also has varying disclosure requirements and guidelines applicable at the state/territory level.

[43] 'Before we can assess the environmental impact of the fluid, we have to know what to look for': Ima Ferrer, quoted in 'Fracking: Science Needs to Catch Up With Public Awareness', *Trends in Environmental and Analytical Chemistry News* (online) <journals.elsevier.com/trends-in-environmental-analytical-chemistry/news/>; see I Ferrer and E M Thurman, 'Chemical Constituents and Analytical Approaches for Hydraulic Fracturing Waters' (2015) 5 *Trends in Environmental Analytical Chemistry* 18.

[44] APPEA, *Chemicals and Compounds Used in CSG Fracking* <appea.com.au>.

products such as toothpaste, baked goods, ice cream, food additives, detergents and soap'.[45] This statement could (and could arguably even have been designed to) mislead: not all household products are drinkable, and other fracking chemicals are *not* common household chemicals. Santos provides Material Data Safety sheets for the chemicals it uses. Reviewing these sheets revealed the use of phrases such as 'avoid release to the environment', 'may be fatal', 'very toxic to aquatic organisms', 'risk of serious damage', 'known or presumed human carcinogen' and 'classified as hazardous',[46] and some state that no data is available on potentially important safety aspects.[47] It is not clear from the publicly accessible information how or where these chemicals are used, in what concentrations they are handled, and in what concentrations they are likely to cause toxicity. However, this information is critical for accurately predicting likely impacts.

Wastewater may contain, in addition to whatever chemicals were in the frack fluid, dissolved salts and other unique contaminants from rock formations. Highly salty (saline) water (also known as brine) can itself be a contaminant to environmental systems.[48] Examples of other contaminants that may derive from rock formations include arsenic, radon, thorium and uranium.[49] In the US, reports of elevated levels of these chemicals in water supplies proximate to fracking operations has caused significant concern.[50] Additionally, natural gas, which is essentially comprised of hydrocarbons (mostly methane), can contaminate water resources as it emerges from rock formations.[51]

Wastewater may be disposed of in underground injection wells (the norm),[52] through evaporation ponds, through treatment at a centralised waste treatment facility followed by reuse or discharge into surface waters or publicly owned treatment works, or through land application (such as irrigation and road spreading).[53] It may also be discharged with minimal or no treatment.[54] It has been proposed that wastewater disposal options are presently inadequate to protect public health and the

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[45] Santos, *What is Hydraulic Fracturing?* <santos.com/what-we-do/production/hydraulic-fracturing/>.
[46]Santos, *Material Data Safety Sheets* <santos.com/what-we-do/production/hydraulic-fracturing/material-data-safety-sheets/>.
[47]Ibid.
[48] N R Warner et al, 'Impacts of Shale Gas Wastewater Disposal on Water Quality in Western Pennsylvania' (2013) 47 *Environmental Science & Technology* 11849; US EPA, above n 3, ch 7, which also notes that salinity is likely to be higher in water produced from shale fracking than from CSG (7-12).
[49] I M Cozzarelli et al, 'Arsenic Cycling in Hydrocarbon Plumes: Secondary Effects of Natural Attenuation' (2015) 54 *Groundwater* 35; US Department of Health and Human Services, *Health Consultation – Dimmock Groundwater Site, Carter Road and State Route 3023, Dimmock, Susquehanna County, Pennsylvania* (2016); Joan A Casey et al, 'Predictors of Indoor Radon Concentrations in Pennsylvania, 1989-2013' (2015) 123 *Environmental Health Perspectives* 1130.
[50] Ibid; see also James K Otton, *Environmental Aspects of Produced-Water Salt Releases in Onshore and Coastal Petroleum-Producing Areas of the Conterminous US – A Bibliography* (US Geological Survey, 2006).
[51] T H Darrah et al, 'Noble Gases Identify the Mechanisms of Fugitive Gas Contamination in Drinking-Water Wells Overlying the Marcellus and Barnett Shales' (2014) 111 *Proceedings of the National Academy of Sciences* 14076; S J Maguire-Boyle and A R Barron, 'Organic Compounds in Produced Waters from Shale Gas Wells' (2014) 16 *Environmental Science: Processes and Impacts* 2237; S K Alawattegama et al, 'Well Water Contamination in a Rural Community in Southwestern Pennsylvania Near Unconventional Shale Gas Extraction' (2015) 50 *Journal of Environmental Science and Health* 516; V M Heilweil et al, 'Stream Measurements Locate Thermogenic Methane Fluxes in Groundwater Discharge in an Area of Shale-Gas Development' (2015) 49 *Environmental Science & Technology* 4057.
[52] C E Clark and J A Veil, *Produced Water Volumes and Management Practices in the United States* (Argonne National Laboratory, 2009); US EPA, above n 3.
[53] US EPA, above n 3, ch 8.
[54] Ibid. Regarding the importance of treatment, see Y Lester et al, 'Characterization of Hydraulic Fracturing Flowback Water in Colorado: Implications for Water Treatment' (2015) 512-513 *Science of the Total Environment* 637.

environment,[55] though, potentially, future improvements could lower the likelihood and magnitude of this source of risk.

Water resources that may be susceptible to contamination include both groundwater and surface water supplies, such as aquifers, streams and lakes.[56] Factors related to the likelihood of dangerous contamination with respect to a given operation include the use of harmful chemicals,[57] the integrity of the project's infrastructure,[58] the adoption of risk minimisation procedures such as the use of plugs and spill prevention procedures,[59] the site's specific geology and hydrology (which may impact the likelihood of migration to water sources),[60] the depth, nature and frequency of proposed fractures,[61] the distance over which wastewater must travel before being disposed, and the method of wastewater transport and disposal.[62]

Flow-on impacts of water contamination include impacts to biodiversity of aquatic systems and soil contamination, which in turn can impact a variety of species[63] – including, as flagged above, humans, who depend on clean water for drinking water, recreation, and agriculture.

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[55] Rebecca Hammer and Jeanne VanBriesen, *In Fracking's Wake: New Rules Are Needed to Protect our Health and Environment from Contaminated Wastewater* (Natural Resources Defense Council, 2012). See also S B C Shonkoff et al, 'Potential Impacts of Well Stimulation on Human Health in California', in *An Independent Scientific Assessment of Well Stimulation in California* (California Council on Science and Technology, 2015).

[56] See, generally, US EPA, above n 3; Igor Mrdjen and Lee Jiyoung, 'High Volume Hydraulic Fracturing Operations: Potential Impacts on Surface Water and Human Health' (2016) 26 *International Journal of Environmental Health Research* 361 (both focusing on the impacts to human health).

[57] 'Harmful' may mean for humans, other living organisms, or aspects of the environment, and will relate to what is being assessed and the manner in which the chemicals are encountered.

[58] For information on this risk factor see Robert B Jackson et al, 'The Environmental Costs and Benefits of Fracking' (2014) 39 *The Annual Review of Environment and Resources* 327, 341; Thomas W Merrill and David M Schizer, 'The Shale Oil and Gas Revolution, Hydraulic Fracturing, and Water Contamination: A Regulatory Strategy' (2013) 98 *Minnesota Law Review* 145, 185-6 (regarding cracked well casings); Nima Jabbari, Fred Aminzadeh and Felipe Barros, 'Hydraulic Fracturing and the Environment: Risk Assessment for Groundwater Contamination from Well Casing Failure' (2017) 31 *Stochastic Environmental Research and Risk Assessment* 1527 (discussing variables likely to influence well casing failures).

[59] Merrill and Schizer (above n 58, 184) argue that spills are a more likely source of risk than migration through subsurface cracks, especially with respect to deep wells (such as a typical shale well) located well below the groundwater table. See also Hannah J Wiseman, 'Risk and Response in Fracturing Policy' (2013) 84 *University of Colorado Law Review* 101, and, regarding general risk minimisation associated with the well, see Jabbari, Aminzadeh and Barros, above n 58.

[60] Jabbari, Aminzadeh and Barros, above n 58; US EPA, above n 3, 5-8.

[61] Depth is particularly relevant for groundwater contamination, as the depth of fractures can be used to calculate proximity to the water table. Shallow fracking such as for CSG, but also shallow shale fracking, may be associated with greater risk: see Jackson et al, above n 58.

[62] Wastewater is often injected into underground storage wells, but can also be left in open air pits, discharged in a controlled manner into water bodies or on land, or simply 'dumped'. Each of these methods has its own set of risk factors. See generally US EPA, above n 3, chs 7-8.

[63] See, eg, G A Burton Jr et al, 'Hydraulic "Fracking": Are Surface Water Impacts an Ecological Concern?' (2014) 33 *Environmental Toxicology and Chemistry* 1679. A review of fracking's impact on terrestrial and aquatic ecosystems across a number of shales in the US found that species which breed in vernal ponds in particular can be negatively affected by changes to water from fracking operations: M C Brittingham et al, 'Ecological Risks of Shale Oil and Gas Development to Wildlife, Aquatic Resources and their Habitats' (2014) 48 *Environmental Science & Technology* 11034; Erik Kiviat, 'Risks to Biodiversity from Hydraulic Fracturing for Natural Gas in the Marcellus and Uticus Shales' (2013) 1286 *Annals of the New York Academy of Sciences* 1; see also the references therein; Dina Papoulias and Tom MacKenzie, 'Hydraulic Fracturing Fluids Likely Harmed Threatened Kentucky Fish Species' *US Geological Survey* (online) 28 August 2013; 'Waste from Marcellus Shale Drilling in Cross Creek Park Kills Fish' Pittsburgh Post-Gazette (Pittsburgh, Pennsylvania) 4 June 2009; W Sang

et al, ‘Effect of Hydrofracking Fluid on Colloid Transport in the Unsaturated Zone’ (2014) 48 *Environmental Science & Technology* 8266; C R Bern et al, ‘Soil Disturbance as a Driver of Increased Stream Salinity in a Semiarid Watershed Undergoing Energy Development’ (2015) 524 *Journal of Hydrology* 123.

B *Altered Hydrology*

High volumes of water are used in a typical fracking operation,[64] and if the water being used is freshwater (rather than recycled frack fluid), which it typically is at present,[65] this can impact upon water quality and water availability, and can disrupt hydrological systems and the species that rely upon them.

In some local areas, extremely high percentages of total water use are used for fracking,[66] which is relevant to note alongside total and averaged figures relating to overall water consumption on an industry-wide basis. Although the water for a particular operation can be acquired from (treated) wastewater from another fracking operation – in other words, it can be recycled – it is typically acquired from freshwater sources, which is simpler and cheaper than acquiring and treating wastewater.[67] Large areas of the US, and Australia, are dry and drought-prone, and in such places in particular, freshwater acquisition could potentially significantly contribute to water quality and availability problems.[68] Depleting water levels (reducing water quantity) can impact the natural hydrology and quality of a water source, which may in turn have flow-on effects for both people and other living organisms.

Whether or not surface water or ground water is used, what percentage of overall supplies are used, and, consequently, the associated environmental impacts, will depend on the particular place. Fracking operations in the eastern states of the US generally rely on surface water, while the arid and semi-arid western states tend to utilise mixed surface and groundwater supplies.[69] It is expensive to transport water, so companies tend to draw from supplies local to the fracking site.[70] Shale fracking

[64] It has been estimated that the US fracking industry used 250 billion gallons of water between 2005-2015: Andrew Kondash and Avner Vengosh, 'Water Footprint of Hydraulic Fracturing' (2015) 2 *Environmental Science and Technology Letters* 276; per well, average water use ranges from 2 600 gallons to 9.7 million gallons: Tanya J Gallegos et al, 'Hydraulic Fracturing Water Use Variability in the United States and Potential Environmental Implications' (2015) 51 *Water Resources Research* 5839. In Queensland, Australia, the average volume of water for a CSG well is 10,000 litres per day: Alex St John, *The Coal Seam Gas Debate*, Parliament of Australia Science, Technology, Environment and Resources <aph.gov.au>. Other sources of non-renewable energy also typically require high volumes of water: see Erik Mielke, Laura Diaz Anadon and Venkatesh Narayanamurti, 'Water Consumption of Energy Resource Extraction, Processing, and Conversion' (Energy Technology Innovation Policy Discussion Paper Series, Discussion Paper No 2010-15, Harvard Kennedy School, 2010).

[65] US EPA, above n 3. Note however that this trend may be changing, at least in certain areas: Erin Ailworth, 'Frackers Look for Ways to Reduce Their Water Use' *Wall Street Journal* (online) 5 May 2015; Robert B Jackson et al, above n 58, 335.

[66] US EPA, above n 3, 4-15.

[67] Ibid, 4-9.

[68] Both countries contain regions classified by the World Resources Institute as under extremely high water stress: see Aqueduct, *Water Stress in the United States* citing Andrew Maddocks, *Water Stress Magnifies Drought's Negative Impacts Throughout the United States*, World Resources Institute (online) 14 April 2014; and generally, Aqueduct, *Water Risk Atlas* (interactive global map of water stress) <wri.org>. Drought information for Australia can be accessed via the Bureau of Meteorology <bom.gov.au/climate/drought>. For a discussion of acquisition impacts in Australia, see Donald P Dingsdag, 'Risks of Coal Seam and Shale Gas Extraction on Groundwater and Aquifers in Eastern Australia' in Basant Maheshwari, Vijay P Singh and Bhadranie Thoradeniya (eds) *Balanced Urban Development: Opinions and Strategies for Liveable Cities* (Springer, 2006) 235.

[69] US EPA, above n 3, 4-5 and 4-6.

[70] Ibid, 4-5.

in Australia, if it expands, is likely to be developed in Western Australia and the Northern Territory, where groundwater will most likely be the primary water source utilised by fracking operations.[71]

Water withdrawals that involve groundwater can be harmful where withdrawals exceed natural recharge rates and thus decrease water storage in aquifers, because this can potentially mobilise contaminants and allow infiltration of lower quality water from the land surface and adjacent formations.[72] Additionally, water withdrawals can decrease groundwater discharge into streams which can also affect surface water quality. Surface water withdrawals can be problematic in this sense too, altering stream flows and reducing stream resilience by decreasing the capacity to dilute contaminants.[73]

C *Climate Change Impacts*

It was explained above that energy demand is a principal driver of fracking, and that the practice has been justified on the basis of a lower contribution to climate change when compared with the alternative of other fossil fuels. A comparison of alternatives, and a comparison to the status quo or 'business as usual' scenario can be useful both for broad-scale policy analysis and for project-specific analysis. However, a 'better of two evils' evaluation cannot substitute for a proper impact analysis, and the evidence is unequivocal that fracking contributes to climate change through methane leakage (or fugitive emissions), which involves unintended methane release at the fracking site, and through the combustion of natural gas, which happens downstream. Intentional venting or flaring of gas may also be a source of methane. Each of these contributions are scientifically important; when, where and how to reduce emissions is a political decision and who bears responsibility over preventing and mitigating harm is, partly, a legal one, though both need to be informed by adequate scientific information.

There is appreciable uncertainty around the exact significance of the problem of methane leakage. Over the past five years scientists have been repeatedly publishing findings which call into question previous estimates. Evidence of higher than expected methane leakage is apparently accounted for by unreliable measuring devices and methodologies. One 2013 paper contended that natural gas sector methane was probably two-three times higher than previous scientific studies had anticipated.[74] Another paper from the same year looked specifically at methane leakage from the Marcellus Shale and found that operational wells were emitting two to three orders of magnitude more than the US EPA's estimates.[75] A 2014 study concluded that fugitive emissions in the Bakken and Eagle Ford shales had also been likely underestimated, calling into question supposed climate benefits.[76] Papers from 2015 began to attempt to explain discrepancies; a study of the Barnett Shale

[71] The Scientific Inquiry into Hydraulic Fracking in the Northern Territory, *Interim Report* (Chaired by The Hon Justice Rachel Pepper, July 2017), 47.
[72] US EPA, above n 3, 4-29; M P Steadman et al, 'Groundwater use in the Eagle Ford Shale: Some Policy Recommendations' (2015) 6 *Texas Water Journal* 67.
[73] J Gallegos et al, 'Hydraulic Fracturing Water Use Variability in the United States and Potential Environmental Implications' (2015) 51 *Water Resources Research* 5839; S Entrekin et al, 'Rapid Expansion of Natural Gas Development Poses a Threat to Surface Waters' (2011) 9 *Frontiers in Ecology and Environment* 503.
[74] Scott M Miller et al, 'Anthropogenic Emissions of Methane in the United States' (2013) 110 *Proceedings of the National Academy of Sciences* 20018.
[75] D R Caulton et al, 'Toward a Better Understanding and Quantification of Methane Emissions from Shale Gas Development' (2014) 111 *Proceedings of the National Academy of Sciences* 6237.
[76] O Schneising et al, 'Remote Sensing of Fugitive Methane Emissions from Oil and Gas Production in North American Tight Geologic Formations' (2014) 2 *Earth's Future* 548.

in Texas identified differing approaches to measurement,[77] while a group of scientists from various US states contended that sensor transition failure was likely to be widespread and responsible for the reporting of what they described as 'erroneously low' recorded levels of methane emissions.[78]

Methane is a significantly more potent greenhouse gas than carbon dioxide – and recent findings suggest 25% more so than previously anticipated by the Intergovernmental Panel on Climate Change ('IPCC') in 2013.[79] The current IPCC estimate is that one unit of methane needs to be multiplied by a factor of 84 to obtain methane's CO_2e over a 20-year timeframe.[80] This is applicable to leaked fugitive emissions as well as combustion emissions. Methane can have both direct and indirect climate change impacts; lesser-discussed indirect impacts relate to its interactions with carbon dioxide, stratospheric water vapour, ozone, sulphate aerosol and hydro(chloro)fluorocarbons.[81] Scientists have called for further studies to be conducted on methane in order for its potency, or in scientific terms, 'radiative forcing' value (which can broadly be equated to its contribution to global warming) to be properly understood, noting the implication of not having correct values for methane in terms of being able to make policy choices about reducing greenhouse gas emissions.[82]

There is no need to repeat here the literature outlining the dramatic local, regional and global ecological, social, and economic flow-on impacts of climate change.[83] The imperative to act to reduce overall greenhouse gas concentrations on a global scale is internationally recognised.[84] Neither the United Nations ('UN') nor the IPCC have an 'official' position on natural gas or fracking; rather, both bodies call for emissions reductions and allow individual countries to determine how those reductions are made. The IPCC, in its most recent major study culminating in its *Fifth Assessment Report*, neither endorses nor condemns fracking, although it does comment that greenhouse gas emissions could be reduced from the energy sector by replacing coal fired power plants with 'highly efficient natural gas combined-cycle (NGCC) power plants or combined heat and power (CHP)' provided that natural gas is available and 'the fugitive emissions associated with its extraction and supply are low or mitigated'.[85] Any benefits associated with natural gas with respect to climate change are reduced if less advanced power plants are used for combustion.[86]

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[77] R Harriss et al, 'Using Multi-Scale Measurements to Improve Methane Emission Estimates from Oil and Gas Operations in the Barnett Shale Region, Texas' (2015) 49 *Environmental Science & Technology* 7524.
[78] Touché Howard, Thomas Ferrara and Amy Townsend-Small, 'Sensor Transition Failure in the High Flow Sampler: Implications for Methane Emission Inventories of Natural Gas Infrastructure' (2015) 65 *Journal of the Air and Waste Management Association* 856.
[79] M Etminan et al, 'Radiative Forcing of Carbon Dioxide, Methane, and Nitrous Oxide: A Significant Revision of the Methane Radiative Forcing' 43 *Geophysical Research Letters* 12614.
[80] Pachauri and Meyer, above n 2, 87.
[81] Gunnar Myhre and Drew Shindell (coordinating lead authors) et al, 'Anthropogenic and Natural Radiative Forcing' in *Climate Change 2013 – The Physical Science Basis* (IPCC Fifth Assessment Report, 2013) 659, 677.
[82] Etminan et al, above n 79.
[83] For the most comprehensive assessment of scientific information to date, see the works of the IPCCC <ipcc.ch>, particularly, IPCC, *Climate Change 2014: Impacts, Adaptation, and Vulnerability* (IPCC Fifth Assessment Report, 2014); see also Chapter 4.
[84] United Nations Framework Convention on Climate Change, opened for signature 9 May 1992, 1771 UNTS 107 (entered into force 21 March 1994); Paris Agreement, FCC/CP/2015/L.9 (12 December 2015)('*Paris Agreement*').
[85] Thomas Bruckner, Igor Alexeyevich Bashmakov and Yacob Mulugetta (coordinating lead authors) et al, 'Energy Systems' in *Climate Change 2014 – Mitigation of Climate Change* (IPCC Fifth Assessment Report, 2014) 511, 517.
[86] Ibid 527.

The overall contribution of fracking to climate change can be garnered by adding together the cumulative contributions of each operation – however, the issue is not so simple as being a product of additive contributions. The existence of one operation might have either a stimulating or inhibiting effect on the existence of others, and it will be symptomatic of the drivers already discussed. Rather than simply serving to provide a substitute for other energy sources, natural gas supply increases via a fracking expansion may – at least to some extent – add to overall fossil fuel consumption, particularly if prices are driven downwards. Essentially, whether fracking will have an overall negative impact on climate change will depend on the quantity of 'dirtier' (more emissions-intensive) fuels that are displaced, the difference in emissions intensity between these more emissions-intensive fuels and natural gas, and whether any emissions 'savings' will be offset by the greater supply. These questions cannot be answered by either science, economics or politics alone; rather they involve a complex interplay of factors which may be very difficult to predict accurately.

At the scale of an individual fracking operation, contribution to climate change will vary between each operation, both with respect to how much methane leakage is likely to occur, and how much natural gas will be extracted and combusted downstream (and, if applicable, whether or not there is any venting or flaring of natural gas). As Chapter 5 investigates, the proportion of emissions from the total project released within the jurisdiction that the fracking took place, as opposed to in a foreign jurisdiction where combustion may take place, is likely to weigh heavily on how the law treats climate change as an environmental impact of fracking.

D *Uncertainty*

As is the case with many of the connections between development projects and environmental risks, there remains a considerable degree of uncertainty with respect to what the risks of fracking are likely to be in a given case. Scientific evidence collected from past incidents and predictions made by drawing on the best available information are helpful in determining risk in a qualitative sense. However, since the technology is still relatively new, the science limited, and the ecosystems which fracking operations could impact diverse in nature (and, depending on the context, not necessarily very well understood), it is essentially not possible to say with certainty how likely a risk is to materialise or what its flow-on implications might be.

When the US EPA completed its extensive, comprehensive study on fracking impacts to drinking water resources in 2016, it broadly concluded that there was not enough information to suggest that fracking could or could not be conducted safely.[87] This has been reiterated by other contributors to the scientific literature.[88] A major issue confounding the ability to determine the likely harm caused by fracking to water resources is that baseline data is required for a proper impact analysis, but does not exist for many fracking sites.[89] Missing data makes it difficult to causally isolate any statistically significant changes, and the fact that there may be other sources of impact not related to fracking precludes the establishment of a definitive link between fracking and any observed harm. A lack of long-term systematic studies also makes drawing any reliable conclusions impossible. Above in

[87] US EPA, above n 3.

[88] Merrill and Schizer, for example, summarised that the magnitude of risk from all sources of water contamination is 'uncertain and highly contested': above n 58, 187. This is also reiterated by Cooper, Stamford and Azapagic, above n 20.

[89] US EPA, above n 3, 5-69, 7-1; Teodoro Bosquez IV, 'Fracking Debate: The Importance of Pre-Drill WaterQuality Testing', *American Bar Association* (online) 18 February 2015; Bobby Magill, 'Scientists: Lack of Data Means Fracking Impacts Unknown', *Climate Central* (online) 10 December 2013 (quoting Hannah Wiseman on the lack of baseline data).

Section C, the uncertainty with respect to fracking's contribution to climate change was also outlined; this is compounded by uncertainty relating to the impacts of climate change on given ecosystems.

The law, which tends to prefer concrete, provable facts, has a particular mechanism to deal with scientific uncertainty: it can encourage or require that a 'precautionary' approach is adopted where there is a lack of scientific certainty. This is discussed in further detail in Chapter 5, which explains that there is no settled answer as to what a precautionary approach might require.[90] Broadly, with respect to dealing with uncertainty around the impacts of fracking, however, taking a precautionary approach might mean banning fracking altogether, imposing a moratorium pending the establishment of a greater degree of certainty or pending more scientific information, being conservative about which projects are approved, only allowing projects to proceed where strict conditions have been agreed to, or not allowing projects at all (even in spite of no ban or moratorium) if there is insufficient information to ensure a particular minimum level of risk.

With respect to the EIA context, it is likely that the conditions attached to projects will be the primary way in which decision-makers attempt to minimise risk. However, a prerequisite to a decision-maker having that option available is that risk factor must be able to trigger the EIA system. Not all of the impacts discussed in the above sections will necessarily trigger the Australian EIA system or require assessment under EIA, either on account of the scope of the law not covering the type of impact, the impact not being considered by the decision-maker as likely to be significant, or the impact not being considered by the decision-maker as sufficiently causally connected to the project or action. The following Chapters, Chapters 4 and 5, deal with these issues as a central focus.

III REGULATORY CONTEXT

To appreciate the arguments made in the following chapters of this thesis, it is not strictly necessary to have an understanding of every law in each jurisdiction that might apply to fracking projects, and it is certainly not possible to cover them all here. As this section will show, there are many, and importantly, they are likely to change over time. Rather, an appreciation of which *types* of law might be relevant will establish a sufficient foundation. The following regulatory analysis compiles the main relevant types of laws that might apply to fracking projects outside of federal EIA.

These laws fall into the following categories:

- laws which ban or restrict fracking in specified geographical areas over a certain time period (or indefinitely) (Section A);
- laws which require subnational-level impact assessment (Section B);
- oil and gas or petroleum laws which apply to fracking and which impose permitting or other requirements on fracking projects and fracking activity (Section C);
- natural resources laws which regulate impacts on certain aspects of the environment such as water resources (Section D); and
- international laws (Section E).

As future chapters will also note, both state/territory *and* federal impact assessment laws may apply to a fracking project. International law by contrast does not govern fracking per se, and federal governments rather than individuals are concerned with violations; nonetheless, an understanding of

[90] See, generally, Jacqueline Peel, *The Precautionary Principle in Practice – Environmental Decision-Making and Scientific Uncertainty* (Federation Press, 2005); Jacqueline Peel, 'Precaution – A Matter of Opinion, Approach or Process?' (2004) 5 *Melbourne Journal of International Law* 483.

the international context is useful in completing the regulatory 'picture'. Each of these aspects are also referred to, to the extent relevant, in Chapters 4-7.

A *State and Territory Bans and Moratoria*

The following table represents the situation in each Australian state and territory with respect to natural gas fracking:[91]

Table 2.1, *Australian State and Territory Responses to Fracking*

State	Status
Western Australia	Active exploratory activity (shale gas)
Northern Territory	Moratorium recently lifted; area bans
South Australia	Active (shale and tight gas)
Queensland	Active (CSG)
New South Wales	Active (CSG)
Australian Capital Territory	No feasible reserves
Victoria	Ban
Tasmania	Moratorium

Fracking is most active in Queensland and NSW, which are commercially producing CSG. In north-eastern South Australia, shale and tight formations are fracked, but there is no significant known CSG reserves. Exploratory activity is occurring in Western Australia, where there are large shale reserves. Fracking is not allowed in Victoria or Tasmania, and does not occur in the ACT.

The table below summarises the position of each state in the US.[92]

Table 2.2, *US State Fracking Activity*

State	Status	State	Status
Washington	No feasible reserves	Tennessee	Not inactive, but only limited fracking occurs
Oregon	No feasible reserves	Mississippi	Active
California	Active; local bans or moratoria	Michigan	Active

[91] For further information on reserves and production, see Geosciences Australia, *Australian Energy Resources Assessment* (Australian Government, 2017). Victoria's ban on fracking came into effect through the *Resources Legislation Amendment (Fracking Ban) Act 2017* (Vic). Tasmania's moratorium is in effect until 2020: 'Tasmanian Government Policy Statement on Hydraulic Fracturing (Fracking) 2015' (Policy Statement, 26 March 2015).

[92] Adapted from (*inter alia*) 'Map: The Fracking Boom, State by State' (2016) *Inside Climate News* <insideclimatenews.org> and Earth Justice, *Fracking Across the United States* <earthjustice.org>. Applicable state and local laws were also consulted, where relevant.

Idaho	No feasible reserves	Indiana	Active; local bans or moratoria
Nevada	Minimal reserves; not active	Alabama	Active
Utah	Active	Florida	Not active; local bans or moratoria; statewide ban failed to pass
Arizona	No feasible reserves	Ohio	Active; local bans or moratoria
Montana	Active	West Virginia	Active; local bans or moratoria
Wyoming	Active	Virginia	Active
Colorado	Active; local bans or moratoria	North Carolina	Not active; moratorium
New Mexico	Active; local bans or moratoria	South Carolina	No feasible reserves
North Dakota	Active; local bans or moratoria	Georgia	No feasible reserves
South Dakota	No feasible reserves	New York	State and local bans or moratoria
Nebraska	Active	Pennsylvania	Active; local bans or moratoria
Kansas	Active	Maryland	State and local bans or moratoria
Oklahoma	Active; local bans or moratoria	New Jersey	No feasible reserves
Texas	Active	Delaware	No feasible reserves
Minnesota	No feasible reserves	Vermont	State ban; no feasible reserves
Iowa	No feasible reserves	New Hampshire	No feasible reserves
Missouri	No feasible reserves	Massachusetts	State and local bans or moratoria except on native Indian-owned land; no feasible reserves
Arkansas	Active	Connecticut	No feasible reserves

Louisiana	Active	Rhode Island	No feasible reserves
Wisconsin	No feasible reserves	Maine	No feasible reserves; local bans or moratoria
Illinois	Likely to become active (permit approved 2017); local bans or moratoria	Alaska	Could become active, but likely for oil rather than gas
Kentucky	Allowed but not typically fracked	Hawai'i	No feasible reserves; local bans or moratoria

To summarise, there are no known, economically feasible reserves in 20 of the 50 US states, and five have an active ban or moratorium across the state. Bans can be overturned so are not strictly permanent, but they are more concrete than moratoria. In the fracking context a moratorium may be intentionally imposed while scientific study is undertaken, or while protective legislation is developed, or there may be a 'de facto' moratorium, where no permits are approved on account of a particular factor such as a pending court decision or policy. Because there is some overlap between states that have banned fracking and those which have no feasible reserves (ie some states have no feasible reserves at this stage but have pre-emptively banned fracking in any case), this leaves 26 states where fracking could feasibly occur. Of these, fracking is active in 21 states. Nine of the active fracking states have *local* bans or moratoria in place, meaning fracking is only allowed in certain parts of the state. Note that this is a rapidly changing area of law and policy, and while the position of certain states is unlikely to change, it may in others.

B *State and Territory Environmental Impact Assessment*

Each state and territory in Australia has EIA laws that require certain types of projects likely to have environmental impacts to be assessed and approved by a member of the executive government such as a Minister, or a body such as its state Environmental Protection Agency/Authority.[93] These laws are different from, and additional to, federal impact assessment under the EPBC Act. The scope of state/territory EIA legislation is broader than that of the EPBC Act, because it covers aspects of the environment not necessarily of national significance. In practice, a state/territory-level impact assessment may cover both state and federal matters and be able to be accredited as essentially subsisting for a federal assessment,[94] a measure which reduces duplication. This concept was introduced in Chapter 1.

[93] The major instruments are the: *Environmental Effects Act 1978* (Vic); *Development Act 1993* (SA); *Environment Protection Act 1996* (WA); *Land Use Planning and Approvals Act 1993* (Tas) and *Environmental Management and Pollution Control Act 1994* (Tas); *Environmental Assessment Act 1982* (NT); *Environmental Planning and Assessment Act 1979* (NSW); *Environmental Protection Act* 1997 (ACT); *Environmental Protection Act 1994* (Qld), *Sustainable Planning Act 2009* (Qld) and *State Development and Public Works Organisation Act 1971* (Qld).

[94] This is allowable under the EPBC Act for states and territories that have entered into a bilateral agreement with the Commonwealth: EPBC Act pt 4, div 1.

The way in which Australian states and territories supplement federal impact assessment law with their own impact assessment law is not consistent between states and territories, and with respect to application to a fracking project, will differ in terms of EIA requirements. Although the focus of future chapters is on federal law, relevant state/territory laws are referred to in those chapters where it is useful to draw a comparison or to present a complete picture.

In the US, a number of states have state-based impact assessment laws sometimes called 'Little NEPAs', referring to their mirroring of the federal NEPA. If a 'Little NEPA' exists in the state where a fracking project is proposed, it may apply (depending on its scope) to actions that are not covered by NEPA because they do not have a federal nexus.

C *Oil and Gas / Petroleum Laws and Permitting Requirements*

While it is not within the scope of the thesis to cover oil and gas or petroleum law in detail, it is important to note that this category of laws will most likely impact fracking operations. Oil and gas or petroleum laws (a fragmented category of laws which might have various different names and subject matter scopes) may operate to encourage or discourage projects that involve the extraction of natural gas, depending on the relevant requirements imposed. Generally, these laws can be thought of as hurdles rather than barriers, and they operate to implement specific prerequisites and conditions associated with obtaining approval to extract natural gas. They may also cover the construction of pipelines.[95] These laws are not typically considered to be 'environmental' laws, but rather are a separate category of laws, which may have environmental consequences.

In Australia, petroleum (which is essentially a hydrocarbon or mixture of hydrocarbons in solid, liquid or gaseous state and which thus includes natural gas) is owned by the Crown. Onshore petroleum (the focus of this thesis, as opposed to offshore petroleum) is owned by the state or territory government in which it is located, regardless of whether it occurs underneath privately held land.[96] A license or equivalent is required to extract the petroleum, and title passes from the relevant state or territory government to the license holder at the Earth's surface. Particular laws will apply to fracking projects in the jurisdictions where those projects are allowed.[97] Typically two types of permit will be required for an operation: the permit or license to conduct exploratory or prospecting activity, and the license to extract the gas. Although the High Court has held that the Commonwealth government may regulate petroleum activities pursuant to the trade and commerce power of the Australian Constitution,[98] oil and gas law for onshore activities is state/territory-based in Australia.

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[95] Additionally, pipeline construction could require a separate license especially if the pipeline will continue outside of the area to which the license applies, and may also be subject to particular industry codes and standards.

[96] This is set out in the relevant state/territory legislation, listed in Appendix 1. For example, the *Petroleum (Onshore) Act 1991* (NSW) s 6(1) states that: '[a]ll petroleum, helium and carbon dioxide existing in a natural state on or below the surface of any land in the State is the property of the Crown, and is taken to have been so always. No compensation is payable by the Crown for any such petroleum, helium or carbon dioxide that was at any time vested in any person other than the Crown'; the *Petroleum and Gas (Production and Safety) Act 2004* (Qld) s 26(2) states that: '[a]ll petroleum as follows is, and always has been, the property of the State—(a) petroleum on the surface of land, if it was produced in the State; (b) petroleum in a natural underground reservoir in the State, other than petroleum in the reservoir produced outside the State and injected or reinjected into the reservoir' and s 26(3) continues: '[t]o remove any doubt, it is declared that—(a) a person does not acquire any property in petroleum merely because the person discovers petroleum in a natural underground reservoir […]'.

[97] These are listed in Appendix 1.

[98] *Myrphyores Inc Pty Ltd v Commonwealth* (1976) 136 CLR 1.

In the US, oil and gas or petroleum laws are also largely state-level laws. However, by contrast to the Australian situation, gas is usually owned by the landholder rather than the government. A 'split estate' exists where the rights to the gas are separate from the rights to the land; in this case the rights to develop the gas can be bought and sold. A landholder can sever its rights to create a split estate, and can also lease its rights and collect royalties. Landholders thus also have the option of abstaining from collecting or allowing the collection of their natural gas. The situation created by this difference in laws changes the nature of the fracking debate in the US compared with other countries such as Australia; banning fracking is more likely to be viewed as impinging on private rights and the opportunity to realise fully the value of one's land.

Adjunct legal requirements may also apply, such as 'gas reservation laws' which require a certain proportion of extracted gas be reserved for domestic supply, and laws which limit where extraction projects are permitted to be sited, including places where indigenous title is recognised (in Australia, under the *Native Title Act 1993* (Cth)). Even where a license does exist and there are no native title claims, access arrangements may need to be negotiated with landholders. Additionally, occupational health and safety laws are likely to govern the manner in which the extraction is able to be conducted.[99] These could have flow-on consequences to the environment – for example, a lax safety law might lead to a greater likelihood of spills and thus contamination from chemicals.

Permissions required under oil and gas or petroleum laws are different from permissions required under impact assessment laws, and will usually operate alongside EIA. For example, a license or permit may be required to extract gas, and in addition, the associated project could be subject to impact assessment requirements and/or permission from an executive Minister. A proponent would only be able to go ahead after clearing both types of requirements.

D *Specific Environmental and Natural Resource Law and Policy*

If a fracking project is likely to impact upon a specific aspect of the environment that is the subject of a particular law which regulates that aspect, then that law might apply in such a manner as to regulate the project. This includes biodiversity laws, water laws, protected areas laws (including those governing heritage places and designated parks), waste and product stewardship laws and also energy laws including greenhouse gas reduction and climate change laws. One or multiple laws and/or policies may govern these areas, depending on the jurisdiction.

In Australia, many of these aspects are covered by the EPBC Act, the same act that governs EIA. The EPBC Act creates offences for actions taken without permission from the Minister, creating a system whereby permission from the Minister is obtained through the EIA process. Protected areas and species are the primary aspects of the environment regulated by the EPBC Act.[100] Water resources are protected in a more fragmented way, discussed further in Chapter 4. The climate system, as Chapter 5 demonstrates, is not very well protected by the EPBC Act. Thus water law and climate law are primary examples of regulatory areas where important legislation outside of the EIA system and EPBC Act might apply to fracking projects. State/territory climate, energy, water and biodiversity laws may also apply to fracking projects. A list of these laws is provided in Appendix 1.

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[99] For a more detailed high-level overview of the US context, see Michael P Joy and Sashe D Dimitroff, *Oil and Gas Regulation in the United States: Overview* (Thompson Reuters, 2016) <uk.practicallaw.thomsonreuters.com>

[100] Namely, world heritage, national heritage, wetlands of international importance, listed threatened species and communities, listed migratory species, the marine environment, and the Great Barrier Reef: EPBC Act, pt 3.

In the US, there are many environmental laws which fall outside of the federal EIA system created under NEPA, and which might nonetheless apply to fracking projects. NEPA only applies where there is a federal nexus to a project such as where it is conducted by a federal agency or on federal lands. Other major environmental protection laws include the *Clean Air Act*,[101] the *Clean Water Act*,[102] the *Safe Drinking Water Act*,[103] the *Comprehensive Environmental Response, Compensation, and Liability Act*,[104] the *Resource Conservation and Recovery Act*[105] and the *Endangered Species Act*.[106] There are numerous exemptions for fracking under these laws; those that are relevant to the discussions in future chapters are discussed therein. In addition, state laws may cover these areas.

Generally, a water law could require that any activity which involves extracting water from a public source requires a permit to be obtained before a particular volume of water is allowed to be taken. It might also require that a particular level of water quality is maintained, and impose penalties for individuals and companies who cause a water source to be polluted above particular or more general threshold standards. A biodiversity law may require a permit to be obtained before any endangered or threatened species or its habitat is put into jeopardy, create a penalty for taking or harming wild animals, or contributing to habitat fragmentation and destruction. A climate or energy law might require that a specific target for greenhouse gas emissions reductions is met, or that projects proposing to emit a certain quantity of emissions be registered or otherwise be subject to approvals.

E *International Law*

There is no international law on fracking. While some countries have banned fracking at the federal level, it is typically up to state, provincial, municipal or local governments whether to allow fracking to occur, though if allowed, it may be subject to particular federal and/or state/territory-level requirements such as those already discussed. Such is the case in the US and in Australia.

Nonetheless, international obligations relevant to the fracking industry may influence fracking. Once a national-level government has signed or ratified a treaty which expresses particular obligations, it is bound to comply with those obligations internationally.[107] Typically, the government will enact legislation designed to implement its international obligations, which could be through one targeted law, a policy goal, or many laws considered together. Thus, even if a federal government is not regulating fracking per se, it may impose national laws which place legal restrictions on the fracking industry.

Agreeing to be bound by a treaty, even if it is not actually implemented or is in the process of being implemented by the relevant federal or national government, may be enough to send a signal to businesses and industries to align their practices with the goals of the treaty. A recent and relevant example is the *Paris Agreement* to the United Nations Framework Convention on Climate Change ('UNFCCC'), discussed further in Chapter 5.

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[101] *Clean Air Act of 1963* 42 USC §7401 *et seq.*
[102] *Clean Water Act of 1972* 33 USC §1251 et seq.
[103] *Safe Water Drinking Act of 1974* 42 USC §300 et seq.
[104] *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* 42 USC §9601 et seq.
[105] *Resource Conservation and Recovery Act of 1976* 42 USC §6901 *et seq.*
[106] *Endangered Species Act of 1973* 16 USC 1531 et seq.
[107] *Vienna Convention on the Law of Treaties*, opened for signature 23 May 1969, 1155 UNTS 331 (entered into force 27 January 1980), arts 12-14. It is useful to refer to enforcement provisions, and to look at how a treaty is actually likely to be enforced in practice, in order to gain a fuller picture of the strength of international obligations.

The below table lists international treaties which could create obligations that influence the fracking industry. In practice, most of these treaties tend to have relatively weak compliance mechanisms, so the likelihood that the obligations within them will impact industry will in reality depend heavily upon the response of the relevant federal or national government. These instruments are discussed in future chapters as relevant.

Table 2.3, *Key International Laws*

Instrument	Effect
Convention on Biological Diversity[108]	Protects biological diversity and encourages sustainable use
Convention on Migratory Species[109]	Protects listed migratory species
Ramsar Convention[110]	Protects listed wetlands
World Heritage Convention[111]	Protects listed natural and cultural UNESCO heritage sites
United Nations Framework Convention on Climate Change;[112] *Paris Agreement*[113]	Encourages the mitigation of climate change and reduction of greenhouse gas emissions
Trade agreements (eg *Trans-Pacific Partnership* ('TPP')/*Comprehensive and Progressive Agreement for Trans-Pacific Partnership* ('CPATPP);[114] *North American Free Trade Agreement*[115] ('NAFTA')	May govern foreign investment and import/export of (for example) natural gas

Though this thesis does not discuss trade in further detail, it is worth noting that trade agreements may represent an effective restriction on governments' ability to control the environmental impacts of fracking projects, and may otherwise have market implications affecting fracking. Trade agreement mechanisms and clauses impacting exports may influence stances on fracking and in this manner operate alongside the drivers discussed in Part I.

[108] *Convention on Biological Diversity*, opened for signature 5 June 1992, 1760 UNTS 79 (entered into force 29 December 1993.
[109] *Convention on the Conservation of Migratory Species of Wild Animals*, opened for signature 23 June 1979, 1651 UNTS 333 (entered into force 1 November 1983).
[110] *Convention on Wetlands of International Importance Especially as Waterfowl Habitat*, opened for signature 2 February 1971, 996 UNTS 245 (entered into force 21 December 1975) ('*Ramsar Convention*').
[111] *Convention For the Protection of World Cultural and Natural Heritage* opened for signature 16 November 1972, 1037 UNTS 151 (entered into force 17 December 1975)('*World Heritage Convention*').
[112] *United Nations Framework Convention on Climate Change*, opened for signature 4 June 1992, 1771 UNTS 107 (entered into force 21 March 1994) ('UNFCCC').
[113] *Paris Agreement*, FCC/CP/2015/L.9 (12 December 2015).
[114] The TPP was signed on 4 February 2016, but was not able to enter into force following US withdrawal; the CPATPP is a replacement which was signed on 8 March 2018 (and does not include the US).
[115] *North American Free Trade Agreement*, Canada-United States-Mexico, signed 17 December 1992, 32 ILM 296 (entered into force 1 January 1994).

The inclusion of investor-state dispute settlement ('ISDS') mechanisms, which are essentially mechanisms that allow parties to have disputes arbitrated under international arbitration rules,[116] can operate to give foreign investors (such as, potentially, fracking companies) the power to bring compensation proceedings against government parties. Through this mechanism, companies (foreign investors) can argue that environmental controls such as regulations or bans are affecting their business in the host country. These controls might for example deprive them of the value of their investment, or treat them unfairly vis-à-vis local competitors.

A number of commentators are of the view that arbitration tribunals heavily favour foreign investors over domestic governments under ISDS clauses.[117] In the case of the TPP, Professor Joel Mintz has commented that it provided 'scant protection against the possibility that the rosters of qualified arbitraries will be dominated by representatives of corporate interests who view national environmental laws as needless obstacles to private profit-making.'[118] Although this point is contentious, evidence relating to past decisions does appear to support it. There have been over 600 ISDS arbitrations to date including a large number of cases involving mining and energy companies. In most cases, foreign investors succeeded.[119]

In *Bilcon v Canada*, the Canadian Government had rejected a proposal by US company Bilcon to blast-extract basalt from an ecologically important area in Nova Scotia. Bilcon successfully sued the Government for CAD $300 million under the ISDS mechanism of NAFTA.[120] A key aspect of this decision was that the tribunal found that the EIA process used (which considered social impacts broadly) was faulty. A similar situation arose in the case of *Lone Pine v Canada*, in which Canadian company Lone Pine is using its registration in Delaware, US, to bring a dispute under NAFTA arguing that it should be awarded CAD $250 million on account of Quebec's fracking moratorium which is preventing it from shale gas exploration in the area and potentially being able to exploit any gas found.[121]

In the US, the Department of Energy has the power to assess whether export of natural gas is consistent with the public interest *except* in relation to exports to countries with which the US has a

[116] See, eg, Daniel M Price, 'An Overview of the NAFTA Investment Chapter: Substantive Rules and Investor-State Dispute Settlement' (1993) 27 *International Lawyer* 727; Wilhelm Kohler and Frank Stähler, 'The Economies of Investor Protection: ISDS Versus National Treatment' (CESifo Working Paper Series No 5766) 22 February 2016; Won-Mog Choi, 'The Present and Future of the Investor-State Dispute Settlement Paradigm' (2007) 10 *Journal of International Economic Law* 725.

[117] See, eg, K Tienhaara, *The Expropriation of Environmental Governance: Protecting Foreign Investors at the Expense of Public Policy* (2009, Cambridge University Press); Economic Justice Collective, *The Unions-Communities Roundtable on the Trans Pacific Partnership* (2015).

[118] Joel Mintz, *TPP: Another Threat to Environmental Safeguards*, The Hill Congress Blog (November 13, 2015) <thehill.com/blogs/congress-blog/energy-environment/>. The process of arbitration itself can be seen as a bypass mechanism whereby domestic courts and federal/state environmental requirements can be side-stepped; additionally, the TPP arbitration mechanism entitles third parties with an interest in the matter, for example interested corporations, to fully participate in arbitration proceedings but environmental NGOs have only the opportunity to provide written reviews for 'consideration', thus potentially providing for a skewed representation of interests.

[119] Friends of the Earth, *Fracking the Planet: How the Trans-Pacific Partnership Will Expand Fracking in Australia and Around the Globe* (2015).

[120] *William Ralph Clayton, William Richard Clayton, Douglas Clayton, Daniel Clayton and Bilcon of Delaware Inc v Government of Canada* (2009) (UNCITRAL, PCA Case No 2009-04).

[121] *Lone Pine Resources Inc v The Government of Canada* ICSID Case No UNCT/15/2, ongoing at the time of writing: documents available via <italaw.com/cases/1606>.

trade agreement, in which case it must approve natural gas exports.[122] And with respect to Australia, it has been contended that national treatment provisions in the TPP (and impliedly the CPATPP) could facilitate natural gas exports to Asia,[123] though competition could increase between other (CPA)TPP countries also wishing to export, if tariffs are removed.

IV CONCLUSION

Fracking for natural gas is a complex, multi-stakeholder issue that is associated with many variables, which raises conflicting values, and whose impacts are characterised by scientific uncertainty. It has the potential to provide domestic and international markets with natural gas that can be used for energy; it also has the potential to cause harm to water resources, the climate system, geological structures, biodiversity, and people and their health and local economies. These possibilities, including the magnitude and likelihood of harm and benefits, must be weighed by individuals when deciding whether to support fracking, governments when deciding whether to permit it, and administrative decision-makers when deciding whether to approve specific project proposals. Because each of these groups will hold and represent different values, stances will inevitably differ.

The most prominent driver for fracking, in a general sense, is energy demand, while the leading concern relates to water contamination. It is not possible, however, to 'pit' energy against water, as both are necessary to sustain life. Proponents of fracking hope that water contamination can be minimised; opponents argue that the risk is not acceptable given that energy can be provided from different, less polluting sources.

Fossil fuels remain relatively cheap to produce and consume, while the costs to society and its environment and economy are high. The dramatic increase in fracking has come at a time when markets are starting to be corrected and compensated for by regulations and policies dis-incentivising fossil fuels and incentivising more sustainable forms of energy. However, the desire for energy demand at a low economic cost is still very strong, and the interdependencies among social-ecological systems as they relate to the impacts of fossil fuels are only starting to be properly understood.

Fracking is presently regulated in a fragmented manner in both Australia and the US. Bans and moratoria operate at local and state/territory levels, and sometimes there are bans and/or moratoria at both levels. Permits may need to be sought for exploration, drilling, and water extraction, though requirements differ in each jurisdiction and may apply differently depending on variables particular to each case. EIA law, as Chapter 1 established, is the law which regulates decision-making on whether to approve or reject a fracking proposal on environmental, social and economic grounds, where there is likely to be a significant environmental impact. EIA law may operate at the federal and state/territory levels, separately or together. Other environmental laws –relating to energy, water, climate change, and biodiversity, for example, may also be relevant to fracking, again at both the federal and state/territory levels.

Federal EIA law, upon which this thesis focuses, is thus only one 'piece' of the matrix of laws that might apply to fracking, but it is an important one, as Chapter 1 indicated. In examining federal EIA law, fracking will serve as an interesting example, despite (in fact partly because of) its complex regulatory and political context. This thesis, through the following chapters, develops arguments drawing on

[122] *Natural Gas Act of 1938* 15 USC §717b(c).
[123] Friends of the Earth, above n 119. See also Michael A Levi, 'What the TPP Means for LNG' on *Council on Foreign Relations* (17 November 2015) <cfr.org/blog/what-tpp-means-lng>.

fracking to demonstrate why and how climate change, water, and social and economic impacts, as well as cumulative impacts in general, need to be better incorporated into and balanced within federal-level EIA decision-making if the risks of fracking presented above are to be minimised.

Chapter 4: Water Resources

The previous chapter established that concerns over the impacts of fracking on water resources are of primary importance to stakeholders. This Chapter examines the way in which impacts to water resources are managed by the legal system at the federal level in Australia. It focuses on the EIA system and its capacity to minimise risk, by setting out the current EIA law and identifying problematic gaps. Context is provided to this discussion through a conceptualisation of water resources as aspects of broader environmental and social-ecological systems ('SES'). Reference is made to the US law system as a comparative example of a regulatory response to the need to protect water resources from fracking, and facilitates concluding comments on the approach that Australia could adopt moving forward.

As fracking cases have largely not been tested in Australian courts – particularly, at the federal level through the EPBC Act – a key purpose of this Chapter is to explore the potential avenues through which water resource protection is likely to apply to fracking, and thus to facilitate an understanding of the framework of existing legal protection. This may serve to inform proponents, potential review applicants, and executive decision-makers on the water protections available under federal EIA law as they relate to project approval decisions. It will also serve to highlight gaps that might be addressed in future law reform so as to create a less fragmented, systemic framework for the protection of water resources from activities associated with natural gas fracking which maximises the capacity to manage risk. In order to internalise (in part, at least) the market failure that is created when those who cause harm such as through water pollution are not held properly accountable for preventing or remediating it,[1] legislative gaps that limit the protection of water resources from environmental risk must be closed.

Part I, below, discusses how systems thinking is relevant to water resources and supports a case for federal-level protection. Part II explores the federal EPBC Act in detail, and analyses its application to water resources threatened by impacts from fracking activities. A key component of Part II is an analysis of the existing water trigger, which is timely given a recent independent review. Part III deals exclusively with the US system, being a system which has grappled with fracking issues for a longer time and to a greater extent than has the Australian system. Though the two systems regulate fracking and more specifically capture risks to water resources in quite distinct manners, looking at how issues have materialised in the US, as Australia considers its own regulation, may provide helpful insights. Finally, Part IV discusses the implications of the prior discussions and Part V presents a conclusion.

I WATER RESOURCES AND SYSTEMS

Treating water resource protection in the way that domestic law systems have historically tended to – in terms of water resources being particular distinct places rather than components of systems – encourages a narrow understanding of water resources' importance and therefore of what impacts to water resources are likely to be significant. It is important to acknowledge the physical and conceptual systems in which water resources sit, in order to ultimately better understand how such resources can

[1] Stephen Hunter, *Independent Review of the Water Trigger Legislation* (Commonwealth of Australia, 2017), 6.

be protected, and what potential deficiencies in regulatory protection – including through the EIA system – might ultimately lead to environmental and flow-on harms.

In this Part, water resources are described as forming parts of multiple systems: first, all water resources are part of the hydrosphere and are connected to the global hydrological cycle; second, they are part of a global, integrated network of water resources; third, each water resource is part of a SES that includes humans and biodiversity dependent on the water resource for various aspects of given species' life cycle and fulfilment of specific survival needs. In understanding water resources as part of broader systems, an appreciation can be gained for why water resources should be considered holistically at an appropriately broad scale. [2]

A *The Hydrosphere and the Biosphere*

The total amount of water in the hydrosphere is considered to be finite,[3] though at different periods of time, a greater or lesser amount will be held within various sources. The main sources are glaciers and snow, groundwater, ground ice and permafrost, lakes, wetlands, soil, rivers, and the atmosphere.[4] The distribution of water amongst these reservoirs – which will change over time on account of evaporation, precipitation, condensation, runoff, melting, etc[5] – determines how much fresh water is available for particular uses: for example, human consumption as drinking water, or for habitat. Human activity such as fracking and mining can influence the hydrological cycle by depleting or contaminating freshwater sources in a particular area, which is likely to have flow-on implications in other areas, and to the biosphere. The biosphere – the sum total of all of the Earth's ecosystems – is dependent on the hydrosphere in order to sustain life.

In a book centred around the place of fresh water in international law, Boisson de Chazournes argues that '[a]ny analysis of water resources requires that the interconnection between all sources of water be taken into consideration'.[6] Although she does not write of systems thinking specifically, this statement nonetheless draws attention to the need for systems thinking when regulating – or analysing a regulatory approach in relation to – water resources.

Such an approach is endorsed by the global Sustainable Development Goals ('SDGs') mentioned in Chapter 2: Goal 6 advocates for 'holistic management of the water cycle', which means 'taking into account the level of "water stress", calculated as the ration of total fresh water withdrawn by all major sectors to the total renewable fresh water resources in a particular country or region'.[7] According to the World Resources Institute, Australia is in the second highest of five stress categories, rated 'high

[2] Outside of the EIA context, approaches that share a holistic character with the systems approach adopted in this thesis have been influential in informing reform proposals with respect to water governance more broadly. For example, Cameron Holley, focussing on groundwater, has advocated for an approach which, similarly to the systems approach, pays particular attention to the role of different actors. See, eg, Neil Gunningham and Cameron Holley, 'Next-Generation Environmental Regulation: Law, Regulation, and Governance' (2016) 12 *Annual Review of Law and Social Science* 273; Cameron Holley and Daniel Sinclair, 'Rethinking Australian Water Law and Governance: Success, Challenges and Future Directions' (2016) 33 *Environment and Planning Law Journal* 275 (and see the other articles in that journal edition).

[3] See, eg, Claudia Sadoff, Karin Kemper and David Grey, 'Calming Global Waters: Managing a Finite Resource in a Growing World' in Vinay Bhargava (ed), *Global Issues for Global Citizens* (World Bank, 2006), chapter 14.

[4] Joseph Holden, *Water Resources* (Taylor and Francis, 2002), 10.

[5] Ibid, 20.

[6] Laurence Boisson de Chazourne, *Fresh Water in International Law* (Oxford University Press, 2013) 1, II.

[7] UN Sustainable Development Goals, *Goal 6* <https://sustainabledevelopment.un.org/sdg6>.

stress.'[8] Australia's level of water stress, and more generally the availability of water when considered at both a local and a system-wide scale, should be taken into account in regulatory frameworks and in decision-making, bearing in mind that both reduced quantity of freshwater from water allocations, as well as any reduced clean freshwater availability on account of pollution, should be relevant. The discussions below consider the extent to which Australian EIA law requires these kinds of considerations, and whether recent decisions contradict or align with the general imperative.

B *An Integrated Network of Water Resources*

International law tends to treat water resources on the basis of their place within an integrated 'network' of water resources, parts of which may span national borders, by targeting particular aspects of this network. One example is the *Ramsar Convention* on wetlands of international importance,[9] which aims to protect specifically listed wetlands by encouraging parties to take action to limit degradation and promote conservation with respect to listed ('Ramsar') wetlands. The wetlands listed are specific places, but the Ramsar 'network' is an interrelated 'whole', of sorts.

The *Ramsar Convention* is translated into Australian law via the EPBC Act. In Australia, an understanding of the *Ramsar Convention* thus tends to be through the lens of the EPBC Act, which is relatively static except to the extent that its interpretation is able to evolve through case law. At the international level, the *Ramsar Convention* is advancing to take on a more systems-focussed outlook that treats wetlands as specific places but connected to other aspects of local water systems. Verschuuren notes that at the international level, 'wetland management has been integrated into river basin management, recognizing the fact that wetlands usually are only a part of a bigger catchment area and, for their conservation, largely dependent on the quality of the entire catchment'.[10] He points to the Conference of the Parties' guidelines for integrating wetland conservation into river basin management,[11] which encourage moving away from a 'reductionist' approach to protecting wetlands in isolation of the river basins to which they are directly or indirectly connected.

Another example is the protection of 'watercourses' under the *Convention on the Law of the Non-Navigational Uses of International Watercourses*[12] and the *Helsinki Convention on the Protection and Use of Transboundary Watercourses and International Lakes*.[13] These conventions both require that parties not cause significant harm to shared (cross-border) watercourses.[14] A watercourse is defined

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[8] World Resources Institute, *Water Stress by Country* (December 2013) <http://www.wri.org/resources/charts-graphs/water-stress-country>.

[9] *Convention on Wetlands of International Importance Especially as Waterfowl Habitat*, opened for signature 2 February 1971, 996 UNTS 245 (entered into force 21 December 1975) ('*Ramsar Convention*').

[10] Jonathan Verschuuren, 'The Case of Transboundary Wetlands Under the Ramsar Convention: Keep the Lawyers Out!' (2008) 19 *Colorado Journal of International Environmental Law and Policy* 49.

[11] Ramsar Convention, Seventh Conference of the Parties, *Guidelines for Integrating Wetland Conservation and Wise Use into River Basin Management*, Resolution VII.18 (1999), in Ramsar Convention Secretariat, *Ramsar Handbooks for the Wise Use of Wetlands, Handbook 7: River Basin Management* (3rd ed, 2007). Note that there is debate about the legal status of COP decisions, which although not binding may serve as 'subsequent agreements' or 'subsequent practice' in interpreting primary treaties under the *Vienna Convention on the Law of Treaties* (opened for signature 23 May 1969, 1155 UNTS 331 (entered into force 27 January 1980)).

[12] *Convention on the Law of the Non-Navigational Uses of International Watercourses*, opened for signature 21 May 1997, 36 ILM 700 (entered into force 17 August 2014).

[13] *Helsinki Convention on the Protection and Use of Transboundary Watercourses and International Lakes,* opened for signature 17 March 1992, 1936 UNTS 269 (entered into force 6 October 1996).

[14] *Convention on the Law of the Non-Navigational Uses of International Watercourses*, above n 12, art 8; *Helsinki Convention on the Protection and Use of Transboundary Watercourses and International Lakes*, above n 13, pt I. Note that an international law obligation not to cause harm to the environment of another country

as 'a system of surface waters and groundwaters constituting by virtue of their physical relationship a unitary whole and normally flowing into a common terminus'.[15] This definition treats watercourses as systems nested within the global hydrosphere system mentioned above, and impliedly as aspects of that broader system. The International Law Commission has further defined what 'groundwaters' means, commenting that 'groundwaters' refers to 'the hydrologic system composed of a number of different components through which water flows, both on and under the surface of the land. These components include rivers, lakes, aquifers, glaciers, reservoirs and canals. So long as these components are interrelated with one another, they form part of the watercourse'.[16] A watercourse is therefore a system somewhere in between a Ramsar wetland system and the global hydrological system in terms of scale.

Australia does not have international watercourses, but it is worth noting the above conventions as they recognise, in a general sense, the environmental and social harms that can result on account of pollution to surface/groundwater systems, and thus inherently facilitate a systems approach to water protection. Australia does have water systems that span between states and territories (well-known examples include the Murray Darling Basin and the Great Artesian Basin). Where water resources cross jurisdictional boundaries, taking a systems approach justifies regulation both within and between jurisdictions in order to adequately protect these water systems.

C *Water Resources as Components of Social-Ecological Systems*

Humans, as components of the biosphere, are entirely dependent on freshwater resources. A single water source, even if viewed in isolation from other aspects of hydrological and watercourse systems, is nonetheless a component of a greater SES that likely includes humans as well as a range of other species.

An increasing number of researchers are studying SES in this manner: for example, Cabello and her colleagues studied a river basin SES by looking at the relationships between societal organisation and water uses and demands, between ecosystem organisation and water requirements and supplies, between societal metabolism and aquatic ecosystem health, and between water demand and availability.[17] This approach led to the conclusion that the particular system studied had been affected by long-term social-ecological evolution and overall eco-hydrological functioning. The authors described the applicable regulatory framework as 'a key driver shaping human-environmental interactions' and ecological change.[18] Others have also argued for an integrated approach to water

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is considered part of customary international law: see Patricia Birnie, Alan Boyle and Catherine Redgwell, *International Law and the Environment* (Oxford University Press, 3rd ed, 2009), 109.

[15] *Convention on the Law of the Non-Navigational Uses of International Watercourses*, above n 12, art 2(a).

[16] *The Law of Non-Navigational Uses of International Watercourses*, Extract from the Yearbook of the International Law Commission 1994 vollII(2), UN Doc A/CN.4/L.493, 90 <http://legal.un.org/ilc/documentation/english/a_cn4_l493.pdf>; see also *UN Watercourses Convention – Users Guide Fact Sheet Series: Number 3 – Groundwater Systems* <http://www.unwatercoursesconvention.org/documents/UNWC-Fact-Sheet-3-Groundwater-Systems.pdf>. Contra Alistair Rieu-Clarke, who debates whether a systems approach is actually facilitated by these definitions: 'Determining Sovereign Rights and Duties Over International Watercourses: The Contribution of the International Law Commission and the UN General Assembly' in Terje Tvedt, Owen McIntyre and Tadesse Kassa (eds), *A History of Water, Volume 2: Sovereignty and International Water Law* (I B Tauris, 2015) 149, 155.

[17] Violeta Cabelo et al, 'River Basins as Social-Ecological Systems: Linking Levels of Societal and Ecosystem Water Metabolism in a Semiarid Watershed' (2015) 20 *Ecology and Society* 20.

[18] Ibid, 31.

governance that includes both social and environmental aspects of water systems;[19] in a paper published in *Ecology and Society*, Lebel and his colleagues addressed governance in the context of such systems, asking '[h]ow do certain attributes of governance function in society to enhance the capacity to manage resilience?'[20]

A SES-focused systems approach may be useful for understanding the impacts of fracking on water resources. Taking a systems approach is likely to facilitate an appreciation of the interconnectedness between water resources and social, ecological, and social-ecological systems. In turn, it is useful when considering how such systems, and components of such systems, are likely to respond to different management scenarios or different levels of impact. The way in which a system 'responds' will dictate what impacts are likely to be felt and by whom. Such an approach may also assist in addressing the issue of how to best regulate these systems.

D *The Water-Energy Nexus*

The relationship between energy production and water consumption is sometimes referred to in academic literature as the 'water-energy nexus'.[21] The water-energy nexus is one of many relationships between the natural environment and human beings which are integral to balanced SES functioning and to sustainability. The nature of the relationship differs between the various types of fuel that produce energy. For example, renewable resources overall tend to have a lesser impact on water resources than do fossil fuels.[22] As humans need both water and energy to survive, the ideal relationship is one which allows energy production without jeopardising water resources, or which at least minimises risk of impact to water resources. Two important metrics for understanding how water resources are jeopardised by energy production are the water footprint, and the extent of water pollution.[23]

The water-energy nexus is mentioned here as a reminder that water resources are integrally tied into energy systems. Decision-makers considering an energy project, such as a fracking project, should consider the water footprint and the extent of pollution of the project at a minimum, and ideally should take into consideration flow-on social and environmental effects throughout relevant SES. On a broader policy level, the water-energy nexus can be examined in a comparative sense, in order to understand how different fuel sources and different project alternatives have correspondingly greater or lesser impacts on water resources.

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[19] See, eg, Margot W Parkes et al, 'Towards Integrated Governance for Water, Health and Social-Ecological Systems: The Watershed Governance Prism' (2010) 20 *Global Environmental Change* 693; Eleanor Ostrom, 'A General Framework for Analyzing Sustainability of Social-Ecological Systems' (2009) 325 *Science* 419; Carl Folke, 'Resilience: The Emergence of a Perspective for Social-Ecological Systems Analyses' (2006) 16 *Global Environmental Change* 253.

[20] Louis Lebel et al, 'Governance and the Capacity to Manage Resilience in Regional Social-Ecological Systems' (2006) 11 *Ecology and Society* 19, 19.

[21] See, eg, Robin Kundis Craig, 'Hydraulic Fracturing (Fracking), Federalism, and the Water-Energy Nexus' (2013) 49 *Idaho Law Review* 241.

[22] Erik Mielke, Laura Diaz Anadon and Venkatesh Narayanamurti, 'Water Consumption of Energy Resource Extraction, Processing, and Conversion' (Energy Technology Innovation Policy Discussion Paper Series, Discussion Paper No 2010-15, Harvard Kennedy School, 2010) 35.

[23] E S Spang et al, 'The Water Consumption of Energy Production: An International Comparison' (2014) 9 *Environmental Research Letters* 105002. 'Water footprint' broadly means the amount of water used to produce goods and services.

II WATER RESOURCES UNDER AUSTRALIAN LAW

A *Overview*

Australia's federal *Water Act*[24] was not established for the purpose of protecting water resources generally from point source pollution. Rather, its main objective is to provide a management framework for a specific water resource, the Murray Darling Basin, including the sustainable management of that resource between stakeholders with conflicting interests, and a trading scheme. The *Water Act* was independently reviewed in 2014. The review focused on improving basin management and not on expanding protections from pollution resulting from mining or fracking activities.[25] Essentially, the *Water Act* does not regulate fracking and is not likely to in future, except to the extent that water extraction for fracking purposes might fall within its auspices depending on the nature of the particular proposal. It does, however, provide an applicable[26] definition of water resources, being:

> (a) surface water or ground water; or (b) a watercourse, lake, wetland or aquifer (whether or not it currently has water in it) and including all aspects of the water resource (including water, organisms and other components and ecosystems that contribute to the physical state and environmental value of the water resource).[27]

This definition can help to understand what is – and what is not – within the purview of the EPBC Act, which does not provide a separate definition for water resources. The EPBC Act serves as the main source of environmental protection for water resources from the impacts of fracking at the federal level. Within a limited scope, described below, it prohibits actions likely to have a significant impact on water resources, unless approved by the federal Minister for the Environment and Energy ('Minister').

Prior to 2013, freshwater resources fell under the EPBC Act only where those resources formed part of a protected place or served as habitat for particular protected species. As of 2013, impacts to water resources, generally, now constitute a specific EPBC Act trigger, where the impacts result from large coal mine developments or coal seam gas ('CSG') developments. As explained in Chapter 1, triggers enliven the operation of the EPBC Act and its various assessment procedures that govern decision-making and ultimate approvals to undertake actions.

Though not a binding law, the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*,[28] formed out of the National Water Quality Management Strategy, should be mentioned. These are comprehensive guidelines that set out supposedly adequate levels of water quality for various uses (drinking, aesthetics, recreation, etc). The guidelines can be referred to in order to gauge an idea of what base level of water quality is likely to be considered acceptable in Australia.[29] They could also hypothetically be referenced by a decision-maker when making an approval decision under the EPBC Act or state/territory process as a guide in order to compare the proposed impact with these

[24] *Water Act 2007* (Cth).
[25] Eamonn Moran et al, *Independent Review of the* Water Act 2007 (Commonwealth of Australia, 2014).
[26] EPBC Act s 528 (references the *Water Act* definition).
[27] *Water Act 2007* (Cth) s 4.
[28] Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (Paper No 4, October 2000).
[29] Ibid.

standards, or in order to attach conditions to a project to the effect that the project must not cause pollution to rise in excess of the standards.

At the state and territory level, as with the federal level, 'water law' tends to focus primarily on water use and allocation.[30] However, state and territory EIA laws and general environmental protection laws do cover, and thus operate to protect, water resources from risks of environmental harm at least to some extent. For example, in NSW, significant impacts to water resources require assessment under the *Environmental Planning and Assessment Act 1979* (NSW). Specifically in the case of large mining and CSG proposals, the Mining and Petroleum Gateway Panel needs to issue a certificate to a proponent before it can lodge a development application; application for a certificate requires the proponent to undertake a preliminary assessment against set criteria. Before issuing the certificate, this panel can seek expert advice from (*inter alia*) the Department of Primary Industries – Water.[31] Further, water pollution constitutes an offence under the *Protection of the Environment Operations Act 1997* (NSW),[32] under which act the NSW EPA is the lead regulator for the environmental and human health impacts of CSG. NSW additionally has a monitoring strategy which, in response to an independent review of CSG activities,[33] has recently been expanded.[34] This strategy aims to ensure that water quality is monitored over time. This example demonstrates how state/territory laws can work together to govern impacts to water resources, and thus reduce risk, at that level.

Notwithstanding state/territory protections, however, some level of federal control over decisions that affect water resources is important for the adequate protection of those resources, particularly in light of the systems discussions raised above, but also as a check and balance. States and territories are able to modify, repeal and create their own matrix of legislation and at any given time there is likely to be inconsistencies between the states and territories. Additional federal control can ensure base level protections apply irrespective of which state or territory jurisdictions are also implicated in a project's approval. Federal protection can, at least partially, avoid a 'race to the bottom' between states and territories and endorse a less (albeit probably not un-) biased approach in terms of weighing environmental harms over more classically recognisable, localised economic gains.[35] The remainder of this Chapter focuses on the federal level, though implications of the federal-state/territory duality are discussed where relevant.

B *EIA-Based Decision-Making and The EPBC Act*

The EPBC Act framework for the protection of MNES was introduced in Chapter 1, and has been alluded to already in this Chapter. The implication of this structural framework for the protection of water resources is that water resources are only protected where they constitute a MNES (or where the action in question is conducted by a Commonwealth agency or on Commonwealth land).[36] Water

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[30] See, eg, *Water Act 1989* (Vic); *Water Management Act 2000* (NSW) and *Water Act 1912* (NSW); *Water Act 2000* (Qld). Note that water allocation is relevant to fracking to the extent that licenses to extract water to use in fracking operations may be required.

[31] NSW Department of Primary Industries – Water, *Assessing the Water Impacts of Major Developments in NSW* <http://www.water.nsw.gov.au/water-management/law-and-policy/planning-and-assessment>.

[32] s 120.

[33] NSW Chief Scientist & Engineer, *Final Report of the Independent Review of Coal Seam Gas Activities in NSW* (September 2014).

[34] NSW Department of Primary Industries – Water, above n 31.

[35] 'Classically recognisable' economic gains is used to refer to the direct revenue from investment and taxation able to be gained by states and territories from a large project; environmental gains are indirectly also economic gains, but in a less foreseeable and not as easily calculable or immediate manner.

[36] Note that it is not likely for a fracking operation to be conducted by a Commonwealth agency, and most fracking operations are unlikely to be conducted on Commonwealth land: for a map of land tenure in Australia,

resources which may constitute a MNES are those resources which are Ramsar wetlands, are or are part of declared World Heritage or Natural Heritage properties, or, in some cases, which form critical habitat for threatened species or ecological communities, or migratory species.[37] These MNES are addressed in Subsection 1, below. Additionally, water resources constitute a MNES where they are likely to be significantly impacted by a large coal mine development or a CSG development. This latter MNES is addressed as in Subsection 2.

To date there are no cases where the Federal Court has determined a likely significant impact on a water resource on account of a fracking activity. However, in *Fullerton Cove Residents Action Group Inc v Dart Energy Ltd*,[38] NSW's state Land and Environment Court considered matters relevant under the EPBC Act and concluded that the CSG pilot exploration project proposed was not likely to have a significant impact, including on groundwater resources[39] and other MNES.

At the time of writing, the most recent case to involve water resources in the context of an energy project was the *New Acland* case, a coal mine expansion case in Queensland. The federal Minister determined that the water trigger was a controlling provision on account of likely significant impacts to water resources, but nonetheless approved the expansion in 2017.[40] However, the matter, which required multiple approvals, was challenged in Queensland's Land Court, where Smith PA rejected the proposal based on, *inter alia*, not being satisfied as to the management of groundwater impacts.[41] It was reported by the Australian Broadcasting Corporation in early 2018 that the Environment Department had invited New Acland to submit new water modelling after the Land Court's rejection.[42]

Additionally, in 2016, the federal Minister approved a CSG development project proposed by Santos despite having similarly found a likely significant impact to water resources under the EPBC Act.[43] The advice of the Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development ('IESC') noted many instances of missing data.[44] The IESC is a statutory committee formed under the EPBC Act in 2012 to provide and publish independent expert advice at the request of either the Australian government or a state or territory government in relation to the impacts of a CSG or large coal mining development. Neither of these decisions were challenged in the Federal Court.

The water trigger was considered by the Minister to be applicable to the *Adani* case,[45] discussed in greater detail in Chapter 5 with respect to climate change impacts. When the decision was appealed in the Federal Court, water was not discussed, save for the mention that the water trigger had applied and that the Minister had imposed water related conditions, including requiring a groundwater

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see Geoscience Australia, *Public Lands of Australia 2002 Map* <data.gov.au/dataset/public-lands-of-australia-2002-map/resource/2ee7906a-6140-4b58-806e-76140a08e588>.

[37] See EPBC Act pt 3.

[38] [2013] NSWLEC 38.

[39] Ibid, 319.

[40] Australian Government Department of the Environment and Energy, Approval – Stage 3 Expansion of New Acland Coal Mine, Queensland (EPBC 2007/3423), 18 January 2017.

[41] *New Acland Coal Pty Ltd v Ashman & Ors and Chief Executive, Department of Environment and Heritage Protection (No 4)* [2017] QLC 24. Note that this 'Court' has recommendatory power only.

[42] Peter McCutcheon, 'New Acland Coal Mine Expansion Given Second Chance by Queensland Government', *ABC News* (online), 13 February 2018.

[43] Australian Government Department of the Environment and Energy, Approval – Santos GLNG Gas Field Development Project (2012/6615), 22 March 2016.

[44] IESC, 'Advice to Decision Maker on Coal Seam Gas Project – IESC 2014-061: Santos GLNG Gas Fields Development Project (EPBC 2012/6615) – Expansion', 4 November 2014.

[45] *Australian Conservation Foundation Inc v Minister for the Environment* [2016] FCA 1042, 45 ('*Adani*').

management plan. However, the Queensland Government has granted Adani a license to extract unlimited water for the purposes of the mine.[46]

1 ***Protected Places and Species***

The below table (following page) indicates how particular water resources might fall within the purview of the EPBC Act based on their categorisation as particular protected places or as habitat for particular threatened species.

[46] Associated Water License, *Water Act 2000 (Qld)*, granted 29 March 2017, expiry 30 June 2077, <http://www.smh.com.au/cqstatic/gvdane/adaniawl.PDF>.

Table 3.1, *Water Resources as Protected Places and Species' Habitat*

MNES	Aspect protected	Notes on interpretation/scope	Australian Government's *Significant Impact Guidelines*
Ramsar wetland	Ecological character[47]	The Conference of the Parties to the *Ramsar Convention* has defined changes in ecological character as 'the impairment or imbalance in any biological, physical, or chemical components of the wetland system, or in their interactions, which maintain the wetland and its products, functions and attributes.'[48] This definition was brought into Australian law when adopted by the Federal Court in the *Greentree* case.[49]	A significant impact may arise where: • areas of the wetland are destroyed or substantially modified • there is a substantial measurable change in the hydrological regime of the wetland • there are impacts to species dependent on the wetland; or • there is a substantial change in the level of pollutants which may impact ecological integrity, social amenity or human health.[50]
World heritage site; natural heritage place	Heritage value	What constitutes a 'heritage value' will depend on the particular place, and may include both cultural and natural aspects, as well as aesthetics ('natural beauty'). There are 19 World Heritage properties in Australia.[51] Of these, 12 are located in states that allow or have only temporarily banned fracking.[52]	Pollutants are a means by which a significant impact to a heritage place may occur.[53] Pollutants in the fracking context could include frack fluids and wastewater.
Threatened species or community	Critical component of species' or	Water resources themselves are not protected under the MNES that covers threatened species	Significant impacts to threatened species include those which:

[47] Descriptions of ecological character can be obtained at <www.environment.gov.au/water/wetlands/database/index.html?>.
[48] 7th Meeting of the Conference of the Contracting Parties to the Convention on Wetlands, 'Resolution VII.10: Wetland Risk Assessment Framework' (San Jose, Costa Rica, 10-18 May 1999), 11.
[49] *Greentree v Minister for the Environment and Heritage* [2005] FCAFC 128, 12. The Court established that whether there is (or has been, as the case was) a significant impact 'does not depend upon the wetlands being 'natural' or 'pristine' prior to the activities': 48.
[50] Australian Government Department of the Environment, *Matters of National Environmental Significance - Significant Impact Guidelines 1.1* (Commonwealth of Australia 2013), 13.
[51] Australian Government Department of Environment and Energy, *Australia's World Heritage List* <http://www.environment.gov.au/heritage/places/world-heritage-list>.
[52] Ibid.
[53] Australian Government Department of the Environment, above n 50, 16.

	community's habitat; essential aspect of the species' or community's life cycle	and communities. Rather, it may be possible to argue for the protection of a water resource on the basis that an action that affects the water resource would be likely to have a significant impact on a listed threatened species or community. Failure to adequately take into consideration listed threatened species or communities has led to approval decisions being overturned by the courts.[54]	• lead to a long-term decrease in population • reduce or fragment habitat or otherwise adversely affect habitat • disrupt a breeding cycle; or • interfere with a species' recovery.[55] Impacts to threatened communities include those which: • modify or destroy abiotic factors, including water, necessary for the community's survival, 'including the reduction of groundwater levels, or substantial alteration of surface water drainage patterns'; or • cause mobilisation of chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the community.[56]
Migratory species	Critical component of species' habitat	This trigger is limited in scope, effectively, to water resources which form part of a species' habitat that is a listed species under the *Convention on Migratory Species*,[57] *CAMBA*,[58] *JAMBA*,[59] or another migratory species agreement approved under the EPBC Act.[60]	Significant impacts which may apply to fracking cases include impacts that: • destroy, modify or isolate an area of important habitat (including specifically by altering nutrient or hydrological cycles); or • seriously disrupt the lifecycle of an ecologically significant proportion of the population of migratory species.[61]

[54] See, eg, *Mackay Conservation Group v Commonwealth of Australia* (Unreported, Federal Court of Australia, Katzmann J) 4 August 2015.
[55] Ibid, 9-10.
[56] Ibid, 11.
[57] *Convention on the Conservation of Migratory Species of Wild Animals*, opened for signature 23 June 1979, 1651 UNTS 333 (entered into force 1 November 1983) ('*Convention on Migratory Species*').
[58] *Agreement Between the Government of Australia and the Government of the People's Republic of China for the Protection of Migratory Birds and their Environment*, Australia-China, signed 20 October 1986, 1988 ANTS No 22 (entered into force 1 September 1988) ('*CAMBA*').
[59] *Agreement Between the Government of Australia and the Government of Japan for the Protection of Migratory Birds in Danger of Extinction and their Environment*, Australia-Japan, signed 6 February 1974, 1981 ATS No 6 (entered into force 30 April 1981) ('*JAMBA*').
[60] EPBC Act s 209.
[61] Australian Government Department of the Environment, above n 50, 12.

2 *The Water Trigger*

As has been alluded to, as a matter of law the water trigger serves to protect all water resources from certain activities: those classified as large coal mining or CSG developments. It is narrow in scope as it does not cover all types of fracking projects – notably, shale and tight gas projects. The water trigger amendment to the EPBC Act came into effect on 22 June 2013, and it became the third trigger added since the EPBC Act's inception.[62]

In the introduction to this Section, recent cases were mentioned which considered water resources and where large developments were approved in spite of likely significant impacts to those resources. It is too early to know whether those projects will cause environmental and flow-on social and economic harms throughout SES or to what extent, though as Chapter 3 highlighted, cases from the US that have led to significant harms do not inspire great confidence.

Given these reasons it is argued that the water trigger is not sufficient to adequately minimise risks to water resources from the impacts of fracking in Australia. Below, the water trigger is considered in greater detail in order to support this conclusion and to provide further important information on the trigger for the fracking context.

(a) Rationale, Concerns and Opposition

The water trigger was reportedly initiated as a response to community concern over the protection of water resources; particularly, concern in the states of NSW and Queensland regarding the expanding CSG sector, as well as a concern that state and territory governments were not able to, or simply were not, exercising a sufficiently high standard of decision-making. These concerns were acknowledged in a Senate Committee Report conducted prior to the amendment's inception.[63]

According to the Federal Government's website, the trigger remedies an issue that was being faced prior to its inception: the Minister was considering impacts to water resources and was seeking advice from the IESC (since 2012), but could not impose conditions in relation to those impacts in order to follow that advice.[64] Prior to the trigger's inception, a 'National Partnership Agreement' ('NPA') on CSG and Large Coal Mining Development was negotiated and came into effect – it was this agreement which set up the IESC (explained further in (b) below) and asked states and territories, and the Commonwealth, to refer to it proposals that might affect water resources.[65] Thus, the comment is expressing that the water trigger was a necessary follow-on from the NPA, which expired in 2014. According to a review of the NPA, the vast majority of proposals referred to the IESC were referred by the Commonwealth, or jointly by Queensland and the Commonwealth, with only six out of 25 referred by states and territories.[66]

One commentator, Whitehead, reported that the water trigger has been framed as at once a 'channel for up-to-date science and cumulative impacts; as a safeguard against conflicts of interest and poor

[62] In 2003, national heritage places was added; in 2008, activities within the Great Barrier Reef Marine Park was added.
[63] The Senate Environment and Communications Legislation Committee, Parliament of Australia, *Environment Protection and Biodiversity Conservation Amendment Bill 2013* (2013).
[64] Australian Government Department of the Environment and Energy, *Water Resources – 2013 EPBC Act Amendment – Water Trigger* <http://www.environment.gov.au/epbc/what-is-protected/water-resources>.
[65] State of New South Wales, State of Victoria, State of Queensland, State of South Australia and the Northern Territory of Australia, *National Partnership Agreement on Coal Seam Gas and Large Coal Mining Developments* (Council of Australian Governments, 2011).
[66] Australian Government Department of the Environment, *National Partnership Agreement on Coal Seam Gas and Large Coal Mining Developments - Clause 21 Report* (Commonwealth of Australia, 2014).

decision-making; and as an unnecessary and blatant legislative overreach'.[67] Indeed, there was also community concern about the impacts of the proposed trigger itself, as then federal Environment Minister Greg Hunt addressed in the Bill's second reading speech.[68] Hunt said of the trigger:

> what we see here is a process which has a good intent but which, in many respects, is deeply duplicative of current state processes. In addition, the legislation adds a layer of bureaucratic tape. It increases approval times, and many have warned that it makes Australia a less desirable place in which to invest.[69]

Public concern that state and territory governments are likely to be subject to a conflict of interest is an important reason supporting the trigger. A conflict may arise where state-level governments serve to benefit financially from their own project approvals despite environmental harms that may be felt further than the geographical bounds of the state or territory. This concern is particularly relevant where prior history has not engendered sufficient confidence that state and territory governments will make good decisions based on the public interest. There is no reason in theory, however, why state- and territory-level legislation cannot be considered a channel for up-to-date science and cumulative impacts.[70]

Regarding the 'legislative overreach' framing, the trigger has been described as essentially having the effect of 'redistribut[ing] a defined portion of State authority to the Commonwealth'.[71] There is no obvious constitutional reason why the EPBC Act cannot be expanded to cover water resources where the protection is based on actions linked to the Commonwealth. Only the courts have the authority to hold otherwise. From a practical perspective, this redistribution is essentially what happens when a new MNES is created.

On 30 November 2015, an issues paper sought public submissions on the water trigger as part of an independent 'post-implementation' review. Of 100 submissions, the majority tended to favour retention of the trigger either in its present form or with modifications such as an expansion of the trigger's scope. Common provisions advocated for by environment groups[72] included:

(i) An extension of the trigger to apply to all unconventional gas developments;
(ii) A requirement that the Minister act consistently with the advice provided by the IESC;
(iii) A requirement that the Minister should not be able to approve any project without having first addressed any concerns raised by the IESC;
(iv) A requirement that the IESC have power to create binding guidelines and requisite standards;
(v) A requirement that the Minister refuse any development likely to have a significant impact on water resources; and

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[67] Isabelle Whitehead, 'Better Protection or Pure Politics? Evaluating the 'Water Trigger' Amendment to the EPBC Act (2014) *Australian Environmental Law Digest* 23, 36.
[68] Commonwealth, *Parliamentary Debates*, House of Representatives, 20 March 2013, 2818 (Greg Hunt).
[69] Ibid.
[70] On the topic of federalism leading to a 'race to the top' where interjurisdictional competition may enhance public policy see, eg, Jonathan H Alder, 'Interstate Competition and the Race to the Top' (2013) 35 *Harvard Journal of Law & Public Policy* 89.
[71] Whitehead, above n 67, 25.
[72] See EDO North Queensland, Submission No 4 to Australian Government Department of the Environment, *Independent Review of the 2013 EPBC Act Amendment – Water Trigger*, 28 January 2016; Humane Society International, Submission No 5, 28 January 2016; Nature Conservation Council of NSW, Submission No 11, 29 January 2016; Lock the Gate Alliance, Submission No 12, 27 January 2016; Friends of the Earth, Submission No 17 (undated); Wilderness Society NSW, Submission No 21, January 2016.

(vi) A pause on further project assessments until bioregional assessments are complete.

These concerns demonstrate clear support for the role of the IESC, and the notion that the Minister should not be able to approve projects independently of the IESC's recommendations, advice and potentially also requirements. Notably, a strong role for IESC advice was supported by Geoscience Australia.[73]

Point (v), which was supported by the Environment Defenders Office Queensland,[74] is essentially a call for modification of the nature of the trigger – instead of triggering the EIA assessment and approval process, it would trigger an automatic rejection of an application. It is unlikely that this would happen through the EPBC Act. Rather, the same result could be achieved through separate legislation such as fracking-specific regulations (or a ban or moratorium on fracking altogether). Others did utilise the review process to call for a moratorium or express prohibition on fracking.[75]

The final point (vi), raised by Lock the Gate, relates to the federal government's 'bioregional assessments', which it is presently conducting on a number of regions in NSW, Queensland, and South Australia. These assessments aim to provide detailed descriptions of the particular region's ecology, hydrology, hydrogeology and geology in order to understand water resources in a more holistic way.[76] They will also provide information pertaining to impact analysis in relation to the CSG and large coal mining development category of proposals (including direct, indirect and cumulative impacts), to risk analysis, and to modelling and data analysis.[77] The Environment Defenders Office network stressed that it was crucial that the information acquired through strategic assessment including the bioregional assessments should inform decision-making under the water trigger, particularly with respect to cumulative impacts.[78]

Agricultural bodies also expressed support for the trigger – for example, strong support for its retention was articulated by Cotton Australia,[79] while the Sustainable Agriculture and Communities Alliance argued that the trigger should be expanded to cover water extraction.[80] As polluted water resources directly affect the agriculture sector (see Chapter 3), this is unsurprising.

The Humane Society International stressed the value of the trigger with respect to Commonwealth oversight over state and territory-approved mining and CSG developments. It argued that it represented an important aspect of the 'check and balance' system,[81] echoing the Environment Defenders Offices network, which used its submission to explain the view that the trigger was a necessary response to public concerns over inadequate state and territory regulation.

Arguments against the trigger were represented by the Minerals Council of Australia. The Council stated that the trigger was contrary to government policy as it restricts bilateral approvals; that it is poorly targeted given that only two industries are implicated (interestingly this is the same rationale supporting an expansion of the trigger's scope by environmental groups, expressed at point (i) above);

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[73] Geoscience Australia, Submission No 70, 29 January 2016.
[74] EDO North Queensland, above n 72.
[75] See, eg, Woollondilly Shire Council, Submission No 1, 18 January 2016.
[76] IESC, *Advice on Bioregional Assessments* (12 December 2014) <http://www.iesc.environment.gov.au/bioregional-assessments>.
[77] For further information, see the Bioregional Assessments website <http://www.bioregionalassessments.gov.au/>.
[78] EDO NSW, Submission No 8, 29 January 2016, 8.
[79] Cotton Australia, Submission No 15, 29 January 2016.
[80] Sustainable Agriculture & Communities Alliance, Submission No 20, 30 January 2016.
[81] Humane Society International, above n 72, 2.

that it duplicates state legislation; and that it will operate to delay projects with costs to industry.[82] The Australian Petroleum Production and Exploration Association ('APPEA') also opposed the trigger, submitting that state processes – particularly in Queensland and NSW – were sufficiently comprehensive.[83] AGL submitted that the water trigger was unnecessary based on existing state protections but argued that if it is retained, 'a tiered assessment system whereby low value and less productive groundwater systems with little surface expression are filtered out' should be implemented,[84] commenting that '[i]t is inefficient for [the Department of Environment] and the IESC to be assessing negligible impact developments'.[85] Though AGL apparently intended this tiered system to be a proposed change to the current trigger, no change is required to achieve AGL's 'filtered' outcome – those water resources not likely to be significantly impacted, or which would only be 'negligibly' impacted, do not trigger the EPBC Act.

The independent review was tabled in mid-2017, and supported the submissions that favoured retaining the trigger, noting that the water trigger is an appropriate measure to address a regulatory gap, though it called for a review of approved projects to assess whether the conditions attached to those projects had been effective in minimising risk.[86] It avoided a recommendation that the trigger should be expanded to cover shale and tight gas by effectively noting that the trigger's future expansion was not within the review's scope, and it found that the role of the IESC was appropriate at present.[87]

(b) Present Formulation

The water trigger is essentially encapsulated in ss 24D and 24E of the EPBC Act. Section 24D prohibits constitutional corporations, the Commonwealth, or a Commonwealth agency from taking an action if it involves a CSG development or a large coal mining development, and if it will or is likely to have a significant impact on a water resource. Section 24E creates an offence for taking such an action and prescribes penalties.

An important thing to note about these provisions is the restriction in scope, alluded to above: the prohibition only applies to constitutional corporations, the Commonwealth and Commonwealth agencies. In practice, this is likely to cover almost all developments, as a 'constitutional corporation' means 'foreign corporations and financial corporations formed within the limits of the Commonwealth'.[88] However, the reason it is worth noting is that this restriction evinces a clear intention to link the trigger with heads of power under the *Australian Constitution*:[89] only matters that align with a constitutional head of power can be regulated at the federal level according to Australian law. This distinguishes the water trigger from the majority of the other triggers, which are constitutionally linked to the 'external affairs power' on account of their dealing with matters reflected in international treaties to which Australia is signatory.

Unlike each of the other MNES, actions that enliven the water trigger are always subject to specific federal approval, and cannot be exempt on the basis that a state or territory assessment was carried out. In relation to each of the other MNES, s 29 of the EPBC Act operates to allow state and territory

[82] Minerals Council of Australia, Submission No 99, 12 February 2016.
[83] APPEA, Submission No 96, 5 February 2016.
[84] AGL, Submission No 33, 27 January 2016, 2.
[85] Ibid.
[86] Hunter, above n 1.
[87] Ibid.
[88] *Commonwealth of Australia Constitution Act 1901* (Cth) ('*Australian Constitution*') s 51(xx).
[89] Namely, the corporations (s 51(xx)) and trade and commerce (s 51(i)) powers.

assessments to be 'accredited' on the basis of a bilateral agreement between the Commonwealth and the particular state or territory that stipulates that a state or territory management arrangement or authorisation process is sufficient. This, as Hunt noted, means that there may be potential duplication – an action likely to impact a water resource might require assessment and approval at both the state and territory and the federal levels. Because the Minister can refer to information that is relevant to likely impacts when making his or her decision,[90] however, the duplication does not necessarily mean that information and documentation derived from the state or territory assessment, if sufficiently comprehensive for the federal assessment, could not form the basis of the federal assessment, or that the approval process timing could not overlap. This aspect of the trigger has been criticised on the basis of adding potential costs and time burdens to the approval process.[91]

A final key point is that the trigger is linked with the IESC. Pursuant to s 131AB, the Minister must seek advice from the IESC in relation to actions which enliven the trigger. Any advice provided to the Minister by the IESC 'must' be 'taken into account' when the final decision is made.[92] Thus, the Minister would not be complying with the EPBC Act if he or she failed to take into account advice provided by the IESC.[93] However, case law in other areas of EPBC Act jurisprudence indicate that 'taking into account' a factor does not necessarily mean acting in accordance with it.[94] As noted above, this is reflected in the concerns expressed through the public submissions process associated with the trigger's review.

The manner in which the water trigger is applied by Ministers is likely to influence the way in which it is interpreted by courts in judicial review. Courts tend to defer to the approach taken by Ministers – where a Minister is not considered to have exceeded the limits of his or her power. Thus, any application of the trigger by the federal government is likely to be a reasonable indicator of how the trigger may be applied in future cases. A Minister may, as determined by a court, exceed the limits of power prescribed by the EPBC Act in a number of ways, the most likely of which is an 'improper exercise of power' on the basis of failing to consider a 'relevant' consideration, considering an 'irrelevant' consideration, making a decision in bad faith, or making a decision so unreasonable that no reasonable person would have made it.[95]

The government *Significant Impact Guidelines* ('*Guidelines*') provide a relatively (compared with the other MNES) detailed map of the likely relevant considerations in relation to the water trigger. First, the *Guidelines* emphasise the importance of considering the 'value' of the water resource, as a precursor to assessing significance. This is defined to mean its 'utility for all third party uses, including environmental and other public benefit outcomes'.[96] Examples given are couched in the language of 'ecosystem services', an environmental sciences/environmental economics field of research and practice that has gained significant traction in influencing management and policy outcomes in recent

[90] EPBC Act s 136.
[91] See the submissions provided to the 2016 review of the trigger, discussed above and available at <www.environment.gov.au/epbc/what-is-protected/water-resources/review>.
[92] EPBC Act s 136.
[93] The ramification would be that a party could sue the Minister in administrative law under the *Administrative Decisions (Judicial Review) Act 1977* (Cth).
[94] See, eg, *Australian Conservation Foundation Inc v Minister for the Environment* [2016] FCA 1042, 175-186.
[95] *Administrative Decisions (Judicial Review) Act 1977* (Cth) s 5(1)(e), (2).
[96] Australian Government Department of the Environment, *Matters of National Environmental Significance - Significant Impact Guidelines 1.3 – Coal Seam Gas and Large Coal Mining Developments* (Commonwealth of Australia 2013), 17.

years.[97] These services include provisioning services (which the *Guidelines* suggest might include the use of water for other industries or for drinking), regulating services (such as climate regulation or the stabilisation of coastal systems), cultural services (including recreation, tourism, science and education), and supporting services (such as the maintenance of ecosystem function, defined to include 'the ecosystem components, processes and benefits or services that characterise the water resource, including support for the biological diversity or species composition of the water resource').[98] As is evident from the examples, thinking about ecosystem services in this manner is likely to facilitate a systems-based approach, however, whether or not an appropriate response is actually effected will depend upon the decision-maker's ability to apply the concepts.

The *Guidelines* secondly set out two main categories of impact, and what a decision-maker or proponent should consider in relation to each. These are changes in hydrological characteristics, and changes in water quality, where the changes are 'of sufficient scale or intensity as to significantly reduce the current or future utility of the water resource for third party users, including environmental and other public benefit outcomes'.[99] Detecting hypothetical changes in hydrological characteristics means considering, *inter alia*, flow regimes, groundwater recharge rates, aquifer pressure or pressure relationships between aquifers, river-floodplain connectivity, inter-aquifer connectivity, coastal processes, water circulation patterns, permanent alterations in tidal patterns, or substantial changes to water flows or quality in estuaries.[100] Detecting hypothetical changes in relation to water quality means considering the quality of water in relation to any existing standard, including state and territory laws and specifically the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*, but also whether or not the proposed action would create a risk to human health, animal health, or to the natural environment via a change in water quality. It is also relevant to consider whether the action is likely to cause persistent organic chemicals, heavy metals, salt, or other potentially harmful substances to accumulate in the environment.[101]

Finally, the *Guidelines* refer to 'other considerations' which include cumulative impacts, timing, and scale. Cumulative impacts are the separate subject of Chapter 6; briefly, the *Guidelines* specifically state that cumulative impacts need to be considered,[102] and that relevant cumulative impacts may be impacts caused by other industries, not necessarily upstream of the proposed project, and across varying locations, and may be caused either by existing or future developments.[103] With regard to timing and scale, the *Guidelines* note that some impacts may have a delayed onset that extends beyond the life of the project, and that it is necessary to consider water resource connectivity when thinking about the scale of a potential impact.[104]

Clearly, the *Guidelines* target concerns related to fracking projects, as fracking is one of the two industries to which they specifically apply. Matching what is required to be considered, above, with the impacts identified and described in Chapter 3, it can be seen that real-life impacts such as those

[97] See, eg, Guy Woodward and David A Bohan (eds), *Ecosystem Services: From Biodiversity to Society* (Academic Press, 2015); Karsten Grunewald and Olaf Bastian (eds), *Ecosystem Services: Concept, Methods and Case Studies* (Springer, 2015).
[98] Australian Government Department of the Environment, above n 96, 16.
[99] Ibid, 17.
[100] Ibid.
[101] Ibid, 18.
[102] But see *Tarkine National Coalition Inc v Minister for the Environment* [2015] FCAFC 89 (Jessup J), discussed in Chapter 5, which implies that cumulative impacts have, in his opinion, only a limited scope of relevance under the EPBC Act.
[103] Australian Government Department of the Environment, above n 96, 20.
[104] Ibid 20-21.

that have occurred and which have been studied in greater detail in the US should theoretically be accounted for if proper consideration of impacts is conducted in accordance with the Australian *Guidelines*. If the *Guidelines* are properly applied, taking into consideration the matters and concepts outlined, and, further, if the bioregional assessments successfully achieve their mandate and the information from these assessments (once complete) then successfully informs and influences decision-making, then the decision-making system formed by the water trigger should be able to inform responsible, systems-focussed decision-making equipped to manage risks in relation to CSG and large coal mining developments.

(c) Limitations

As identified, the trigger is narrow as far as environmental protection from fracking goes, as it only covers CSG fracking and not fracking for gas in other formations such as shale and tight formations. While the majority of fracking in Australia is currently for CSG, a likely expansion of the natural gas sector in Australia will be to include shale fracking. At present this would be unprotected by the water trigger, even though shale fracking activities would pose a potentially significant threat to water resources (see Chapter 3). As the reasons for protecting water resources from CSG fracking and large coal mining developments also apply, arguably equally, to shale fracking developments and other forms of natural gas extraction, the trigger should be expanded to avoid a problematic legal gap.

There are other limitations based on the narrowness of the present trigger's scope. These include the extent to which the trigger applies to issues of water quantity, given the fact that water is 'fully consumed' in the fracking process (unlike other industries), and the extent to which it applies to indirect impacts which, depending on how the project is framed, may include wastewater disposal. Water quality *should* be covered by the trigger, if the *Guidelines* are followed,[105] though the Minister does not necessarily need to follow and courts are not bound by these guidelines. The EPBC Act is silent on the difference between quality and quantity-related impacts. A discussion of indirect impacts is presented in Chapter 5 in relation to climate impacts; suffice to say here that indirect impacts are relevant in limited circumstances as prescribed by s 527E which in theory should cover foreseeable secondary actions and impacts such as contamination that results from disposal processes. Again, however, there is no specific mention in the EPBC Act of wastewater disposal.

A final limitation is one that is inherent in the EPBC Act's systemic process, but one nonetheless worth reiterating – namely that a trigger is not a mandate to make a decision in a certain way, rather, only to examine the environmental impacts of a project and weigh those against other politically important factors such as social and economic factors.[106] The cases already mentioned which approved projects likely to have a significant adverse environmental impact illustrate that environmental considerations are not always paramount.

Those who favour a greater role for the IESC are essentially advocating for 'science' to have a stronger influence compared with pure 'politics' than is the case presently in this process. Not all proponents of the trigger nor of a greater influence for IESC advice would have the IESC *dictate* decision-making. But requiring the Minister to *address* IESC concerns in his or her reasons for decision could represent a balanced approach likely to increase transparency and public confidence in the decision-making system, and at the same time be more likely to lead to outcomes with reduced environmental risk. If the Minister were not considering the IESC advice then he or she would not be discharging his or her duty under the EPBC Act. Accordingly, addressing it should not require significant extra encumbrance

[105] Ibid 16.
[106] EPBC Act s 136.

for the trade-off of greater transparency and ultimately accountability. One practical way to address concerns would be to explain how they will be eliminated or mitigated through, for example, the imposition of conditions on approval.

III FRACKING AND WATER PROTECTION IN THE US

A *Overview*

It is useful to turn to the US to look at how that jurisdiction – which has been grappling with fracking related issues for many years now – has dealt with the protection of water resources. This assessment will gauge whether any lessons are able to be translated from the US experience to Australia.

As Chapter 1 outlined, the US system for environmental protection through EIA is similar to Australia's in some respects. A process of impact assessment that includes a consideration of various relevant social, economic and scientific factors is required, and approvals happen at both state and federal levels. In other key respects it differs. A pertinent difference applicable to the present context is the fact that the environment is relevant for assessment in a general sense at the federal level, as opposed to only certain protected matters. Rather, the limitation of scope in the US is due to whether or not a federal nexus can be established[107] in each case. Typically, the required nexus can be established where the proposal is undertaken by a federal agency, or on federal lands. The principal piece of environment legislation in the US, which prescribes, along with its Regulations,[108] the impact assessment process, is, as Chapter 1 explained, NEPA.[109]

The relevance of the NEPA system for water resource management is that water resources fall within the auspices of the environmental assessment requirements at the federal level in the US without any requirement that proposed impacts come from a particular source (such as coal-related developments) or affect a particular type of place (like the water resources of a protected wetland). Unlike the Australian context through the EPBC Act (which, as has been explained, creates penalties for undertaking actions without permission as well as prescribing an EIA process), significant federal-level protections are also offered through legislation external to NEPA. For example, drinking water resources are further protected through the *Safe Drinking Water Act*,[110] while endangered and threatened species are further protected through the *Endangered Species Act*,[111] which requires federal agencies to consult with the Fish and Wildlife Service where their actions might significantly impact endangered and threatened species including through the modification of critical habitat. The extent of these federal protections in terms of application to fracking operations depends on whether and to what extent their scope is restricted, and whether and to what extent that restricted scope operates to exclude fracking activities.

Fracking is generally viewed in the US as a matter for state level governance, and only in rare situations is federal law implicated. The present position in the US is that its Congress lacks the ability to introduce further regulations for fracking at the federal level. [112] Existing federal regulations which might otherwise apply have significant 'carve-outs' that effectively exempt fracking from their

[107] 'Major federal actions' are covered by NEPA: the meaning of this term, including what is likely to establish the federal component of this requirement, can be garnered from the Regulations: 40 CFR §1508.18.
[108] 40 CFR §§1500-1508.
[109] 42 USC ch 55.
[110] *Safe Water Drinking Act of 1974* 42 USC §300 et seq.
[111] *Endangered Species Act of 1973* 16 USC 1531 et seq.
[112] *State of Wyoming v US Department of the Interior* (Wyo, No 2:15-CV-043, 21 June2016) slip op.

application either per se or in specific circumstances. The *Energy Policy Act*,[113] introduced in 2005 by the Bush administration, was infamous for carving out exemptions to federal environmental protection laws for the fracking industry which relate to water resources. It created an exemption under the *Clean Water Act*[114] that allows the oil and gas industry to dump waste into waterways such as streams without requiring a permit, and an exemption under the *Safe Drinking Water Act* meaning regulations relating to underground injection control programs may not apply to the fracking industry (known as the 'Halliburton Loophole').[115]

The *Energy Policy Act* also served to create a rebuttable presumption under NEPA that certain fracking projects[116] do not require EIA in the form of an impact statement – that is, a presumption that no environmental impact statement is required unless it can be established that there is a risk to the environment. In *Wyoming v US Department of the Interior*,[117] the Wyoming District Court commented that the *Energy Policy Act* 'explicitly removed the only source of specific federal agency over fracking'.[118]

Though it was not created by the *Energy Policy Act,* there is also a gap under the *Resource Conservation and Recovery Act*,[119] known as 'RCRA'. Certain fracking wastes do not fall within the category of hazardous wastes that require management under the Act. Ordinarily, RCRA operates to regulate the disposal of hazardous wastes, but an exemption for oil and gas wastes means that frack fluids and other forms of contaminated water, or water contaminants, do not fall within its auspices. Accordingly, hazardous waste disposal is left to the states, which manage the issue variously.

Finally, there was initially considered to be a gap under the *Comprehensive Environmental Response, Compensation, and Liability Act*,[120] known as 'Superfund', because parties responsible for petroleum product spills are not liable for clean-up under Superfund. However, the US EPA is authorised to intervene and require that such spills are cleaned up under Superfund, and it has exercised its power to do so in fracking cases.[121] Ongoing changes in the US EPA under the present Trump administration cast doubt as to how this discretion is likely to be exercised in future.

B *Federal Law and Fracking – From Obama to Trump*

Reflecting on the changes in US law that have occurred over the past decade as fracked natural gas and oil have become an increasingly prominent source of US energy reveals challenges associated with the question of how water resources can be protected in the face of shifting political priorities and demands that do not necessarily relate to water, but rather, to the appeal of an economy based on carbon resources rather than alternatives, which in turn has necessary implications for water resources. As these concerns are also applicable to the Australian context, so too will the challenges be, albeit in a different iteration.

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[113] *Energy Policy Act of 2005* 42 USC §13201 et seq.
[114] *Clean Water Act of 1972* 33 USC §1251 et seq.
[115] For discussion and a summary of amended provisions, see Renee Lewis Kosnik, *The Oil and Gas Industry's Exclusions and Exemptions to Major Environmental Statutes* (Earthworks, 2007).
[116] See *Energy Policy Act of 2005* 42 USC §14942.
[117] *State of Wyoming v US Department of the Interior* (Wyo, No 2:15-CV-043, 21 June2016) slip op.
[118] Ibid, 25.
[119] *Resource Conservation and Recovery Act of 1976* 42 USC §6901 et seq.
[120] *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* 42 USC §9601 et seq.
[121] See US Government Accountability Office, *Unconventional Oil and Gas Development – Key Environmental and Public Health Requirements* (5 September 2012).

When the major increase in US fracking activity was in its relative infancy, and public concern was mounting, the US EPA commenced a study on the impacts of fracking on drinking water. Drinking water quality was an initial key focus of the fracking debate,[122] and thus the study reflected an important political – as well as health and environmental – priority. This comprehensive, long-term study based on a large collection of scientific information was finalised in 2016, culminating in an extensive report.[123] The report essentially concluded that fracking may negatively impact drinking water resources, with more information still required to draw any final, quantifiable conclusions. In June 2016, the US EPA published guidelines applicable to the discharge of wastewater pollutants from unconventional oil and gas sources into publicly owned treatment works.[124] Otherwise, and aside from the two attempted regulations described below, there has not been major political/legal consequential actions resulting from the US EPA's study.

In 2015, during the Obama administration, the Bureau of Land Management ('BLM') introduced a fracking law that would regulate the disclosure of chemicals, regulate well integrity casing and wellbore construction, and regulate water management and the disposal of fracking waste.[125] These became collectively known as the 'Fracking Rule'. In mid-2016 the Fracking Rule was held to be invalid, with the Wyoming District Court finding that the BLM had not been delegated legal authority by Congress to regulate fracking. It also noted that, '[t]he issue before this Court is not whether hydraulic fracturing is good or bad for the environment or the citizens of the United States'.[126] The Obama administration had appealed the finding, but in late 2017, the Trump administration repealed the Fracking Rule. In early 2018, California filed a suit contesting the repeal.[127]

In December 2016, a new 'Stream Protection Rule' was introduced that aimed to ensure the protection of stream water resources from pollution through waste dumping.[128] This rule would have applied to fracking waste. In February 2017, it too was repealed by the Trump administration.[129] Additionally in December 2016, a new rule called the 'Planning 2.0' rule was introduced in order to improve BLM's environmental review process to better incorporate landscape-scale management, incorporate up-to-date science, and incorporate public input,[130] each important components of the fracking review process. The Planning 2.0 rule has also since been repealed under the Trump administration.[131]

A further example that demonstrates the effects of political change is the rejection and subsequent approval of the Keystone XL pipeline proposed to run between the US and Canada. The Obama administration had rejected the pipeline,[132] the Environmental Impact Statement for which revealed

[122] This can partly be attributed to media campaigns and documentaries, including particularly the *Gasland* documentary (Josh Fox, 2010).
[123] US EPA, *Hydraulic Fracturing for Oil and Gas: Impacts from the Hydraulic Fracturing Water Cycle on Drinking Water Resources in the United States*, EPA-600-R-16-236Fa (US EPA Office for Research and Development, 2016).
[124] *Effluent Guidelines and Standards – Oil and Gas Extraction Point Source Category* 40 CFR §435 et seq.
[125] *Oil and Gas; Hydraulic Fracturing on Federal and Indian Lands* 80 Fed Reg 16128 (26 March 2015).
[126] *State of Wyoming v US Department of the Interior* (Wyo, No 2:15-CV-043, 21 June2016) slip op 2.
[127] Nicola Groom, 'Update – California Sues Trump Administration for Repeal of Fracking Rules', *Reuters* (online) 25 January 2018.
[128] 81 Fed Reg 93006 (19 January 2017), now repealed.
[129] Via HRJ Res 38; *Congressional Review Act*, 5 USC §801.
[130] 81 Fed Reg 89580.
[131] HRJ Res 44 was passed by the House in February 2017, was passed by the Senate in March 2017, and has since been signed.
[132] 'Statement by the President on the Keystone XL Pipeline', Whitehouse Office of the Press Secretary, 6 November 2015.

potential significant impacts to water resources.[133] However, it was subsequently approved under President Trump,[134] without any further environmental impact analysis.

As the Trump administration is still in its first term at the time of writing, it is difficult to forecast what further changes can be expected with relation to the impact of fracking on water resources in the US and whether federal regulation will play a part in water resource protection in future. In March 2017, President Trump signed an Executive Order on promoting energy independence and economic growth, which required a review of environmental regulatory 'burdens' affecting fracking and other energy development.[135] In October 2017 the EPA released a report on its review, which included a short section at the conclusion of the report identifying a 2015 ruling that changed the *Clean Water Act* definition of 'waters of the United States' as a potential regulatory burden on natural gas permitting.[136]

Because NEPA has limited application in practice in the fracking context in the US, the effect of other federal protection legislation, carve-outs, and abolition of protections are significant and determine how much of the control over fracking is effectively left to the states. For a given fracking project in the water context, state-level EIA requirements and other state-level environmental protections will in most cases be the principal operative regulations – if they apply at all.

C *Case Examples*

Most environmental fracking cases in the US are brought in the state courts, pursuant to individual state environmental protection laws. This is because, as indicated above, most fracking actions are not considered to have a federal nexus and/or are excluded from federal control on account of the exemptions just discussed. Accordingly, fracking law in the US is highly fragmented and dependent on how strictly worded, interpreted, and enforced particular state protections are. Below, selected key water-related issues are explored. This is not a comprehensive summary of the US case law, rather, a selection of examples to demonstrate some of the main types of legal problems that arise.

Table 3.2, *US Case Examples*

Type of case	Notes	Example
Groundwater contamination and human health	Claims that relate to human health rather than environmental protection are likely to be brought as private suits in tort law.	$4.2 million USD was awarded to eight Pennsylvania residents who lived in proximity to fracking operations on the basis of 'inconvenience and discomfort' suffered as a result of the contamination.[137]
Challenge to issuance of permit on account of	When a government department issues a permit, a private or public party or group may sue the department arguing that the	A Pennsylvanian water authority sued the Department of Environmental Protection for issuing a drilling permit following an incident where a fracking well stopped flowing for 29

[133] Department of Energy, Final Environmental Impact Statement for the Keystone XL Project, EIS-0433 <www.energy.gov>.
[134] Office of the Spokesperson, Washington DC, 'Issuance of Presidential Permit to TransCanada for Keystone XL Pipeline' Media Note, 24 March 2017.
[135] White House, Presidential Executive Order on Promoting Energy Independence and Economic Growth' 28 March 2017, section 2.
[136] US EPA, Final Report on Review of Agency Actions That Potentially Burden the Safe, Efficient Development of Domestic Energy Resources Under Executive Order 13783' 25 October 2017.
[137] *Ely v Cabot Oil & Gas Corporation* (Md Pa, No 3:09-CV-02284, 10 March 2016) slip op.

water concerns	permit should not have been granted.	hours causing what the Department had initially thought might be a violation of local laws. Because no violation was found, the court allowed the permit in spite of the concerns about risk, on the basis that the landowner 'failed to prove or even argue that any environmental harm that will result from the drilling of the [well in question] will so clearly outweigh the benefits to be derived from the drilling that the issuance of the [permit] constitutes an abuse of discretion'.[138]
Wastewater disposal	Improper waste water disposal may lead to contamination that represents a failure under environmental legislation or which causes private harm. Where wastewater has not yet caused harm, some US state laws allow an action to be brought challenging the approval to dispose of the water in a particular waterway, such as where disposal is permitted through underground injection.	The Center for Biological Diversity sued the Californian agency responsible for approving an aquifer exemption under California's *Safe Drinking Water Act*[139] which meant that fracking waste could be injected into new and reworked wells,[140] on the basis that doing so meant improperly bypassing the *California Environmental Quality Act*.[141]
Threatened aquatic species	Litigation may challenge an action such as the granting of an approval for a fracking project based on species protection provisions.	In 2016, a notice of intent to sue was sent to the BLM and the US Fish and Wildlife Service by three environmental groups on the basis that those agencies violated the federal *Endangered Species Act* in authorising oil and gas exploration and development in the Upper Colorado River Basin, because they allegedly failed to consider threats posed by water depletion and spill impacts on certain endangered species and their habitat.[142]

[138] *Brockway Borough Municipal Authority v Pennsylvania Department of Environmental Protection* (Pa Commw Ct, No 789 CD 2015, 6 January 2016) slip op.
[139] Cal Health & Safety Code §116270 et seq.
[140] *Center for Biological Diversity v California Department of Conservation, Division of Oil, Gas, and Geothermal Resources* (Cal Super Ct, No 16CV-0353, 3 August 2016) slip op.
[141] Cal Public Resources Code §§21000–21189.
[142] Email from Wendy Park et al, Center for Biological Diversity, to Daniel Ashe, Director US Fish and Wildlife Service, Neil Kornze, BLM Washington Office and Sally Jewell, Secretary of the Department of the Interior, September 12, 2016.

A related issue that has been litigated in the US on numerous occasions, also in a broader context, is whether local laws can apply notwithstanding state laws with which they would otherwise conflict. The result tends to depend upon the relevant state's constitution and whether or not it is considered to 'pre-empt' local laws. Prior to New York's fracking moratorium, it was held that local fracking bans could apply notwithstanding that fracking was allowed under state law.[143] But this type of disparity is not allowable in all states. In West Virginia, for example, it was held that state law which prohibited permitting programs from impeding the underground injection of wastewater pre-empted (thus overrode) a local law in the form of a county ordinance banning the storage of fracking waste at drilling sites.[144] The court said,

> the state of West Virginia has concluded that oil and natural gas extraction is a highly valuable economic activity subject to centralized environmental regulation … To that end, plenary power over oil and gas activities in the state is given over to the [relevant state department]... In the absence of an express grant of authority to the contrary, or the necessary implication of such authority flowing from an express grant, the [defendants] cannot interfere with, impede, or oppose the state's goals. Consequently, the [defendants lack] the power to legislate in conflict with the state in this area. Those parts of the [local law] that prohibit disposal of wastewater in [underground injection control] wells conflict with and stand as obstacles to state law, and hence are void.[145]

This is an example demonstrating regulatory fragmentation in the US, and the influence of conflicting political priorities, which vary by location, on environmental protection.

IV IMPLICATIONS AND FUTURE PRIORITIES

A *Lessons from the US*

The political situation in the US is somewhat extreme; it serves and will likely continue to serve well to demonstrate the limits of the legal system and, specifically, to demonstrate the reality of the separation of powers between the executive, legislature and judiciary in practice. Although with the change in administration from former President Obama to President Trump there was a quick repeal of rules by executive order, widescale legislative change takes time and is subject to challenge through the court system. It remains to be seen what longer-term changes will affect regulations that serve to protect water resources from fracking.

Nevertheless, it can be postulated that if water resources were protected only at the federal level, there would be potential problems in terms of the security of protection associated with such a major political change as the one observed with the change in administration. Thus, the US context demonstrates that while there may be challenges associated with solely state-based regulation, there would also be problems if environmental protections existed only at the federal level. The dual system, though frustratingly complicated and in some instances unnecessarily piecemeal, provides, in theory, a capable safeguard, whereby states have regulatory freedom that is checked by basic federal prohibitions. This is not to suggest that federal protection in the US is presently likely to 'pick up any slack' on the part of the states, because federal protections are limited in scope to cover only those operations that have a federal connection or nexus, and which do not in practice exclude fracking

[143] *Wallach v Town of Dryden* 16 NE 3d 1188 (NY, 2014); for a discussion, see 'Wallach v Town of Dryden' (2015) 128 *Harvard Law Review* 1542.
[144] *EQT Production Co v Wender* (SD W Va, No 16-00290, 10 June 2016) slip op.
[145] Ibid, 44.

operations. However, if serious water resource issues were occurring in a particular state or in multiple states, either that state's law, or federal law, (or both) could be called upon to remedy the problem. Federal law carve-outs could be reversed, so that a greater array of environmental protection laws applied, while state protections could be tightened notwithstanding a lax federal system. A similar duality applies in the US between local and state governance, but differences in these two types of regulation typically represent a conflict of priorities rather than a safety net, except where local laws are able to pre-empt state laws.

Australia also benefits from having a federal-state 'check and balance', and the federal water trigger is a direct example of the federal-state system being utilised to tackle an identified problem: lax state regulation needing to be countered by stronger federal control. In the reverse, that some states in Australia have banned fracking demonstrates perceived inadequacies (whether in content or in scope) of *federal* regulation needing to be countered by stronger state control. In the EIA context, an important aspect of the water trigger is that it applies in addition to state-level EIA and state protections. Unlike with respect to the other triggers, state assessments cannot be accredited at the federal level.

What the US context also serves to demonstrate is how environmental protection is so greatly at the behest of political motives not necessarily related to the environment per se, a phenomenon also observable in Australia. Yet, both energy security and water security are and will continue to be major, escalating issues in the short, medium and long-term futures, with the unfortunate water-energy nexus dichotomy that greater energy security is likely to result in threatened water security, at least until fossil fuels are no longer the primary source of energy.[146] Both coal and natural gas, and the water-related risks associated therewith, are perfect examples. In order to manage the transition to a cleaner energy future effectively, stricter or at least better enforced water protection regulation will be required – despite the economic cost that this might impose in the short term. If fracking becomes more widespread in Australia and if Australia were to mimic the US approach of allocating the majority of fracking regulation to the state level, it would need to tighten state/territory level water resource protections significantly or risk serious environmental harm. The federal water trigger minimises this need to the extent that federal protection is presently more secure than is state protection.

Like the US, Australia may be faced with a number of potential types of lawsuit derived from water contamination, including in tort law as well as administrative environmental law, if or as fracking expands. The example types of case law referred to in Part IV above could each be relevant to the Australian context – claims in tort for human health concerns resultant from contaminated drinking water (and potentially also contaminated water used in agriculture), claims in administrative environmental law challenging the issuance of approvals such as permits to frack or to dispose of wastewater (depending on the legislative context and review avenues available), and environmental law challenges based on harm to threatened species or the environment more generally, which may be available via either state or federal law, or both. As Australia does not have a separate piece of federal legislation aimed at threatened species protection, any federal level challenges related to biodiversity would be brought under the EPBC Act. Fragmentation in terms of the array of possible water-related claims is experienced already in Australia with respect to coal mining, but the challenges are likely to be compounded with fracking, which threatens water resources, including deep groundwater resources, in different ways.

[146] See the above discussion in Part I, Section D.

B *Future Legal Priorities for Australia*

Assuming the water trigger is retained at the federal level, which is the course recommended by the independent review,[147] then issues of scope in terms of the coverage of all types of energy extraction and fracking projects which threaten water resources need to be addressed. The present protection only extending to large coal mining developments and CSG developments means that other types of natural gas extraction, including shale extraction, are not covered by federal law, creating a dual system which may have benefits but that presently contains problematic gaps.

Additionally, in order to be a successful regulatory measure, the trigger needs to be interpreted in such a way that responds to the concerns present at the trigger's inception, which essentially served as impetus for the creation of the trigger, and which were outlined in Part III. Namely, the federal trigger needs to provide protection that is more adequate in practice than is state/territory-level protection in ensuring the integrity of water resources and the environmental systems of which they form part.

If the water trigger were not to be retained, then the existing state and territory protections flagged as being potentially inadequate by the Senate Committee[148] would need to be addressed at the state/territory level in order for risk to be appropriately minimised. The water trigger is not a safeguard against fracking activities, and instead depends on the Minister to reject inappropriate developments and attach conditions to those that require them. It would be wise, therefore, to address state and territory concerns at the state/territory level even if the federal trigger is retained, or to consider a new federal water protection law akin to the US' *Safe Drinking Water Act* and/or *Clean Water Act*.

Addressing state/territory level concerns would require legislative review with a view to determining how to improve risk minimisation and reduce the influence of bias in relation to major project approvals. Some way to facilitate a systems-wide approach would ideally need to be incorporated into state and territory protections, particularly in the absence of a federal control – for example through inter-state/territory agreements, uniform protection provisions, or provisions which invite consideration of impacts beyond state and territory boundaries so as not to cause harm in other jurisdictions. The results of the bioregional assessments could inform state-based processes, which should be coupled with impact assessment guidelines that reflect the importance attributed by the federal *Guidelines* on significant impacts.

If uniform mandatory conditions applicable to all fracking projects (regardless of the jurisdiction in which they are approved) were to be introduced, including conditions that cover baseline sampling, post-implementation monitoring, reporting, and adaptive management to ensure water quality remains at an acceptable level during and beyond the life of the project (with reference, for example, to the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*) would be high priority. An appropriate basic benchmark could be that if a project cannot go ahead because it will not meet basic minimum standards, it should be seen as violating the public interest and not a viable project, at least in the absence of explicit justification to the contrary.

If the federal trigger is retained and appropriately expanded in scope, and if state/territory protections are also targeted, as this Chapter recommends, then it may be acceptable to introduce a bilateral approvals process for the water trigger, in line with the other triggers, in order to target the concerns relating to duplicated processes and unnecessary costs and delays. This is not to suggest that the

[147] Hunter, above n 1.
[148] The Senate Environment and Communications Legislation Committee, above n 63.

debates around the appropriateness of bilateral agreements generally should subside. The fact that bilateral agreements and accredited approvals processes need to adapt and be re-assessed every time state legislation changes is problematic, and there is persuasive merit to the argument that all impact assessment relating to MNES should be the responsibility of the federal Environment Department. But strengthening of state/territory-level protections and an expansion of federal scope would be necessary precursors if bilateral approvals are to be recognised in the water context.

V CONCLUSION

Harm to water resources is a serious and potentially significant risk associated with fracking operations. Water resources are critical for each of the ecological, social, and economic aspects of sustainable development, and they are a key component of the earth systems upon which all species directly or indirectly rely. While the volume of water in the total earth system is finite, its availability for human consumption and in freshwater sources accessible to other species for drinking water and critical habitat is declining on a global scale. In Australia, water availability is particularly endangered. This means that over-extraction and pollution, both risks presented in the fracking context, are likely to have very costly consequences if they materialise.

Avoiding risk materialisation requires good governance. At present, the fracking ban in Victoria and moratorium in Tasmania mean water resources are not threatened by fracking operations conducted in those jurisdictions. In the remaining states and territories, risk is managed by existing frameworks of state protections, partially complemented by the federal water trigger, which has only a restricted scope. This matrix of protections has two critical points of possible failure within current law. First, any water quality standards, however imposed, need to be enforced in order to prevent risk from materialising. Care must be taken to ensure that operations are conducted in such a manner as to facilitate compliance, monitoring for noncompliance needs to be vigilant, and adaptive feedback to remedy water quality failures must be in place. Second, and most relevant to this thesis, EIA procedures must be applied in line with their environmental objectives, such that protection of water resources is weighted as a critical imperative in approval decision-making, as compared with any competing economic and social matters.

Aside from the important issue of a limited scope that excludes shale and tight gas, federal Australian law is otherwise reasonably *equipped* to minimise and manage the risks to water resources posed by fracking (namely, CSG fracking). If the full 'value' of water resources are accounted for – their social, economic and ecological values in terms of the full suite of ecosystem goods and services that water resources are capable of providing, along with their 'intrinsic' value, taking into account also water scarcity – then it should be unlikely that any social or economic competing factor could outweigh the need for protection or warrant a situation where risk is likely to materialise. However, a combination of complex contextual factors – the approval statistics that indicate most projects are approved in spite of water concerns, the priorities that have been evinced through the review of the water trigger, and the way in which the EPBC Act allows for discretionary, politics-driven decision-making – raise concerns that in practice, the water trigger may not be sufficient to protect water resources at the federal level.

Part IV above suggested priorities for Australia. Strengthening legislation that targets water quality and water protection, as well as the EIA legislation that regulates the approval of projects, are necessary steps toward better governance of water resources to mitigate against the risks posed by fracking operations in Australia.

Chapter 5: Climate Change

This Chapter examines climate change law in Australia and in particular, the inclusion of climate change considerations in EIA. It is argued that impacts which affect the environment through influencing the climate system and thus contributing to the effects of climate change should be considered in the assessment of proposed actions. In order to ensure an assessment process that is able to provide comprehensive information to decision-makers on all relevant environmental outcomes, climate change – one of the greatest present threats to the environment in Australia and globally – cannot be excluded from the assessment process. This is essential to the fracking issue, as the climate change impacts of natural gas fracking are an integral component of fracking projects' overall environmental impact profile.[1]

Climate change may be defined as:

> a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.[2]

Part I of this Chapter elucidates Australian law's tendency to exclude climate change impacts resulting from downstream fossil fuel project emissions[3] from the EIA-based decision-making process. It analyses and applies coal cases – including the most recent Federal Court authority, *Australian Conservation Foundation Inc v Minister for the Environment* (the '*Adani*' case),[4]– to the fracking context, and reflects on how climate change is likely to be considered in fracking cases in Australia both with respect to direct and indirect emissions under existing law. Fossil fuel extraction such as gas fracking is a necessary precursor to fossil fuel combustion and the supply chain that delivers energy to consumers. The appropriate regulation of fossil fuel extraction projects such as fracking projects is a critical step in reducing global greenhouse gas emissions, and EIA is a key regulatory avenue for this purpose.

Part II compares the US context, looking at how EIA-based decision-making under NEPA treats climate change through an analysis of previous cases and of commentary, particularly with respect to fracking and other fossil fuel extraction projects. The change in US administration and its intention to withdraw from the *Paris Agreement*[5] have drawn attention to US climate policy in recent times. Although its agencies may have changed – or may in future change – the type of proposals that are put forward in light of the administration's views on climate change and energy, EIA legislation has not changed substantially.[6] Part II suggests ways in which Australia might learn from the US context in terms of observing its treatment of climate change impacts and the tools and guidance that exist in that jurisdiction to support the consideration of climate change in EIA.

Part III, building from Parts I and II, addresses the question of whether the EPBC Act should be amended in light of the argument that it does not adequately ensure the consideration of climate

[1] For more on the climate-related impacts of fracking, see Chapter 3.
[2] *United Nations Framework Convention on Climate Change*, opened for signature 9 May 1992, 1771 UNTS 107 (entered into force 21 March 1994) art 1(2).
[3] Fossil fuel extraction and combustion are key contributors to climate change: see Chapter 7, 'Energy Systems' in Intergovernmental Panel on Climate Change, *Fifth Assessment Report* (IPCC, 2014) 511, 525.
[4] [2016] FCA 1042.
[5] FCCC/CP/2015/L.9 (12 December 2015) ('*Paris Agreement*').
[6] As Part II explains, however, important federal government guidance has been withdrawn.

change impacts in important decisions that are likely to contribute to climate change. It contends that a 'climate system trigger' needs to be inserted into the EPBC Act. This would necessitate amendment of the EPBC Act to include a Part 3 MNES which specifically aims to prevent further climate change, and thus protect the environment, generally, from climate change. This approach targets a previously recognised problem in a way that reflects developments in both scientific and legal fields to date and is more in line with the structure of the EPBC Act and its existing MNES than the alternative 'greenhouse trigger' proposal, which has been raised by other commentators. It would ensure that the climate impacts of fracking – which, proportionately, are not as largely weighted towards combustion emissions as compared with coal – are included as part of impact analysis.

I CLIMATE CHANGE AND EIA IN AUSTRALIA

Climate change is not specifically a relevant consideration under Australian federal EIA law, as it is not explicitly – or necessarily – associated with any of the EPBC Act's protected matters, the MNES, and it is not a MNES in its own right. As previous chapters have clarified, impacts that affect the environment but not a MNES are not within the purview of the EPBC Act's impact assessment requirements.[7] Thus, in a given case, unless climate change is sufficiently related to a MNES which has already been triggered, it does not need to be considered when the federal Environment and Energy Minister ('Minister') is making an approval decision, and it will not trigger the operation of the EPBC Act regardless of how significant the potential contribution to climate change.

The scope for climate change to be considered under the EPBC Act is accordingly narrow, but it is also uncertain. What constitutes this sufficient relationship to a MNES is a point of contention which, in the decade since climate change was first argued as a major EIA-related issue in the Federal Court, has not yet been definitively determined. Since the EPBC Act does not reference or incorporate climate change, it is up to parties to put forward, or the Minister to request, information on the climate change impacts of a proposal if they are to be considered. If a person or group wants to challenge a decision on the basis that it did not adequately consider climate change, then it must establish a relationship with a MNES to the satisfaction of the court, and also establish that climate change (or an aspect thereof, as relevant) was not considered by the Minister.

A *The EPBC Act EIA System and Climate Change*

The requisite connection between action and MNES that is needed to establish an argument that climate change should be considered as an impact on a MNES can be represented as comprising an ***action***[8] that is connected to a ***contribution to climate change***, in turn linked with a ***climate change impact***, which has an effect on a ***MNES***. This chain is not articulated explicitly in the EPBC Act, but it is clearly able to be implied based on the Act's mechanics (the way the provisions interact to operate) and the way it has been interpreted over time.

A coal mine is a classic example of a fossil fuel extraction project ***action***, where a potential ***contribution to climate change*** may arise on account of the emissions associated with running the mine, transporting the coal, and ultimately, combusting the coal. In this example carbon dioxide is likely to be the major source of GHG emissions. A fracking project is another example. A proposal to conduct exploratory fracking, to run a commercial fracking operation, and to construct a pipeline to connect a

[7] Unless the impact is occasioned on account of a Commonwealth agency or on Commonwealth land: see Chapter 1.

[8] As highlighted in Chapter 1, 'action' is a defined term: EPBC Act ss 523, 524, 524A. The definition is sufficiently broad as to cover most if not all types of fracking projects and activities.

fracking site to an offsite destination may each be considered ***actions***, or in some cases the relevant action may be multiple aspects together (such as the extraction combined with a pipeline). In this example the ***contribution to climate change*** would also include any methane emissions leaked into the atmosphere.[9]

The terms 'scope one', 'scope two' and 'scope three' emissions can be used to categorise the different kinds of emissions with which an action may be associated. They are a component of actions' ***contribution to climate change*** – in the case of fossil fuel extraction projects, the principal component (note that other contributions may stem from non emissions-related activities such as land clearance). The terms, which stem from the Greenhouse Gas Protocol,[10] describe whether an emission is a direct emission or an indirect emission. Australia has adopted this terminology in its National Greenhouse and Energy Reporting Scheme ('NGERS'),[11] which is an important component of its federal climate change policy. The EPBC Act separates direct and indirect impacts,[12] but does *not* directly link with NGERS or the scope one, two and three terminology. Courts have nonetheless referred to the terminology in deciding climate change cases.[13]

Table 4.1 ***Types of Emissions***

Type	*Definition*	*Known as*
Scope one	The release of greenhouse gas into the atmosphere as a direct result of an activity or series of activities (including ancillary activities).[14]	Direct emissions
Scope two	The release of greenhouse gas into the atmosphere as a direct result of one or more activities that generate electricity, heating, cooling or steam that is consumed by a facility but that do not form part of the facility.[15]	Energy direct emissions
Scope three	The release of greenhouse gas into the atmosphere as a result of the transportation and combustion of fuel produced by a facility.[16]	Indirect emissions; downstream emissions

[9] For information on methane leakage, see Chapter 3.
[10] This is not an official treaty protocol, but rather, an optional (and widely used) accounting tool. Information can be found at <ghgprotocol.org/about-ghgp>.
[11] See Australian Government Department of the Environment and Energy, *National Greenhouse and Energy Reporting Scheme Measurement – Technical Guidelines for the Estimation of Emissions by Facilities in Australia* (Commonwealth of Australia, 2016).
[12] s 527E.
[13] See, eg, *Adani*, 134.
[14] *National Greenhouse and Energy Reporting Regulations 2008* (Cth) 2.23. Note the activities and release of greenhouse gases relate to a 'facility' which is defined as an activity, or a series of activities (including ancillary activities), that involve greenhouse gas emissions, the production of energy or the consumption of energy: *National Greenhouse and Energy Reporting Act 2007* (Cth) s 9.
[15] *National Greenhouse and Energy Reporting Regulations 2008* (Cth) 2.24.
[16] There is no NGERS definition of scope thee emissions as they are not covered by NGERS. They are discussed in, eg, *Adani*, 135.

Examples of ***climate change impacts*** include sea level rise, ocean acidification, ocean warming, increased frequency of extreme weather events, and prolonged periods of drought.[17] These impacts affect many aspects of the Australian environment, including the MNES: threatened species may be further endangered by changes to habitat quality and quantity or habitat fragmentation;[18] local environments such as coral reefs, wetlands or forests in protected areas (heritage areas and Ramsar sites)[19] may suffer a loss in ecological or aesthetic character.[20]

In the three principal Australian Federal Court climate change cases – *Wildlife Whitsunday*,[21] *Anvil Hill*[22] and *Adani* – the Great Barrier Reef was a key MNES argued as likely to be significantly impacted by the climate change contributions of coal projects via their effect on ocean acidification and ocean warming.[23] The chain represented above depicts the logical breakdown of how the plaintiffs needed to demonstrate a link between action and impact on MNES in each of these cases, deduced from the reasons provided by the judges in each case. An important reason for setting out the different links in the chain is to demonstrate that the impact of the relevant action is not 'climate change', as that does not describe a relationship with any MNES. This has been reiterated by the Federal Court.[24]

It is useful to consider how each element in the chain is potentially able to be established. Keeping in mind that the overall establishment of a connection between action and likely MNES impact is a legal matter (it is not a matter of fact),[25] whether or not a ***climate change impact*** is likely to have an effect on a MNES – for example, whether or not ocean acidification and warming is likely to affect the Great Barrier Reef – is a scientific question: though courts may decide that there is insufficient evidence tendered to establish this link, it is otherwise not a matter of judicial opinion. A central question that requires scientific input but yet is a legal question is whether or not that climate change impact is likely to have a MNES impact that is considered 'significant'. Significance is a matter to be determined in each case and the enquiry can be assisted by reference to the government's *Significant Impact Guidelines*, discussed previously in Chapter 4.[26]

A second important question for the law comes earlier in the chain: what, in each case, counts toward the quantity of emissions associated with the ***action*** that constitutes its ***contribution to climate change***, and is that quantity sufficient – given not only the magnitude of CO_2e, but whether it represents a net climate change contribution[27] – to be linked with the ***climate change impact***? The answer to this question, which is likely to be the key question in climate change cases, depends on multiple factors. A central factor is whether or not the ***climate change impact***, in relation to the

[17] See, eg, Intergovernmental Panel on Climate Change, above n 3, and the references therein.
[18] IUCN Species Survival Commission, *Species Susceptibility to Climate Changes Impacts* (IUCN, 2008).
[19] A 'Ramsar site' is a site listed under the *Convention on Wetlands of International Importance Especially as Waterfowl Habitat*, opened for signature 2 February 1971, 996 UNTS 245 (entered into force 21 December 1975) – see Chapter 4.
[20] See, eg, 10th Meeting of the Conference of the Parties to the Convention on Wetlands 'Resolution X.24: Climate Change and Wetlands' (Changwon, Republic of Korea, 28 October-4November 2008).
[21] *Wildlife Preservation Society of Queensland Proserpine/Whitsunday Branch Inc v Minister for the Environment & Heritage & Ors* [2006] FCA 736 ('*Wildlife Whitsunday*').
[22] *Anvil Hill Project Watch Association Inc v Minister for the Environment and Water Resources* [2007] FCA 1480 ('*Anvil Hill*').
[23] The Great Barrier Reef is a listed World Heritage property.
[24] See *Adani*, 134.
[25] *Anvil Hill Project Watch Association Inc v Minister for the Environment and Water Resources* [2008] FCAFC 3.
[26] See also *Booth v Bosworth* [2001] FCA 1453.
[27] Reference to a 'net' contribution (after taking into account factors such as the market response to the project in question) was key to the Minister's reasoning in *Adani*: see below Subsection 1 which provides further detail.

action, meets the definition of 'impact' under s 527E of the EPBC Act. This alone is not a simple question to answer, because it implicates issues of causation, as Subsection 1 below explains.

Complexity is added when one considers that determining a net climate change contribution will necessarily require a mixture of scientific and economic/market-based information, applied to the definitions and standards prescribed by the law; the legal decision-maker must be careful in ensuring that verifiable facts are employed in aid of the satisfaction of the legal requirements, rather than using opinion or judicial discretion to answer the non-legal aspects of the enquiry.[28] Deference should be afforded to expert evidence, with the role of the decision-maker being to determine whether a fact can be established on evidence and if so, whether requisite legal requirements are satisfied.[29] This issue has not been well articulated by courts.

The reason that the first two 'links' in the chain constitute ultimately a legal question is that the law does not consider *all* contributions to climate change to be relevant to whether or not there is a climate change impact. Rather, it attempts (though arguably not very clearly, as the following discussion demonstrates) to limit which emissions should be considered as resulting from the action and thus comprising the action's contribution. It is not that s 527E restricts certain types of emissions or must necessarily be interpreted that way, rather, that courts have not been willing to consider all contributions to climate change (ie, scope one, scope two and scope three emissions) as being relevant to the connection between action and MNES. The smaller the quantity of relevant emissions, then logically, the less likely the link between the action's 'contribution to climate change' and the 'climate change impact' is to be found, though the extent to which small contributions may be considered nonetheless significant also depends on how cumulative impacts are considered (an issue explored in Chapter 6).

There is no settled answer as to how courts will address or resolve these questions or view the overall causal chain: the case law on this point is considered below; upon examination it becomes clear that there has not been a consistent approach sufficient to establish any solid body of precedent. Thus far, commentators have not attempted to reconcile all three major climate change cases with the wording of s 527E. The above articulation of a chain of events, the legal and factual questions, and the below discussions of how the provisions and courts' interpretations and comments relate to those provisions in the climate change context, is an endeavour to make sense of this complex and poorly understood – but highly important – area of law, with the ultimate question being whether the law does not adequately incorporate climate change considerations sufficient to protect the environment from a key impact of fossil fuel extraction projects such as fracking.

1 *Establishing an 'Impact' – s 527E*

'Impact', in relation to an action, is a defined term under the EPBC Act. Its definition can be found in s 527E, extracted in full below:

Meaning of impact

[28] If a decision-maker takes into consideration something which is not supported or not verifiable, his or her decision could be at risk of being challenged on the basis of taking into account an irrelevant consideration; similarly, if a decision-maker fails to take into consideration a matter that is clearly supported by a strong body of evidence, the decision could be at risk of being challenged on the basis of failing to take into account a relevant consideration. In extreme cases challenges can also be brought on the grounds of unreasonableness. Each of these are permissible grounds of review under the EPBC Act pursuant to the *Administrative Decisions (Judicial Review) Act 1977* (Cth).

[29] Particularly, meeting the definitions of action, impact, significance, likelihood, substantial cause, etc.

(1) For the purposes of this Act, an event or circumstance is an ***impact*** of an action taken by a person if:
   (a) the event or circumstance is a direct consequence of the action; or
   (b) for an event or circumstance that is an indirect consequence of the action--subject to subsection (2), the action is a substantial cause of that event or circumstance.

(2) For the purposes of paragraph (1)(b), if:
   (a) a person (the ***primary person***) takes an action (the ***primary action***); and
   (b) as a consequence of the primary action, another person (the ***secondary person***) takes another action (the ***secondary action***); and
   (c) the secondary action is not taken at the direction or request of the primary person; and
   (d) an event or circumstance is a consequence of the secondary action;

then that event or circumstance is an ***impact*** of the primary action only if:

   (e) the primary action facilitates, to a major extent, the secondary action; and
   (f) the secondary action is:
      (i) within the contemplation of the primary person; or
      (ii) a reasonably foreseeable consequence of the primary action; and
   (g) the event or circumstance is:
      (i) within the contemplation of the primary person; or
      (ii) a reasonably foreseeable consequence of the secondary action.

The specific meaning of the term is important when considering whether or not a proposed action is a 'controlled action' under s 67 and therefore subject to impact assessment.[30] The term 'impact' appears many times in the EPBC Act, including s 75, which requires the Minister to consider all relevant adverse impacts of the proposed action when determining whether or not an action is a controlled action; s 82, which provides that relevant impacts are those which have, will have, or are likely to have a significant impact on a MNES; and the provisions of Part 3, which prohibit conduct likely to have a significant impact on each protected matter unless the Minister has approved the conduct.

The need to define an 'impact' of an action becomes particularly relevant where indirect impacts are concerned, because the statutory definition departs from a simple 'cause and effect' or 'but for' conception of what might be considered indirectly connected, introducing, instead, a particular test. It is thus critical to the climate change context, wherein potential indirect impacts include the upstream and downstream emissions associated with a project; these are typically the most significant sources of climate change contribution. At the core of climate change case law in Australia is the issue of whether or not and to what extent the downstream impacts of fossil fuel projects (particularly coal projects, though the same essential principles would apply to other fuel sources) need to be assessed.

Section 527E of the EPBC Act, which came into force in 2007, defines impacts as including both direct impacts and indirect impacts. Indirect impacts, however, are only relevant under limited circumstances: where a substantial causal relationship between the action and the impact can be established, and, if the impact is caused via a secondary party but not on request of the person who took the action, then where the secondary party's actions are facilitated (to a 'major extent') by the initial or 'primary' action, and where the person taking the primary action foresaw or should

[30] A controlled action under the EPBC Act is an action likely to have a significant impact on a MNES – more specifically, an action that would be prohibited by one of the Part 3 provisions in the absence of ministerial approval under Part 9: EPBC Act s 67; see further Chapter 1.

reasonably have foreseen both that the secondary party action would be taken and that the impact in question would be a consequence. An 'impact' that has not been classified under s 527E yet, or which does not meet the definition in s 527E, can be termed an 'event or circumstance'.

According to the Explanatory Memorandum to the Bill which introduced s 527E, the purpose was to clarify the extent to which impacts that are indirect consequences of actions must be considered or dealt with under the EPBC Act.[31] Prior to the s 527E 'clarification', the court had posited that the effects of an 'impact' could include indirect effects which 'are sufficiently close to the action to allow it to be said, without straining the language, that they are, or would be, the consequences of the action on the protected matter.'[32] This was said to be a matter of fact, not law.[33] A non-binding policy statement issued by the Australian Government reiterated, in plain English, the key requirements of s 527E including 'substantial cause', and 'reasonable foreseeability'[34] but did not generally add any substantive guidance as to the preferred interpretation.

The language of section 527E has been described by the judiciary as 'tortured' and 'almost impenetrable'.[35] Though it is complicated, it is not nonsensical or illogical. Rather, the problems with interpreting s 527E are that it contains ambiguous terms that courts will need to give meaning to in each context that arises before them: 'substantial cause', 'facilitates, to a major extent', and 'reasonably foreseeable'. These are not terms completely foreign to the law,[36] although Griffiths J made clear in *Adani* that the meaning given to similar terminology in unrelated contexts will not necessarily be useful.[37]

The most current authoritative interpretation of s 527E and the meaning of impact under the EPBC Act is Griffith J's judgment in *Adani*.[38] His Honour determined the following key points:

(i) For an event or circumstance to be an indirect consequence of an action, it must be demonstrated that the action is a substantial cause of that event or circumstance, pursuant to paragraph (1)(b), *and* that the criteria prescribed by subsection (2) are met.[39] If there is no relevant secondary party action then subsection (2) will not apply, however, if there *is* a relevant secondary party action then (2) is not a 'stand-alone' test: paragraph (1)(b) remains applicable.

(ii) There is no definition of 'an event or circumstance' in the EPBC Act, so those words should be given their ordinary meanings.[40]

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[31] Explanatory Memorandum, *Environment and Heritage Legislation Amendment Bill [No 1] 2006* (Cth), 519.
[32] *Minister for the Environment and Heritage v Queensland Conservation Council Inc* [2004] FCAFC 190 ('*Nathan Dam Case*'), 53.
[33] Ibid.
[34] Australian Government Department of Sustainability, Environment, Water, Population and Communities, *Policy Statement – 'Indirect Consequences' of an Action: s 527E of the EPBC Act'* <environment.gov.au>.
[35] *Tasmanian Aboriginal Centre Inc v Secretary, Department of Primary Industries, Parks, Water and Environment (No 2)* [2016] FCA 168, cited in *Adani*, 27.
[36] In particular, reasonable foreseeability, which is a common concept in tort and other areas of Australian law: see *Wyong Shire Council v Shirt* (1980) 146 CLR 40.
[37] *Adani*, 163.
[38] In *Adani*, Griffiths J held that the Minister can decide that something is not an impact without specifically referring to s 527E, so long as the essential considerations are made – see the discussion below. The appeal court agreed with this point.
[39] Ibid 157.
[40] Ibid 30.

(iii) In classifying an event or circumstance as an impact, ss 528 and 82 should also be consulted.[41] Section 528 is the 'dictionary' section which defines 'relevant impact' by reference to s 82. A relevant impact is one which has, will have or is likely to have a significant impact on a MNES.

(iv) Section 83 states that the Part in which it sits (Part 8 – Assessing Impacts of Controlled Actions) does not apply if the action is covered by a bilateral agreement. Despite this, s 82 should still apply even where a bilateral agreement also applies, meaning that the relevant impacts of an action are those that have, will have or are likely to have a significant impact on a MNES, in all cases.[42]

A notable omission from this list is any clarification of the aforementioned ambiguous terms, despite the focus on substantial cause made in point (i).

It is worth setting out another potential point of confusion: indirect *impacts* are not analogous to indirect or scope three *emissions*. Though courts do distinguish between direct and indirect emissions, this must be a different exercise from separating direct and indirect impacts. In both cases, the 'indirectness' creates distance from the action, but reference to an indirect emission does not describe an impact *per se*, due to the need in Australia to demonstrate a connection to a MNES.

Of the three cases mentioned above – *Wildlife Whitsunday*, *Anvil Hill* and *Adani*, *Adani* was the only case to interpret the s 527E definition. There was no statutory definition of impact when *Wildlife Whitsunday* was decided in 2006. The s 527E definition was introduced on the same day that the *Anvil Hill* judgment was handed down in 2007,[43] and although it was referenced, it was not discussed or interpreted. In both *Wildlife Whitsunday* and *Anvil Hill*, the question was one of a 'likely significant impact' (pursuant to the wording of Part 3) rather than an interpretation of 'impact' separately from questions of likelihood and significance, which is what s 527E asks for. Based on the reasoning in those two decisions, it can be deduced that in 2006-2007, it was still possible to consider climate change's impacts as speculative, occurring at some unspecified time in the future and of unidentified magnitude.[44] Issues of uncertainty and difficulties with causation, though not eloquently articulated, served as stumbling blocks, while no tangible assistance with how to define or interpret the term impact or its associated causation requirements was provided.

2 *The Adani Case*

Adani concerned an approval given to Indian-owned coal company Adani to construct a new open-cut and underground coal mine in Queensland – which would be the largest in the Southern Hemisphere – along with a rail link and associated transport infrastructure. According to the information provided to the Minister, the scope three combustion emissions from Adani's proposal would total approximately 1/183rd of the total available global combustible emissions ('carbon budget') if warming is to be limited to two degrees Celsius (as per the upper tolerance limit under the *Paris Agreement*).[45] In applying for judicial review, the Australian Conservation Foundation Inc ('ACF') argued that the Minister had made an error of law by characterising the combustion emissions as 'not a direct

[41] Ibid 31, 167-172.
[42] Ibid 167-172.
[43] *Anvil Hill*, 37.
[44] Ibid.
[45] *Adani*, 51. The carbon budget is a concept articulated in various scientific papers that have determined the quantity of emissions that can be burned on a global scale if the *Paris Agreement* targets are to be complied with: see, eg, M Meinshausen et al, '*Greenhouse Gas Emission Targets for Limiting Global Warming to 2°C*' (2009) 458 *Nature* 1158.

consequence' of the action, without applying s 527E first, and that he should in any case have taken these emissions into account in making his decision. [46]

It was held at first instance by Griffiths J that the downstream emissions of the Adani project were not of concern to the approval decision. His Honour accepted the Minister's reasoning that it was prohibitively difficult to establish a causal link between the proposed combustion emissions and climate change, because no *net* effect on climate change could be said to be likely: there were too many 'variables', including, particularly, whether but for the coal extracted and combusted on account of the Adani mine, the market would substitute by providing a similar fuel (from the perspective of contribution to climate change).[47] Following this reasoning, it could be true that the quantity of emissions would significantly contribute to climate change, but at the same time be able to be argued that the mine would not significantly contribute to climate change, given the possibility that that same quantity of emissions would be burned by someone else, elsewhere, if the mine was not approved. This type of argument can be called a 'perfect substitute' argument.[48]

The information that had been provided to the Minister stated that if the two degree target was not met and a global temperature rise of three degrees occurred, 'any semblance' of the Great Barrier Reef as it is presently known would 'vanish'. [49] But because the question turned not on the significance to the MNES but on the connection with the proposal, as an indirect impact, this did not necessarily matter for the purpose of EPBC Act decision-making. In any case, the Minister had purported in the case that his approval was made having 'given consideration to the greenhouse gas emissions from mining operations' *and* 'from the burning of the mined coal',[50] implying that he had turned his mind to the scope three indirect emissions and their potential significance. The Minister had cited the difficulty in being able to determine net emissions as well as the responsibility of international emissions frameworks operating within Australia and within the countries that the coal would be exported to in mitigating emissions when articulating why, having considered the overseas emissions, he nonetheless approved the proposal.[51]

Essentially, the Minister avoided a consideration of the significance of the proposed scope three combustion emissions in respect of contributing to future climate change by attempting to negate those emissions with the variables he listed, and by pointing to foreign responsibilities. He made clear that by taking into account the variables he was not simply introducing uncertainty as to the significance of the link between the proposal and climate impacts, rather, the potential operation of the variables meant that *no* link was determinable. The Court was satisfied with this conclusion. The Minister did not substantiate the variables with evidence – at least, no such evidence was discussed as supporting Griffith J's acceptance of the Minister's conclusion.

The ACF had claimed, in Griffith J's words, 'that the Minister impermissibly "front-end loaded" his determination of whether combustion emissions would be a relevant impact…thereby precluding

[46] *Australian Conservation Foundation Inc v Minister for the Environment* [2016] FCA 1042, 63.
[47] Minister's decision,140, cited in *Australian Conservation Foundation Inc v Minister for the Environment* [2016] FCA 1042, 58.
[48] Michael Burger and Jessica Wentz, 'Downstream and Upstream Greenhouse Gas Emissions: The Proper Scope of NEPA Review' (2017) 41 *Harvard Environmental Law Review* 109, 148.
[49] Further, expert commentators believe that the *Paris Agreement* will not be enough to limit warming to 2°*C*: see Michael Gerrard, 'Sadly, The Paris Agreement Isn't Nearly Enough', *The Debate* (November-December 2016, Environmental Law Institute) 57; Oliver Geden, who argues against temperature targets in favour of the pursuance of net zero emissions: 'An Actionable Climate Target' (2016) 9 *Nature Geoscience* 340.
[50] Minister's decision, 48, cited in *Adani*, 58.
[51] Ibid 140, also cited in *Adani*, 58.

himself from having to conduct an assessment of those likely impacts as he would have been required to do if he had adopted the approach favoured by the ACF',[52] that is, to consider s 527E and decide whether there was an impact, before then deciding if it was a relevant impact. Additionally, the ACF claimed that the Minister misconstrued 'substantial cause' in s 527E, and that it should mean 'not de minimis' rather than 'weighty or big'.[53]

Justice Griffiths rejected these arguments. He was satisfied that the Minister had lawfully concluded that the Adani mine was not a substantial cause of the impacts to the Great Barrier Reef from climate change, and explained that the Minister did not need to refer explicitly to s 527E. He accepted that substantial cause was an ambiguous term,[54] but did not clarify its meaning. He stated that the meaning had not needed to be addressed in this case because the Minister had not established the causal relationship between the event or circumstance and the proposed action.

Justices Dowsett, McKerracher and Robertson rejected the ACF's appeal,[55] agreeing with Griffiths J that the Minister does not have to have specific regard to particular provisions if he or she has conducted the proper enquiries. They expressed the view that the ACF's focus on the Minister not referring to s 527E was misplaced, and that their submissions seemed 'to be little more than an attempt to characterise as a procedural error, criticism concerning the merits of the decision'.[56] They found it 'curious' that the ACF did not assert that the Minister failed to take account of relevant matters, or took into account irrelevant matters,[57] a comment which could serve as useful advice for future cases attempting to argue the relevancy of climate change to a particular matter.

3 ***Implications***

The overall reluctance of Australian Ministers and reviewing courts to consider the indirect emissions of single projects as contributing to climate change and subsequently to impacts on MNES in a significant way has remained unchanged. The insertion of s 527E appears to have had little influence on issues around causation and uncertainty in final decision-making, as *Adani* arguably demonstrates. However, there is certainly scope for future cases to help shape the meaning of s 527E in the context of climate change and downstream emissions.

Likely on account of the progression in scientific knowledge regarding climate change, the question in *Adani* needed to turn to whether or not and to what extent the Adani project was responsible for causing future climate change impacts, rather than whether there would be future climate change impacts. Griffiths J avoided that question by effectively drawing on the possibility that the Australian coal mined by Adani would replace rather than add to other sources of emissions. It is not logical to argue that the coal mined by Adani would, once combusted, not contribute to climate change, because burning coal releases emissions that contribute to climate change. Instead, Griffiths J supported the Minister's argument that it might not contribute in a *net* way to climate change, if in fact Adani's coal were to replace other sources of coal and not other sources of less emissions-intensive energy; be burned in an efficient power plant; and/or be mitigated by global climate action and the actions of other nations. Neither the Minister nor Griffiths J made the effort to *establish* that there would be no

[52] *Adani*, 71.
[53] Ibid 72.
[54] Ibid 163.
[55] *Australian Conservation Foundation Inc v Minister for the Environment and Energy* [2017] FCAFC 134.
[56] Ibid 58.
[57] Ibid 49.

net effect on climate change – rather, the possibility of such was relied on as prohibiting the satisfaction of the substantial causal relationship required by s 527E.

Nonetheless, following *Adani*, it would appear that unless and until the 'variables' become no longer 'variable', or alternatively are able to either be addressed by an applicant in such a way as to demonstrate a clear link within the requirements of the EPBC Act between action and climate change impact, in spite of some uncertainties, or challenged on the basis of insufficient evidence,[58] applying the 'net effect'/'perfect substitute' concept could represent a hurdle in Australian climate change law.

Examples of how an applicant might address these variables would be to:

(i) Provide evidence, such as a supply contract, demonstrating where exactly the coal is likely to be burnt and the likely efficiency of the power plant where the coal will be combusted, or alternatively, point to any applicable minimum efficiency standards in the country of proposed export.

(ii) Provide evidence pertaining to the global energy market and whether 'but for' the increased supply of Australian coal, the same amount of coal would be provided by other suppliers.

(iii) Provide evidence relating to the likelihood that 'but for' the increased supply of Australian coal, other energy sources (such as renewable energy) would likely be utilised instead, such as that an increased supply of coal would affect demand.

B *Scientific Uncertainty and the Precautionary Principle*

The 'precautionary principle', introduced in Chapter 1, is one of the key principles of the *Rio Declaration on Environment and Development*,[59] an influential international instrument that resulted from the 1992 UN Conference on Environment and Development, dubbed the 'Earth Summit'. The principle was expressed in Australia in the *Intergovernmental Agreement on the Environment*,[60] signed by the federal and state and territory governments in 1992. Formulated differently in different contexts, of which there are now many on a global scale, it expresses the notion that in order to protect the environment, threats of serious or irreversible damage call for an approach to be taken which does not accept a lack of full scientific certainty to be a reason for postponing measures that would prevent degradation. There is no need to recount here the history of the precautionary principle, or its jurisprudence in Australia, which has been recounted by others in text books, literature and case law.[61]

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[58] The question would then turn to who has the burden of proof in terms of whether there is a net effect.

[59] UN Doc. A/CONF.151/26 (vol I); 31 ILM 874 (1992) ('*Rio Declaration*'), principle 15.

[60] The Commonwealth of Australia, the State of New South Wales, the State of Victoria, the State of Queensland, the State of Western Australia, the State of South Australia, the State of Tasmania, the Australian Capital Territory, the Northern Territory of Australia and the Australian Local Government Association, *Intergovernmental Agreement on the Environment* (Intergovernmental Agreement, 1 May 1992) cl 3.5.1.

[61] See, eg, Timothy O'Riordan, *Interpreting the Precautionary Principle* (Taylor and Francis, 2013); Jacqueline Peel, *The Precautionary Principle in Practice: Environmental Decision-Making and Scientific Uncertainty* (2005, Federation Press); Chief Justice Brian Preston, 'The Role of the Judiciary in Promoting Sustainable Development – The Experience of Australia and the Pacific' (Paper presented at the Kenya National Judicial Colloquium on Environment Law, Mombasa, 10-13 January 2006); Justice Peter Biscoe, 'Ecologically Sustainable Development in New South Wales' (Paper presented at the Fifth Worldwide Colloquium of the IUCN Academy of Environmental Law, Rio de Janeiro, 2 June 2007); Philippa England, 'Doing the Groundwork: State, Local and Judicial Contributions to Climate Change Law in Australia' (2008) 25 *Environment and Planning Law Journal* 360; *Telstra Corporation Ltd v Hornsby Shire Council* (2006) 67 NSWLR 256 ('*Telstra*'); *Leatch v National Parks*

It has been said that 'EIA is the most sophisticated environmental protection framework that exists in many jurisdictions, and therefore, it is arguably the most obvious vehicle for giving effect to the principle'.[62] It is thus not surprising that the precautionary principle can be found in EIA legislation – particularly, for present purposes, the EPBC Act, in ss 3A(b) and 391, where it requires the Minister to take a risk-based approach to decision-making.[63] Section 3A(b) incorporates the precautionary principle as one of five principles of ecologically sustainable development ('ESD'). By virtue of s 136, it must be considered when the Minister is deciding whether or not to approve a controlled action. Section 391 similarly requires the Minister to consider the precautionary principle when making a decision under s 133 whether or not to grant an approval.

Both of these sections essentially adopt the same definition of the principle – that lack of full scientific certainty (first condition) should not be used as a reason for postponing a measure to prevent degradation of the environment where there are threats of serious or irreversible environmental damage (second condition). What measure is actually required, in practice, is a matter of contention, and will inevitably depend closely on the context and the particular facts and risks of a given case.[64] Accordingly, it is difficult to predict whether application of the precautionary principle is likely to change the outcome in a given case and if so, how. Yet as put by one commentator, 'the true test of effectiveness of the principle is not simply the inclusion of it in legislation, but rather the willingness of the courts to uphold its application as expressed in statutes.'[65]

The precautionary principle featured in Australian case law concerning climate change in the mid-2000s, where it was often applied to cases where the action under consideration, or aspects closely related to the action, were potentially going to be affected by climate change. For example, it was applied in the context of sea level rise affecting proposed coastal developments,[66] and in the context of an application to extract groundwater, where the future availability of groundwater was uncertain.[67] It was stated that failure to take into account the precautionary principle, as a principle of ESD, may constitute a failure to consider the public interest.[68] All of these examples – and the great bulk of the development of the principle – were in state courts and tribunals.[69]

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and Wildlife Service (1993) 81 LGERA 270 (Stein J), *Gray v Minister for Planning* (2006) 152 LGERA 258 (Pain J), *Walker v Minister for Planning* (2007) 157 LGERA 124 (Biscoe J).

[62] Warwick Gullet, 'The Precautionary Principle in Australia: Policy, Law and Potential Precautionary EIAs' (2000) 11 *Health, Safety and Environment* 93, 116.

[63] This means that the decision-maker is required to consider and take into account risks or threats of serious or irreversible environmental harm. See 'Decision-Making Under the Act' in Alan Hawke, *The Australian Environment Act: Report of the Independent Review of the* Environment Protection and Biodiversity Conservation Act 1999 (Department of Environment, Water, Heritage and The Arts, 2009)('*Hawke Review*'), 13.12

[64] See, eg, Jacqueline Peel, 'Precaution – A Matter of Principle, Approach, Or Process?' (2004) 5 *Melbourne Journal of International Law* 483; Rosemary Lyster, 'The Relevance of the Precautionary Principle: Friends of Hinchinbrook Society Inc v Minister for the Environment' (1997) 14 *Environment and Planning Law Journal* 390, 396.

[65] Gullet, above n 62, 107, citing Ronnie Harding and Liz Fisher, 'The Precautionary Principle in Australia', in Timothy O'Riordan and James Cameron (eds) *Interpreting the Precautionary Principle* (Cameron May Ltd, 1994), 252, 255.

[66] *Walker v Minister for Planning* [2007] NSWLEC 741 (on appeal *Minister for Planning v Walker* [2008] NSWCA 224); *Gippsland Coastal Board v Gippsland Shire Council (No 2)* [2008] VCAT 1545.

[67] *Alanvale Pty Ltd & Anor v Southern Rural Water & Ors* [2010] VCAT 480.

[68] *Williams v NSW Minister for Planning (No 3)* [2010] NSWLEC 204, 33; *Minister for Planning v Walker* [2008] NSWCA 224, 63 (both per Biscoe J). Note that this language is tied to the statutory language used in the NSW context.

[69] For an analysis, see, eg, England, above n 61.

The Federal Court has since early days been reluctant to apply the principle, at least in such a manner that would result in any changes to an approval decision.[70] Though it is a requisite consideration, if a Minister states that he or she did consider or did apply the principle in making his or her decision, a court only has scope to overturn that where it appears that he or she did not in fact consider the principle and therefore acted beyond the scope of his or her power. Such an argument was tested in 2009 when Lawyers for Forests argued that the Minister's supposed consideration of the precautionary principle was 'not proper, genuine or realistic.'[71] The court deferred to the Minister however, noting that

> [u]nder s 391(1) the Minister is obliged to take into account the precautionary principle only to the extent that this can be done consistently with the other provisions of the Act. Under s 136 the Minister is required to take into account the precautionary principle together with the other principles of ecologically sustainable development and a variety of other matters including economic and social matters. The Minister is not obliged to accord pre-eminence to the precautionary principle when making decisions under ss 133 and 136. So long as the Minister, as he did in the present case, takes account of the precautionary principle, it is a matter for him to determine what weight is to be accorded to the principle having regard to the wide range of other considerations which he is also required to take into account.[72]

The question of whether or not the Minister applied the precautionary principle arose most recently in the climate change context in *Adani*. The Minister stated that he had considered the precautionary principle when deciding to approve Adani's coal mine proposal, in relation to its direct scope one and scope two emissions, but that he had 'sufficient scientific information' to conclude that the proposal would not result in threats of serious or irreversible damage to the Great Barrier Reef.[73]

Justice Griffiths found that the Minister had indeed considered the principle in relation to the direct emissions, but that he had not considered it with regard to the scope three indirect overseas emissions. This was deemed to be acceptable. Griffiths J found two reasons to support his finding that not considering the precautionary principle in relation to the overseas emissions could be condoned:

(i) there was no threat of serious or irreversible damage found, and, since serious or irreversible damage is condition precedent to the enlivenment of the precautionary principle,[74] the precautionary principle did not need to be considered;[75] and

(ii) the Minister only needs to take account of the precautionary principle to the extent that he or she can do so consistently with the other provisions of this Act – those 'other provisions' include s 527E, under which the Minister determined no impact.[76]

The latter point implies that the Minister could not find on the one hand that there was no impact under s 527E, and on the other, that the precautionary principle applied, as the two findings would be inconsistent with one another. This is more persuasive than the former point, which assumes that the

[70] See *Friends of Hinchinbrook Society Inc v Minister for Environment & Ors* [1997] FCA 55.
[71] *Lawyers for Forests Inc v Minister for the Environment, Heritage and the Arts* [2009] FCA 330, 29.
[72] Ibid 36.
[73] Minister's Statement of Reasons, 164, cited in *Adani*, 59.
[74] *Telstra*, where Preston CJ held that whether there is a threat of damage and whether there is scientific uncertainty are two separate but cumulative questions related to enlivening the precautionary principle.
[75] *Adani*, 184.
[76] Ibid 185.

Minister actively found there to be no threat of serious or irreversible damage rather than having not found any serious or irreversible damage because that question did not need to be considered. Technically, the Minister did not need to consider whether there was likely to be a significant impact because he found no causal link between the project and the event or circumstance, which was presented as both serious and possibly irreversible.

With regard to where the Minister did consider the precautionary principle (scope one and two emissions), his phrasing in finding that he had 'sufficient scientific information' to conclude no threat of serious or irreversible damage was unfortunate. It could potentially invite confusion over the scientific uncertainty standard, so it should be reiterated that scientific certainty or even 'sufficient scientific information' is not a prerequisite to finding or in this case not finding potential serious or irreversible environmental harm, though naturally scientific information will be relevant. What is required is simply that there is a 'threat' which arguably should not require an arduous standard of scientific proof – if a high standard of scientific information were to be required to establish the threat, this would end up contradicting the principle.[77]

It has been found by the courts that after having identified a threat (expressed above as the second condition), there is another 'hurdle': the precautionary principle will not apply if there is no uncertainty, or rather if there is indeed full scientific certainty.[78] Instead, there must be a lack of scientific certainty (expressed above as the first condition). *Adani* implicitly raises the question as to whether this uncertainty criterion applies to establishing the threat of damage, or whether it applies to establishing that there is no threat of damage. It is possible that in *Adani* the Minister was purporting to have been convinced of full scientific certainty that the proposed damage would not materialise, in other words, certainty in relation to there being no damage. It would be an absurd result that if damage is scientifically certain, preventative measures do not need to be considered, whereas if damage is scientifically uncertain, they do: the more certain the science on the environmental damage, the more warranted preventive measures would be to avoid that damage, only adopting those measures would not be taking a 'precautionary' approach, but perhaps a 'necessary' or 'preventative' approach.

This semantic discussion could well be of significance, but a common-sense approach may be in future to reject the first condition as a hurdle, instead focusing on whether or not there is a threat of damage and, assuming that that threat cannot be proven or disproven with certainty, to apply the precautionary principle wherever the threat of damage is serious or irreversible. This argument is particularly persuasive given that it appears to now be established that applying the principle does not require any particular result in terms of a fixed measure. Nonetheless, *Adani* demonstrates that the precautionary principle essentially applies to the extent that the decision-maker wishes to apply it. Though seemingly 'mandatory', it does not need to be considered if this cannot be done consistently with other legal requirements, or if the Minister does not find a threat of serious or irreversible harm.

[77] According to Preston CJ in *Telstra*, however, some level scientific evidence is required in order to establish a threat: the threat must be reasonable and have a basis. See Jacqueline Peel's critique: 'When (Scientific) Rationality Rules: (Mis) Application of the Precautionary Principle in Australian Mobile Phone Tower Cases: Telstra Corporation Limited v Hornsby Shire Council' (2007) 19 *Journal of Environmental Law* 103.
[78] This appears to be how the court in *Adani* interpreted Preston CJ in *Telstra*.

C *EIA Law, Climate Change, and Fracking*

Although no fracking cases have been brought in the Federal Court that test the scope of relevancy for climate change impacts, many of the issues that have arisen in the cases relating to coal would be directly translatable to the fracking context. In fracking proposals, too, links between the fracking project proposed, its indirect combustion emissions (a major source of emissions), climate change, and climate change's impact to a MNES, would need to be established. Whether or not those emissions would be considered a substantial cause of the climate change impacts to the MNES would be a key question. In light of the above discussions, it can fairly be concluded that it is difficult to predict how courts would treat this question, except to point to instances of reluctance to find a substantial cause from a single project in a net sense. This is a key reason why Part III suggests a new climate change trigger to assist in better equipping the EIA system to deal with the risks of fracking projects (and other projects likely to contribute to climate change).

There are two points of difference that could be raised in the fracking context and which might lead to different conclusions than in the coal cases. First, it could be argued that combustion of methane is less emissions intensive than is combustion of coal, thus, the indirect or scope three emissions are likely to be lower for a given fracking project than for a coal project. This could fairly simply be established with scientific evidence, subject to uncertainties. Second, and to the contrary, due to methane leakage that happens at the well-site as a direct consequence of a fracking operation (see Chapter 3), the scope one emissions are likely to be higher.

Given the present position in Australia that scope three emissions tend not to be considered as being linked with climate change impacts on MNES but that scope one emissions are considered so linked, it may be that natural gas fracking is ultimately considered as having a greater connection with climate change impacts on MNES than coal mining. This conclusion is bolstered by the fact that the scope one leakage emissions are direct rather than indirect consequences of fracking operations, thus, the substantial cause requirement is not applicable to those emissions. The result is that it would likely be easier to establish that a greater proportion of fracking emissions are relevant to EIA law under the Australian system, and thus likely to be considered by the Minister.

The weakness of the precautionary principle discussed above in Subsection C means that it is unlikely that any greater level of scientific uncertainty associated with the impacts of fracking as opposed to coal would, given potential threats of serious or irreversible harm, mean that a more cautious approach would be taken towards approval decisions.

D *State and Territory Law*

The distinction between federal MNES and other environmental matters not considered to be of federal significance (but which might be of state/territory or local level significance) is based not on a project's geographic location but on the location and scope of its impacts or effects. The effects of climate change are not confined within state/territory boundaries. Rather, they are exhibited nationwide, though they might be felt more strongly in some places than others, and take effect in a cumulative fashion. Their mitigation is also the subject of international agreements to which Australia is party – a point returned to below in Part III. It is for this reason that the focus of this Chapter on the federal level is important: climate change is a nationally significant matter, and thus, it should be considered at the federal level.

This does not mean that climate change is not or should not be considered at the state and territory level as well. This is so particularly in the absence of its inclusion at the federal level, but also because

climate change has location-specific effects that are of importance to states and territories, and because states and territories have opportunities to collectively contribute to achieving emissions reductions.[79] However, there is a risk that state and territory governments will attribute less importance to the environmental impacts of climate change in light of significant state/territory social and economic benefits, and that a 'race to the bottom' could occur where some state and territory governments are more supportive of project investments that contribute to climate change than others. Compared with the harms caused by climate change, social and economic benefits to a state or territory are likely to be concentrated locally.

Unless being accredited under the EPBC Act,[80] state and territory EIAs do not need to consider matters of federal significance; rather, the focus of state and territory assessments will be on impacts relevant to the state or territory specifically. This is where a potential gap is created in the law: climate change can fall within the scope of state and territory level assessment to the extent that it is considered relevant to the state or territory in which the project is proposed, but this scope will not be analogous to that relating to how climate change is relevant to Australia as a whole.

Environmental impacts relevant to assessment in state and territory jurisdictions are not restricted in scope to 'matters of significance', but instead include significant impacts on the environment more generally. Part II, below, discusses a similarly general scope in the US context. This broader scope makes it easier to argue that climate change should be a relevant consideration, but does not overcome the issue of downstream emissions from fossil fuels burned overseas. The scope for state/territory legislation to consider climate change and/or be triggered by emissions-intensive activities will depend on the state or territory. In Queensland, which has a heavy concentration of such projects, certain types of actions specifically require assessment. Many climate-significant activities such as the production of fossil fuels fall into this category,[81] although this is on account of their having been specifically listed (a matter up to the Queensland government) rather than on account of their climate impacts *per se*.[82] In Western Australia, climate change impacts are not specifically relevant under impact assessment legislation. However, the State's Environment Protection Authority has stated that when considering the significance of environmental impacts, it 'may decide to assess greenhouse gas emissions within the EIA process if a proposal's expected total greenhouse gas emissions are deemed to be significant'. This is defined as 'proposals that have the potential to significantly increase the State's greenhouse gas emissions.'[83]

Essentially, it is important to be aware that state and territory EIA may require the consideration of climate change, but that this is not an appropriate substitution for federal-level consideration that takes into account impacts on the Australian environment as a whole.

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[79] *Paris Agreement*, preamble.

[80] Accreditation can happen on account of a bilateral agreement: EPBC Act pt 4.

[81] See *Environment Protection Regulations 2008* (Qld), Schedule 2.

[82] Examples of how climate impacts have been included in EIAs in Queensland can be found via the Coordinator General's Reports for completed projects, accessible at <http://www.statedevelopment.qld.gov.au/assessments-and-approvals/completed-eis-projects.html>.

[83] Environment Protection Authority of Western Australia, 'Environment Protection Bulletin No 24 – Greenhouse Gas Emissions and Consideration of Projected Climate Change Impacts in the EIA Process' (WA EPA, 2015), 1.

II CLIMATE CHANGE IN THE US UNDER NEPA

In the US, climate change is now regularly considered in impact assessment at the federal level, even where climate impacts are only indirectly connected to the action in question. Although from the perspective of legal interpretation, Australian courts are unlikely to look to the US in order to interpret and construe Australian law,[84] the US provides an interesting point of comparison. It has a similar EIA system, upon which the Australian system was modelled, it has a federal-state level governance structure with environmental governance split between both levels, and it has a significant fossil fuel industry that is reliant upon large coal and natural gas projects.

Accordingly, similar issues have arisen in the US as in Australia; with a larger volume of case law passing through US courts, Australia may look to the US to understand how its judiciary have interpreted key issues such as indirect impacts and causation, and even the perfect substitute argument that was made in *Adani*. In terms of natural gas and fracking, the US industry is well ahead of Australia, being the largest present producer of natural gas. Australia may also look to the reaction of the US legislature (and the US Council on Environmental Quality ('CEQ')) and the approach of the US executive (through its agencies) to climate change considerations, as well as the roles of each branch of government in developing climate change law, as providing insight and potentially lessons for Australia. Specifically, although the potential for direct judicial transference is unlikely, Australian courts might consider the US developments on climate change and EIA as it may provide interpretive guidance that could be helpful when considering the difficult issues articulated in Part I.

A *Scope of NEPA*

As alluded to in Chapter 1, the environment is relevant to NEPA and thus to US EIA in a general sense, rather than in relation to specifically defined matters, so long as a major federal action is involved and thus a federal nexus can be established. Although climate change was not a widely recognised concern at NEPA's 1969-1970 inception, the position in the US has evolved as scientific knowledge has improved, such that climate change, and its flow-on effects, are generally considered to be a relevant environmental impact within NEPA's purview. This co-evolution of law and science is possible because matters of significance are determined on a case-by-case basis, rather than being subject to advance determination as is the case with the MNES under the EPBC Act. Interpretation rests with US federal agencies, and, in the case of legal challenges, the courts.[85]

Accordingly, US decision-makers do not need to go through the process put forth in Part II above: in particular, there is no final step connecting the environmental impact to a specified MNES, rather, the relevant connection is between the major federal action, climate change, and the impacts of climate change on the US environment.

B *Climate Change Impacts as Indirect Effects*

Indirect effects (a term considered to be interchangeable with impacts)[86] are required to be considered as part of the EIA process under NEPA. The CEQ Regulations ('the Regulations') define indirect effects/impacts as those which are 'caused by the action and are later in time or father

[84] See, eg, *Nathan Dam Case*, 52.

[85] Markell and Ruhl noted on this point that that NEPA is highly context-specific, which is an attribute in the sense that it can facilitate evolution in terms of whether or not issues such as climate change are to be considered under NEPA. At the same time it allows for discrepancies between courts. See David Markell and J B Ruhl, 'An Empirical Assessment of Climate Change Litigation' (2012) 64 *Florida Law Review* 15, 61.

[86] 40 CFR §1508.8.

removed in distance, but are still reasonably foreseeable.'[87] Thus the two key requirements in establishing an indirect impact are causation and reasonable foreseeability. In considering indirect impacts (as with direct impacts), agencies are required to consider connected, closely related actions,[88] cumulative actions (which have cumulatively significant effects),[89] and 'similar' actions[90] in the same impact statement.

Causation is established where there is a 'reasonably close causal relationship'[91] between the action and the impact in question, 'akin to proximate cause in tort law'.[92] The Supreme Court has explained that 'but for' causation is insufficient to hold an agency responsible under NEPA, noting that, additionally, 'inherent in NEPA and its implementing regulations is a "rule of reason," which ensures that agencies determine whether and to what extent to prepare an EIA based on the usefulness of any new potential information to the decision-making process.'[93] In this statement, reasonableness is linked to the utility of discovering new information. However, there does appear to be a limit – where furnishing new information would be 'so all-encompassing in scope that the task of preparing it would become either fruitless or well nigh impossible'.[94] Reasonable foreseeability can be defined in the US as being 'sufficiently likely to occur that a person of ordinary prudence would take it into account'.[95] Implicit in the requirement to analyse reasonably foreseeable impacts is a duty to engage in 'reasonable forecasting.'[96]

If 'substantial cause' in the Australian context were to have a similar meaning to that of 'reasonably close causal relationship' in the US context, then Australia could look to its own tort law which also has a proximate cause doctrine in the form of legal causation, centred around 'remoteness'.[97] The s 527E relationship could, for example, be established where legal causation can be established, ie, where the potential 'impact' is not too remote from the action. However, it is not necessarily the case that these two requirements will have similar meanings – in fact, because s 527E does deal with remoteness in paragraph (2), indicated through the employment of 'reasonable foreseeability' in that paragraph, it could also be argued that the 'substantial cause' requirement actually adds something not required under US law – for example, that the cause, if one amongst many, must carry a particular weight.

Moore, Garret and Foreman have aptly commented on the major problem with the reasonable foreseeability requirement in the US context. They note that impacts must be foreseeable to some extent 'or else they would not have been raised in the first place', and that the basis on which courts tend to deem some impacts as foreseeable and others as not foreseeable 'seems more ends-driven

[87] Ibid.
[88] Ibid §1508.25(a)(1).
[89] Ibid §1508.25(a)(2).
[90] Ibid §1508.25(a)(3).
[91] *Metropolitan Edison Co v People Against Nuclear Energy* 460 US 766, 774 (1983).
[92] *Department of Public Transportation et al v Public Citizen et al* 541 US 752 (2004).
[93] Ibid.
[94] *Clean Wisconsin, Inc v Public Service Commission of Wisconsin and Wisconsin Department of Natural Resources* 282 Wis 2d 250, 191 (2005), citing *New York v Kleppe* 429 US 1307, 1311 (1976) and *Milwaukee Brewers Baseball Club,* 130 Wis 2d, 72 (1986).
[95] *Sierra Club v Marsh* 976 F2d 763, 767 (1st Cir, 1992).
[96] *Scientists' Institute for Public Information, Inc v Atomic Energy Commission*, 481 F 2d 1079, 1092 (DC Cir, 1973).
[97] See, eg, *Overseas Tankship (UK) Ltd v Morts Dock and Engineering Co Ltd ('Wagon Mound (No. 1)')* [1961] UKPC 2.

than principled'.[98] This means that NEPA analyses are 'vulnerable to an agency's desires to avoid obligations to address impacts it cannot control or evaluate thoroughly and to plaintiffs' attempts to delay agency actions by arguments that remote impacts should have been addressed.'[99] In other words, they argue that it is in an agency's interest to ignore impacts and if challenged argue that those impacts were speculative and not foreseeable, even in cases where it may serve both the public and decision-makers better to acknowledge the impact.

In this vein, Australia and the US face parallel problems regarding reasonable foreseeability, in spite of having distinct legal contexts. Section 527E of the EPBC Act prescribes an inquiry that details the party involved and their relationship to other parties and the proposed action, and the foreseeability of different aspects of the circumstances leading to the potential impact. In the US, reasonable foreseeability is defined more simply, but the requirement is closely linked with the concept of reasonableness generally and the utility of the information that may be garnered to the impact assessment, though not an aspect of foreseeability, is also relevant. In other words, the burdensomeness of the consequences of including a particular impact are part of the reasonableness requirement, of which reasonable foreseeability is also a part, in the US context. The reasonable foreseeability aspect of the inquiry is also more central in the US, whereas in Australia it has not been extensively discussed by courts.

In the US, agencies have their own internal guidance to aid agency decision-makers in interpreting and applying NEPA. The Bureau of Land Management ('BLM'), one of the agencies which frequently reviews proposals for major projects including fracking projects under NEPA, has stated in its handbook that

> [w]hen you are uncertain which effect is direct and which is indirect, it is helpful to describe the effects together. Effects are weighted the same; you do not consider an indirect effect less important than a direct effect in the analysis.[100]

Climate change impacts are recognised as comprising the indirect (if not direct) impacts of projects such as fossil fuel extraction projects in the US, including fracking projects, as the following Section highlights. However, the federal government position on whether climate change needs to be included in impact analysis and to what extent has changed under the Trump administration. This may have flow-on effects, including, potentially, a regression from the developments that were beginning to solidify climate change as a key consideration for NEPA analyses.

C *How Climate Change Considerations are Evaluated*

Even prior to the Trump administration, there was no consistent approach across US agencies with respect to how climate change impacts are considered in EIA and incorporated into final decision-making. However, recent years have demonstrated an overall trend toward including both the direct and indirect emissions of a project, including combustion emissions, as relevant to the project's overall environmental impact in EIA.

[98] C Grady Moore III, Leslie Garrett Allen and Mary R Foreman, 'Indirect Impacts and Climate Change: Assessing NEPA's Reach' (2009) 23 *Natural Resources and Environment* 30, 32.
[99] Ibid.
[100] Bureau of Land Management, *BLM National Environmental Policy Act Handbook H-1790-1* (BLM Printed Materials and Distribution Section, 2008), 56.

Prior to the first issuance of CEQ guidance on incorporating climate considerations as indirect impacts (released in draft form in 2010),[101] some agencies were already evaluating the contributions of their actions to climate change, such as through the burning of fossil fuels leading to downstream emissions. However, this was not being done in a particularly consistent fashion – sometimes, climate change impacts were left out altogether. In a review of the way in which key US agencies that assess projects likely to have potential climate change impacts[102] have considered climate change in their EIA documents,[103] Burger and Wentz concluded that most agencies have started to more reliably include indirect emissions in their impact analyses, loosely in correlation with the issuance of the first CEQ guidance in 2010.[104]

A related trend is that agencies that neglect to look at climate change impacts, including from downstream emissions, have been increasingly challenged in courts, with some success. The omission of consideration of downstream greenhouse gas emissions from coal combustion was in one case held to be 'arbitrary and capricious' by the Colorado District Court,[105] while the DC Court of Appeals found a pipeline impact assessment conducted by the Federal Energy Regulatory Council ('FERC') to be inadequate as it did not properly consider the impacts of combustion of natural gas.[106] In the latter case, it was submitted that FERC's analysis of indirect climate impacts was 'wholly inadequate'.[107] According to the environment groups that challenged the impact assessment, because 'FERC knows where the natural gas will be burned, how it will be burned, and the amount that will be burned [and] [i]t can measure the greenhouse gas emissions with widely available tools already in broad use by other federal agencies,'[108] it should have provided more information on indirect combustion impacts.

The US Environmental Protection Agency ('US EPA') plays the role of providing comments on impact statements prepared by other agencies in relation to climate considerations, a role afforded to it by the *Clean Air Act*.[109] It can urge agencies to include up- and downstream emissions in greater detail in their impact statements.[110] This has been done on numerous occasions, for example in the FERC case discussed above.[111] It remains unclear what role the EPA will play in this respect under the Trump administration.

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[101] *Draft Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews*, 75 Fed Reg 2010–3531 (CEQ, 2010).

[102] Bureau of Land Management ('BLM'), US Forest Service ('USFS'), Federal Energy Regulatory Commission ('FERC'), Bureau of Ocean and Energy Management ('BOEM'), Department of Energy, US Army Corps of Engineers, and the Department of State.

[103] In the US, the principal EIA document is the Environmental Impact Statement ('EIS').

[104] Burger and Wentz, above n 48. See, eg, Bureau of Land Management, 'Final Supplemental Environmental Impact Statement for the Leasing and Underground Mining of the Greens Hollow Federal Coal Lease Tract' (February 2015); United States Forest Service, *Final Environmental Impact Statement, Federal Coal Lease Modifications,* COC-1362 & COC- 67232, 80 (August 2012); US Army Corps of Engineers, 'Final Environmental Impact Statement, Alaska Stand Alone Gas Pipeline' (October 2012); US Department of State, 'Final Supplemental Environmental Impact Statement for the Keystone XL Project' (January 2014).

[105] *High Country Conservation Advocates v United States Forest Service*, 52 F Supp 3d 1174, 1196 (D Colo, 2014).

[106] *Sierra Club v Federal Energy Regulatory Commission* (DC Cir, No 16-1329, 22 August 2017).

[107] *Sierra Club v Federal Energy Regulatory Commission*, No 16-1329 (DC Cir opening brief, 9 December 2016).

[108] Ibid 10.

[109] *Clean Air Act 1990* 42 USC § 7609, § 309.

[110] See Burger and Wentz, above n 48, and references therein.

[111] EPA Letter 10/26/15 at 2-3, cited at cited in *Sierra Club v Federal Energy Regulatory Commission*, No 16-1329 (DC Cir opening brief, 9 December 2016).

A modified, updated guidance to agencies on the incorporation of climate considerations into environmental impact statements released by the CEQ in 2016 reiterated an encouragement to agencies to include indirect emissions in EIA, both upstream and downstream of the action in question, including in relation to any connected actions, subject to 'reasonable limits'.[112] The CEQ Guidance served as an interpretation of NEPA by the CEQ, and CEQ interpretations are to be afforded substantial deference by courts.[113] This requirement was specifically referred to in the FERC case, where the US EPA had urged FERC to comply with the CEQ Guidance.[114]

The guidance was withdrawn in April 2017 under the Trump administration, which does not mean that climate change no longer needs to be considered as an indirect impact of coal and natural gas cases, but rather reflects the current administration's reluctance to actively endorse barriers to economic development on environmental grounds. As alluded to, agencies may change the type of proposals they put forward, and they may also exclude or downplay the importance of climate change impacts under the current administration. However, the court system, deferential though it may tend to be, still acts as a check and balance on agency decision-making, and the courts can require impact analysis to be re-done if it is not considered sufficient in terms of its consideration of climate change.

An example of deference can be found in *Sierra Club v US Department of Energy*,[115] where the DC Court of Appeals endorsed the Minister's conclusion that it did not need to analyse the environmental effects of export-induced natural gas emissions, because they were 'too speculative to be reasonably forecast and meaningfully quantified'.[116] This was on the basis that the Department of Energy had provided a reasonable explanation as to why the calculation would be too speculative. Courts also appear satisfied to defer to agencies if agencies can calculate with evidence that the proposed emissions from a project would be lower than an emissions calculator would otherwise predict.[117] However, completely unsubstantiated attempts to discount potential emissions are not likely to be supported by US courts.

The perfect substitution argument mentioned in the *Adani* discussions in Part I has been tested in the US and rejected. In *High Country Conservation Advocates v United States Forest Service*,[118] the District Court of Colorado found that the production of coal likely to occur as a result of the mining proposal would increase the supply of cheap, low-sulphur coal which would impact the demand for coal relative to other fuel sources,[119] therein rejecting the argument by the US Forest Service that the market would supply a perfect substitute for the coal if the project was not approved. Arguments pertaining to the foreseeability of downstream emissions, including in relation to the unknown efficiency of power plants[120] and future mitigation activities[121] have also been rejected. Clearly, the success of these types

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[112] 'Reasonable limits' are based on feasibility and practicality: *Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews*, 81 Fed Reg 51866-51867 (CEQ, 2016) 13 <energy.gov/sites/prod/files/2016/08/f33/nepa_final_ghg_guidance.pdf>.

[113] *Andrus v Sierra Club* 442 US 347, 357-58.

[114] EPA Letter 10/26/15 at 2-3, cited in *Sierra Club v Federal Energy Regulatory Commission*, No 16-1329 (DC Cir opening brief, 9 December 2016).

[115] *Sierra Club v United States Department of Energy*, No 16-1186 (DC Cir, 15 December 2016).

[116] Ibid 2.

[117] See *Mayo Foundation v Surface Transportation Board,* 472 F 3d 545, 556 (8th Cir, 2006).

[118] 52 F Supp 3d 1174, 1190 (D Colo, 2014).

[119] Ibid 1198.

[120] *High Country Conservation Advocates v United States Forest Service*, 52 F Supp 3d 1174, 1190 (D Colo, 2014).

[121] Ibid citing *New York v Nuclear Regulatory Commission* 681 F 3d 471 and *Neighbours of Cuddy Mountain v US Forest Service* 137 F 3d 1372, 1381 (9th Cir, 1998).

of arguments will be determined on a case by case basis, and more case law is required to establish a clean line of precedent. Nonetheless, the differing approach in the US to that indicated by *Adani* in Australia is noteworthy.

Commentators have tended to support the notion that agencies should be required to analyse the indirect combustion emissions of their proposed actions. Burger and Wentz, supportive of the trend toward more inclusive climate impact analyses, even provide a reference list of tools that can be used to calculate downstream emissions including those that will occur outside the particular agency's jurisdiction,[122] noting that it 'would be illogical to ignore greenhouse gas emissions in other jurisdictions, since a ton of CO_2e has the same effect regardless of where it is emitted'.[123] They also recommend that agencies conduct a market analysis detailing how the proposed increase in fossil fuel supply will affect prices and consumption vis-à-vis alternative fuel sources.[124] If no market analysis is conducted, then Burger and Wentz suggest that a statement could be included which acknowledges that the net impact of the action may be smaller than the estimated gross emissions, but 'under no circumstances should the agency state that the project should have no effect on emissions as compared with the no action alternative because there are "perfect substitutes" for the produced fuel [as] such an assertion is factually wrong and has been rejected by the courts.'[125]

With adequate guidance and appropriate tools, the climate change impacts of major projects – including the downstream emissions associated with transport and combustion – can be a requisite consideration for EIA without being necessarily associated with inappropriate time and cost burdens. As Australia starts to contemplate changes in its energy projects landscape, including an expanding natural gas and fracking industry, as well as an expanding renewables industry, now is a fitting time to also contemplate the implementation of the required changes in law.

III AMENDMENT OF THE EPBC ACT TO INCLUDE CLIMATE CHANGE

There are a number of suggested ways in which the EPBC Act could be amended with the view to facilitating better recognition of climate change and its impacts:

- new sections could be included requiring climate change as a consideration relevant to all decision-making, akin to the way in which the precautionary principle and the principles of ESD are required to be considered;
- existing sections could be amended to connect climate change with each specific MNES (for example under Part 9, Division 1, subdivision B);
- climate change could be added as a required consideration under s 136;[126] and/or
- a new MNES could be added which designates contributions to climate change as a trigger for assessment and approval.

The first three of these options would likely be simpler than the latter to implement – including a new MNES broadens the scope of the EPBC Act more significantly than does including new considerations that do not add a new trigger. However, as the previous discussions in this and earlier Chapters have

[122] Burger and Wentz, above n 48, Appendix.
[123] Ibid 177.
[124] Ibid.
[125] Ibid 181.
[126] In this vein, the independent review of the EPBC Act suggested that decision-making should consider the reasonably foreseeable impacts of decisions on the ability of a protected matter to adapt to current and emerging threats, of which climate change is one: Hawke, above n 63, ch 13 (generally), and 6.21.

highlighted, a requirement to merely consider a matter does not typically lead to any particular outcomes, nor does it mean that the matter will influence an approval decision in a tangible or predictable way. Importantly, the first three options would apply once the EPBC Act has been triggered already on account of an existing MNES, which would not target climate change in its own right. Thus, consideration of climate change would be in the context of other issues. The fourth option however would allow the EPBC Act to be triggered by climate change concerns alone and irrespective of (likely, additional to) other important environmental matters. It would create a penalty for actions likely to significantly contribute to climate change unless approval is sought and the issues appropriately considered. It is this option which is thus recommended and which is examined further below.

The following sections draw on the EPBC Act's objects and on Australia's international commitments to support the justification for including a climate trigger in the EPBC Act, referencing the contributions of others who have suggested a 'greenhouse trigger'. Section B discusses how a 'climate system trigger' could work, explaining why a climate system trigger is preferable to a greenhouse trigger, from the perspective of systems thinking.

A *Justification for a Climate Trigger*

1 *The EPBC Act's Objects*

Section 3 of the EPBC Act contains its objects, outlining what the EPBC Act is intended to achieve. Although not an enforceable stand-alone provision (it is not accompanied by any penalty provisions), s 3 helps define the Act's purpose or objective, and in this sense is a reference point for interpreting the other provisions of the Act[127] and thus its EIA system.

Subsection (2) of s 3 explains how the EPBC Act achieves its objectives. One of the ways listed is to implement the EIA system, which will 'ensure activities that are likely to have significant impacts on the environment are properly assessed'.[128] It is argued that the capacity for 'proper assessment' to be conducted is negated if it does not include the significant impacts associated with climate change.

The first-listed object, s 3(1)(a), is to provide for the protection of the environment, especially (but, impliedly, not exclusively) those aspects that are of national environmental significance. It is arguable that this object cannot be achieved without consideration of climate change in a meaningful sense, since climate change is such a significant threat to the environment.[129] This object is not being achieved with respect to the impacts of climate change: in a review of the EPBC Act for the State of the Environment Committee, Chris McGrath found the EPBC Act was having 'no positive effect' in relation to climate change,[130] and opined that amending the EPBC Act to ensure the consideration of greenhouse gas emissions would mean that the EIA system could be utilised to complement the Australian Government's other greenhouse gas reduction efforts.[131]

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[127] *Acts Interpretation Act 1901* (Cth) s 15AA.
[128] EPBC Act s 3(2)(d).
[129] See, eg Ross Garnaut, *The Garnaut Climate Change Review* (Cambridge, 2008); Ross Garnaut, *The Climate Change Review 2011 – Australia in the Global Response to Climate Change* (Cambridge, 2011); and Australian Government Department of the Environment and Energy, *State of the Environment Report 2016* (Commonwealth of Australia, 2016), which discuss the impacts of a global temperature rise for Australia.
[130] Chris McGrath, 'Review of the EPBC Act' (Paper prepared for the 2006 Australian State of the Environment Committee, Department of the Environment and Heritage, Canberra, 2006) 11 <environment.gov.au/system/files/pages/fd365356-502f-44e6-9b60-2ffd67bea344/files/epbc-act.pdf>.
[131] Ibid 12.

The second-listed object is promoting ESD through the conservation and ecologically sustainable use of natural resources (s 3(1)(b)). Fossil fuels including coal and natural gas are natural resources, and their use can impact ecological sustainability through affecting the climate system. Development that generates large quantities of fossil fuels and thereby impacts the climate system is increasingly unlikely to be justified as being ecologically sustainable. Perhaps in the past it could have been argued that coal mining and natural gas extraction assist sustainable development through the generation of energy, and the provision of jobs, at what was previously understood to be a small cost to the environment. Similarly, that fracking assists ecologically sustainable development by unlocking a 'bridging fuel' not available without fracking technologies, as the global economy transitions away from coal. As alternative (renewable) energy sources become more readily available, however, and as the overall cost of fossil fuel consumption increases, the validity of these arguments decreases.

The objects in s 3(1)(c) and (ca) are to promote the conservation of biodiversity and to provide for the protection and conservation of heritage respectively. Biodiversity and heritage are each aspects of the environment protected by the EPBC Act that are vulnerable to climate change. According to a comprehensive study,

> [t]he impacts of climate change on Australia's biodiversity are now discernible at the genetic, species, community and ecosystem levels across the continent and in our coastal seas. The threat to our biodiversity is increasing sharply through the 21st century and beyond due to growing impacts of climate change, the range of existing stressors on our biodiversity and the complex interactions between them. A business as usual approach to biodiversity conservation under a changing climate will fall short of meeting the challenge.[132]

Effective protection and conservation of biodiversity and heritage requires that climate change, a key stressor, therefore be addressed.

2 *Australia's International Climate Change Commitments*

Of the remaining four objects, s 3(1)(e) has the most pertinent link to climate change: to assist in the co-operative implementation of Australia's international environmental responsibilities. When the EPBC Act came into force, Australia was already party to the UN Framework Convention on Climate Change ('UNFCCC'), but its *Kyoto Protocol*,[133] which defined international climate change law for so many years, was not yet in force. Accordingly, Australia had limited global climate commitments, and these commitments did not extend to emissions reduction requirements or pledges.

Nearly 20 years later, the situation has changed – Australia has stronger and better defined obligations to the international community to reduce greenhouse gas emissions and minimise the impacts of climate change – principally, through its Nationally Determined Contribution ('NDC') under the *Paris Agreement*. When deciding to ratify the *Paris Agreement*, Australia conducted an interest analysis, where expert analysts found that Australia had a 'clear national interest' in supporting global action on climate change.[134]

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[132] W Streffen et al, *Australia's Biodiversity and Climate Change: A Strategic Assessment of the Vulnerability of Australia's Biodiversity to Climate Change* (2009), 221-222. Note also that on 27 June 2018, the Parliament of Australia's Senate referred to the Environment and Communications Reference Committee the matter of Australia's faunal extinction crisis – over the course of 2018, threats from climate change and other stressors to Australia's fauna will be assessed. The Senate report is due on 4 December 2018.

[133] opened for signature 16 March 1998, 2303 UNTS 148 (entered into force 16 February 2005).

[134] 'National Interest Analysis [2016] ATNIA 10 with Attachment on Consultation Paris Agreement' (12 December 2015), 5. Available at <aph.gov.au>

Australia's achievement of its commitments under the *Paris Agreement* will mean that 'business as usual' is not a viable pathway for a lower carbon future. Deep decarbonisation in order to achieve the *Paris Agreement*'s goals will require a profound transformation of Australia's energy system away from fossil fuels and other climate intensive activities.[135] New projects will thus need be considered in light of how much they will contribute to Australia's emissions profile, and whether the advantages of climate-contributing projects outweigh the costs of emissions.

Although it is true that Australian fossil fuel combustion that occurs outside Australia does not 'count' towards Australia's emissions for the purpose of international commitments, decision-makers should at least be considering the implications of facilitating projects that lock in many years of new fossil fuel emissions in light of a global context that is rapidly moving towards eventual carbon neutrality. The perfect substitution argument made in *Adani* is weak, and will weaken over time as all countries continue to reduce their emissions. In addition, fuel burned elsewhere will still impact the Australian environment. To consider overseas emissions does not mean that the EPBC Act would apply extra-territorially[136] or be able to be triggered by foreign actions. Rather, that Australian projects whose purpose and direct consequence is fuel production that will have a significant contribution to climate change (and thus impact the Australian environment) when that fuel is burned should be considered in light of those consequences.

3 *Federal Policy and the Greenhouse Trigger Discussions*

An important reason as to why the EPBC Act has not been amended to include climate change to date is that the Australian federal government has contended, that climate change is dealt with through other avenues – namely, by putting a price on carbon, and/or through other economic and regulatory measures. This was stated explicitly by the then Labor government in 2011 as a reason for not amending the EPBC Act to include climate change.[137] Certainly, other measures are likely to be required in order for Australia to achieve its commitments under the *Paris Agreement*,[138] but the EIA system under the EPBC Act remains an important avenue through which emissions reductions can be assessed, as it is the principal way of targeting individual projects and ensuring that appropriate conditions are in place prior to the commencement of emissions-intensive activities.[139] Because EIA in Australia is driven by the proponent, and proponents are often private entities, some of the burden of obtaining information about future emissions would be placed on the private sector if EIA was used as a tool to target climate change.[140]

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[135] Deep Decarbonization Pathways Project, *Pathways to Deep Decarbonization* (Sustainable Development Solutions Network and the Institute for Sustainable Development and International Relations, 2015), 3; A Denis et al, 'Pathways to Deep Decarbonization in 2050 – How Australia Can Prosper in a Low Carbon World', the Australian report of the *Deep Decarbonization Pathways Project* (Sustainable Development Solutions Network and the Institute for Sustainable Development and International Relations, 2014).

[136] See Margaret Young, 'Trade Measures to Address Climate Change: Territory and Extraterritoriality' in Panagiotis Delimatsis (ed) *Research Handbook on Climate Change and Trade Law* (Edward Elgar, 2016) 329.

[137] Australian Government Department of Sustainability, Environment, Water, Population and Communities, *Australian Government Response to the Report of the Independent Review of the* Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth of Australia, 2011).

[138] Deep Decarbonization Pathways Project, above n 135; The Australian Panel of Experts on Environmental Law, *Climate Law* (Technical Paper 5, 2017).

[139] See Chris McGrath, above n 130.

[140] This may have pros and cons: placing the burden on the private sector reduces the burden on the government, but at the same time, proponents may have biases in the way that they collect and present information.

The EPBC Act's objectives do not mention social or economic benefits, which is interesting given that social and economic factors are part of the overall consideration of whether a project is approved despite being likely to have a significant impact on a MNES.[141] It is also noteworthy when compared with NEPA's clear tie between environmental protection and human well-being. Nonetheless, protection of the environment clearly can have social and economic benefits. Social benefits associated with reducing greenhouse gas emissions – in particular, methane from fracking – are discussed in Chapter 7. The economic benefits of reducing greenhouse gas emissions, on a long-term timescale, are clear[142] (though, broadly, not within the scope of this thesis). The social and economic benefits of lessening the impacts of climate change would arguably be relevant under the social and economic consideration requirement of s 136 of the EPBC Act if climate change was relevant under the EPBC Act, and could facilitate net positive decision-making.[143]

When the EPBC Act was independently reviewed nearly ten years ago ('the Hawke Review'),[144] the addition of a new MNES was recommended: the environment impacted by a significant (500 000 tonnes or greater) contribution to greenhouse gas emissions.[145] This proposed new MNES became known as the 'greenhouse trigger', due to the fact that an activity which was likely to cause the emission of greater than 500 000 tonnes of CO_2e would be considered a controlled action under s 67, and thereby effectively trigger the need for assessment. A trigger of this nature had also been proposed prior to the Hawke Review. Investigated between 1999-2001 by the government at the time, it was discussed in academic literature and policy circles for many years following.[146] In 2005, a bill[147] was introduced that would create the trigger, but it failed to garner support from the Coalition government.

Multiple submissions provided to the Hawke Review expressed the need to continue to pursue the greenhouse trigger. For example, the Australian Network of Environmental Defender's Offices submitted that

> [u]ndoubtedly one of the more prominent absences from the EPBC Act is the lack of an effective "greenhouse trigger"… it is important that new projects and facilities that will generate significant amounts of GHG emissions are comprehensively assessed under the Act.[148]

[141] One might argue that social and economic impacts are inherent within the principles of ESD, however, the term 'ecologically sustainable development' is a departure from the term used more often internationally, being simply 'sustainable development'; it might be inferred that this departure was intentional, in order to make sure the focus was on the natural environment.

[142] See, eg, Garnaut, above n 129; Nicholas Stern, *Stern Review on The Economics of Climate Change* (Government of the United Kingdom, 2006).

[143] Net positive decision-making is decision-making which facilitates decisions that have an ultimately positive impact, allowing no net environmental degradation, and no net social and economic harms. For further, see particularly Stephen Jay et al, 'Environmental Impact Assessment: Retrospect and Prospect' (2007) 27 *Environmental Impact Assessment Review* 287.

[144] Hawke, above n 63.

[145] Ibid 30 (Recommendation 10).

[146] See, eg, A Macintosh, 'The Greenhouse Trigger: Where Did it Go and What of its Future?' in Tim Bonyhady and Peter Christoff (eds), Climate Law in Australia (Federation Press, 2007).

[147] *Avoiding Dangerous Climate Change (Climate Change Trigger) Bill 2005* (Cth).

[148] Australian Network of Environmental Defender's Offices, Submission No 189 to Australian Government Department of the Environment, Heritage and the Arts, *Independent Review of the Environment Protection and Biodiversity Conservation Act 1999*, January 2009, 21.

Concerns over the need for a greenhouse trigger were echoed by Friends of the Earth, who called for a greenhouse gas trigger to 'meet EPBC Act's objectives and purposes',[149] WWF,[150] the Climate Action Network Australia,[151] Greenpeace,[152] and The Wilderness Society,[153] among others. Humane Society International stated its position as being that '[c]limate change considerations should be explicitly brought into decision making throughout the EPBC Act'.[154] Chris McGrath, a prominent climate law commentator, expressed strong support for the trigger, also proposing additional guidance under a suggested new 'requirements for decisions about climate change actions' provision.[155]

The greenhouse gas trigger debate subsided somewhat after the government responded to the Hawke Review some two years later. The government noted that a greenhouse gas trigger was unnecessary, on account of its intention to introduce a carbon pricing mechanism (a market-based policy response) which it envisioned would be the new comprehensive policy response required to lower emissions.[156] Indeed, around the time of the government response to the Review, a new scheme was put forward, which was a sophisticated phased introduction of carbon pricing intended to transition into carbon trading and linkage with international markets.[157] That scheme, over six hundred pages of legislation and touted in mainstream media as a 'carbon tax', lasted only until the next change in government.

The significance of this context is that it highlights that the need for further action on climate change was widely acknowledged, and that had there been no planned market-based complementary mechanisms, EPBC Act amendment might have garnered further support. The present federal climate policy at the time of writing is an 'Emissions Reduction Fund' which supports activities seeking to assist in reducing Australia's greenhouse gas emissions,[158] but which is not associated with penalties for emissions intensive activities, or binding reduction targets.

Australia's political partisanship with regard to climate change action arguably provides justification for the focus to return to the EPBC Act, regardless of whether a market-based or mandatory reductions mechanism is eventually introduced. Amendment of the EPBC Act would still require political support, and thus could be susceptible to political fluctuations too, but is not as sweeping a measure as a broad-scale policy response as it would not require a new legislative scheme or have as obvious direct financial impacts on sectors of the economy or on the general population that are likely to cause controversy. Further, and for that reason, it could be introduced in a more timely fashion.

The impetus that underlay the greenhouse gas trigger discussions remains valid, and arguably the need for climate change considerations to be addressed is even stronger now than it has been previously. However, the greenhouse gas trigger is conceptually different from the majority of the other MNES, and requires agreement on a set threshold, which could be difficult to amend over time.

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[149] Friends of the Earth, Submission No 190, 30 January 2009, 3.
[150] WWF, Submission No 181, January 2009, 8-9.
[151] Climate Action Network Australia, Submission No 8, 4 December 2009.
[152] Greenpeace, Submission No 86, 16 December 2008.
[153] The Wilderness Society, Submission No 153, January 2009.
[154] Humane Society International, Submission No 182, January 2008, 4. Note: the submission is dated 2008 and thus has been cited this way, but it is acknowledged that this would have been a typographical error.
[155] Dr Chris McGrath, Submission No 17, 14 December 2008, 8.
[156] Australian Government Department of Sustainability, Environment, Population and Communities, above n 137, 27.
[157] This was known as the 'carbon pricing mechanism': see, eg, Centre for Climate and Energy Solutions, *Australia's Carbon Pricing Mechanism* (CCES, 2011); Mark Beaufoy and Laura Schuijers, *Carbon Pricing Mechanism Takes Shape* (DLA Piper, 2012).
[158] Department of the Environment and Energy, *Emissions Reduction Fund* <environment.gov.au/climate-change/emissions-reduction-fund>.

A new approach is therefore proposed below: to introduce a climate system trigger, which would prohibit actions likely to have significant impacts on the climate system without Ministerial approval, and which would require the consideration of such impacts in decision-making – effectively designating 'the climate system' as a matter of environmental significance to Australia.

B *A Climate System Trigger*

In the following subsections, important aspects of the proposed climate system trigger are discussed. These assist in explaining the proposed trigger, why it is important as opposed to a trigger that sets a threshold, how it draws on systems thinking, and how it would relate to fracking. The climate system can be defined broadly, as it is by the Intergovernmental Panel on Climate Change ('IPCC'), as 'an interactive system comprising five key components: the atmosphere, the hydrosphere, the cryosphere, the land surface and the biosphere, forced or influenced by various external forcing mechanisms, the most important of which is the Sun',[159] or by the UNFCCC as 'the totality of the atmosphere, hydrosphere, biosphere and geosphere and their interactions'.[160]

1 *Predetermination of 'Significance'*

The mooted greenhouse gas trigger would have employed a quantitative threshold, setting it apart from all other existing MNES triggers, which do not have set thresholds but rather are triggered on account of a flexible notion of 'significance'. This type of trigger would render 'the environment' (generally) as the protected matter, specifying instead the source of impact (greenhouse gas emissions) – as the nuclear trigger, for example, does.[161] In essentially predetermining significance to the environment, it would potentially undermine the significance enquiry, including the discretion of the primary decision-maker to determine the meaning of significance in accordance with the government guidelines[162] and case law.

Designating projected emissions at or over 500 000 tonnes of CO_2e as significant and emissions under that amount as not significant is problematic. Over time, and in different people's opinions, it might be that the figure thought of as constituting significance varies. For example, 499 999 tonnes may have been considered not significant at the turn of the century – but as international obligations tighten and as climate change impacts worsen, that may no longer be considered the case. It is also problematic to the extent that it would create an incentive toward proposals for facilities that emit under 500 000 tonnes, with the result that there may be more proposals in total, even though slightly under the threshold – and potentially to break up larger projects into smaller compound ones (though that is already discouraged).[163]

The greenhouse gas trigger method also potentially undermines the appeal decision in the *Anvil Hill* case,[164] which held that the significance enquiry is not a 'jurisdictional fact'. It was argued in that case that whether or not an impact was of significance was a matter of fact, and the Minister's power to deem an action as a controlled action and progress with EIA was conditioned on the existence of that fact. The significance of this argument, if it had succeeded, would have been that the 'fact' as to whether or not there was a likely significant impact would be open to review. But the argument was

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[159] IPCC Working Group I: The Scientific Basis, 'The Climate System: An Overview' in *Climate Change 2011: The Scientific Basis* (IPCC, 2001) <ipcc.ch/ipccreports/tar/wg1/040.htm>.
[160] UNFCCC, art 1(3).
[161] EPBC Act pt 3 sub-div E.
[162] Australian Government Department of the Environment, *Matters of National Environmental Significance - Significant Impact Guidelines 1.1* (Commonwealth of Australia, 2013).
[163] EPBC Act s 74A.
[164] *Anvil Hill Project Watch Association Inc v Minister for the Environment and Water Resources* [2008] FCAFC 3.

rejected.[165] The present position is thus that significance under the EPBC Act is not supposed to be viewed as a matter of fact – yet it would be difficult to argue that a greenhouse gas trigger does not beget a factual enquiry.

Where legislation is inconsistent with a court decision, it overrides that court decision – thus legislation could override the *Anvil Hill* appeal decision. However, the implication of setting significance as a given threshold that clearly could either be established or not established would be that the question of significance *would* potentially become a jurisdictional fact, and the exercise of decision-making power conditional upon establishment of the fact (that the facility would be likely to emit over 500 000 tonnes of CO_2e). This may call into question whether other significance questions under other triggers could also be matters of fact, if so, opening up the review process such that courts could decide whether significance is established in a given case, in order to know whether the Minister's decision that was preconditioned on significance was validly made. Such an outcome would not be in line with the EIA constituting a timely and efficient review process.

A 'climate system trigger' would help to avoid these problems. Conversely to the greenhouse gas trigger, the climate system trigger would not need to be associated with a particular quantity of emissions, but rather, a likely significant impact to the climate system. Guidance could be developed or a precedent set indicating a tonnage amount agreed to indicate significance, which could have a similar effect to the trigger, if desired, but such would not be codified in the EPBC Act and could be departed from case by case. This would provide the opportunity of flexible application to the case at hand, and for the trigger amount to change (for example tighten) over time. Whether or not that path is taken, what a significant impact to the climate system might be would, certainly, need to be determined – a process that could happen over time informed, as with the other triggers, by the best available science and by government guidance.

A system-based trigger would facilitate the more natural inclusion of a broader range of climate change related activities – particularly, activities which do not emit greenhouse gases from facilities but which nonetheless impact the climate system, such as agricultural practices (eg, enteric methane production from livestock), forestry and land use changes (eg, land clearance) – without necessarily requiring the calculation of a CO_2e value.

Finally, whereas the greenhouse gas trigger would not actually require, in its application, any consideration of the environment, a climate system trigger would compel the decision-maker to think about the link between action and a critical environmental system (the climate system). This inherent systems-centric conceptualisation would then facilitate contemplation of the broad-reaching indirect implications that the impact to the climate system would have, and whether any of these are also likely to be significant. Such an enquiry may assist in the evaluation of other impacted MNES as well – such that the overall impact assessment would be less fragmented and more of a holistic enquiry as to the environmental consequences of the action in question. A set threshold might more appropriately form part of another policy response extraneous to the EPBC Act – such as a carbon pricing mechanism, if one were to be reintroduced.

2 *Systems Thinking*

Many of the existing protected Part 3 matters can be understood as global systems – the wetlands of international importance, for example, are a system of wetlands spanning multiple different countries protected under the *Ramsar Convention* – most of which are not located in Australia or affected by

[165] Ibid 14-34.

actions within Australia.[166] Species listed as threatened are protected under the *Convention on Biological Diversity* on the basis of meeting a globally recognised vulnerability criterion; properties listed under the *World Heritage Convention* are protected on the basis that they form part of a global network of heritage sites.

Thus, although it may initially seem as though the climate system is not a 'national matter' because it does not fall exclusively within Australia in a geographic sense, this is actually the case for many of the MNES. The EPBC Act's respect to these MNES is given on the basis of Australia's obligations, rather than based on where the MNES are located, although there is almost complete overlap for other MNES, as Australia's obligations have been translated in Australian legislation as covering those aspects of the system that fall geographically within Australian jurisdiction. The climate system to some extent does geographically fall within Australia's jurisdiction, though this is an artificial way of thinking about such a system – in any case, it is a system which forms part of, and in turn directly impacts, the Australian environment. Australia has the capacity to adversely impact the climate system through activities within its jurisdiction, and, through global commitments, a duty to protect it from further anthropogenic interference to a dangerous level.

Further, the climate system has social, economic and environmental flow-on effects that are exclusive to Australia (namely, the impacts of climate change to Australia's citizens, its economy and its environment). In fact, the climate system as a whole could arguably be said to have a closer influence on each of Australian society, the Australian economy, and the Australian environment overall than any other existing MNES.

3 *Climate System Trigger Applied to Fracking*

A climate trigger would, *prima facie*, apply to all fracking projects, because fracking is associated with likely climate impacts.[167] The trigger's application to a given project would depend on the way in which significance were given meaning over time, and whether the project under consideration is, on that basis, considered as having likely significant impacts – recalling that impact is a defined term.

An advantage of the proposed climate system trigger as opposed to the status quo for capturing fracking is that it would mean that the characterisation of impact would be more straightforward. Scope one and two emissions would clearly be direct impacts to the climate system, obviating the need to apply s 527E(1)(b) or (2), and ensuring that climate change impacts resultant from at least a proportion of the project's emissions are mandatorily taken into consideration.

Scope three emissions from fracking would most likely also be relevant for consideration under a climate system trigger. Scope three emissions of any source would appropriately be classed as a direct impact to the climate system. The relevant impact to the climate system from scope three emissions would essentially be determinable by the quantity of scope three emissions released into the atmosphere – and specifically, that quantity's global warming potential. However, the issue that such emissions may or may not be considered a direct impact of the fracking project in question, which was raised in Part I, would still be important under a climate system trigger. Recalling s 527E, discussed above, and given that combustion is self-evidently the substantial cause of scope three emissions, then regardless of how the term substantial cause is defined, the inquiry would hinge on the foreseeability or 'remoteness' of combustion as a downstream consequence of the fracking activity. Combustion overseas could readily be considered as a relevant 'secondary action' within the contemplation of the proponent and an obviously foreseeable consequence of the fossil fuel

[166] See Chapter 4.
[167] See Chapter 3.

extraction. Thus, the indirect emissions issue would also be more straight-forward for all parties with a climate system trigger as opposed to the status quo, and it is more likely that indirect, overseas emissions would be relevant for consideration by the decision-maker.[168]

Upon establishing an impact to the climate system for a given fracking project, the focus would then shift to the extent to which climate system/climate change considerations are 'relevant' impacts, on account of significance and likelihood.[169] There may be some concern that the particular effects (in the fracking case emissions) associated with the action make only a relatively minor contribution to climate change in the scheme of all other influences. In part, this is a cumulative impact issue, addressed under the cumulative impacts discussion in Chapter 6. Given the extreme state of vulnerability of the climate system and its present disposition toward future climate change, the threshold of significance should be low. Significance could be measured with reference to a number of different parameters relevant to context and intensity, including for example the context of Australia's existing emissions profile and other efforts to mitigate climate change. The absence of other successful emission reduction efforts at any given time could be a factor weighing towards determining a particular quantity as significant.

It could be hypothesised that most large-scale fracking projects would attract the proposed climate system trigger, given the emissions intensity of extracting, transporting and ultimately burning extracted natural gas. Methane leakage at the extraction and potentially transport stages, as well as venting and flaring, combined with the energy required to extract and move the fuel, and downstream combustion, would all be potentially relevant considerations when deciding on significance.

If likely significance were established, all initial thresholds thus having been met, then the climate impacts of the particular fracking project would need to be considered alongside any other impacts to other MNES, for example water resources, discussed in Chapter 4. Routinely, multiple MNES are considered together under the EPBC Act. The addition of a climate trigger would facilitate a holistic consideration of the presently-known impacts of fracking, enabling the government to make an informed decision on individual fracking projects. It would mean that the same basic 'controls' on fracking would be open across all states and territories that allow fracking (namely, the ability of a Minister to impose conditions), leaving individual states and territories to decide whether to apply stricter regulations in addition.

It is worth reiterating that, in a similar vein to all other EPBC Act triggers, simply having an avenue open for climate system impact consideration would not mean that in every case climate system impacts would have to be considered – the likely significance threshold would still need to be surpassed. Additionally, opening up the avenue would also not mean that a significant impact on the climate system would have to lead to any particular outcome, such as an emissions-intensive project not being accepted. The routine deference afforded to primary decision-makers by the judiciary would mean that the executive would still have significant power to determine how to weigh the climate considerations associated with fracking with other environmental considerations, and also with social and economic considerations. Instead, the introduction of a climate system trigger would be a responsible response to the potential growth of a new aspect of the fossil fuel industry as the energy landscape shifts in Australia.

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[168] The only way to potentially circumvent this would be to posit as Griffiths J did in *Adani* that the climate system may not be impacted in a net sense by the scope three emissions – as argued previously, this would require evidence to establish. Nonetheless, the simplest and perhaps most compelling advantage of including the new MNES would be to reduce complexity and confusion over legal causation.

[169] EPBC Act s 82.

In summary, a climate system trigger would have the effect of making it more likely that both the direct and indirect (upstream and downstream) emissions of fossil fuel projects such as fracking projects would be relevant under the EPBC Act, and to then progress to the significance and likelihood enquiries. Without a climate system trigger, it is not clear whether any or all of direct, upstream or downstream emissions would be within the scope of the EPBC Act – this would depend entirely on the way in which the link between these emissions and impacts to MNES are presented and interpreted by the decision-maker in each case.

IV CONCLUSION

This Chapter has argued that any pretensions to assess the environmental impacts of fossil fuel actions such as fracking operations through EIA are inadequate unless there is a climate change trigger in the EPBC Act. The reasons for this are essentially twofold: firstly, climate change is a critical aspect of the environmental impacts of fracking, on account of methane leakage at the fracking site, as well as on account of facilitated scope three downstream emissions. Secondly, the EPBC Act as it presently exists (without a climate change trigger) does not adequately protect the environment from climate change impacts, as evidenced by the limited scope for 'indirect impacts' afforded by the legislation, emphasised in case law such as the recent *Adani* case. A possible avenue for change was discussed – a climate system trigger, which would be enlivened through impacts to the climate system that are ultimately expressed through climate change. This avenue was presented as preferable to a previously mooted greenhouse gas trigger, on account of its consistency with Part 3 of the EPBC Act and its facilitation of the consideration of environmental consequences and the action-consequence chain in a systems-oriented fashion.

The US approach to climate change's inclusion in EIA-based decision-making was discussed as a comparative example. Under NEPA, climate change is clearly a potentially relevant consideration to all agency decisions. This position is evident through past agency decisions on actions with potential climate impacts, and through case law where courts have reprimanded agencies for not including the impacts of climate change – including indirect emissions that in Australia would be called scope three emissions – in their environmental assessments. The US system has confronted fracking in addition to other fossil fuel projects, particularly coal projects. The need to consider climate impacts in US decision-making on these types of projects was reiterated by the CEQ's now-withdrawn guidelines, which provided agencies with assistance in how to incorporate climate change impacts. Though the US approach has evolved over time, and though this evolution has not been particularly smooth, the US system may help to indicate a possible pathway for Australia. The US example also serves to demonstrate the importance of political context.

Having considered, in detail, the difficulties associated with Australian law not having a specific climate system trigger and thus the need to rely on existing MNES to assess climate change (Part I), the benefits of a broad scope for climate change considerations to be relevant in decision-making (Part II) and the possibility of a trigger that could extend the breadth of the EPBC Act (Part III), it is ultimately concluded that in order to protect the Australian environment from climate change, the climate system should be added as a new MNES. Although this measure would ideally be supplemented by other policy responses such as a market-based emissions reduction scheme and, for the fracking context, greater controls over the fracking process, it is a critical measure in its own right, and is an appropriate amendment to the EIA system for the future. As a second option – important particularly if no new MNES is added – EPBC Act amendments should be considered which require climate change to be considered mandatorily for all decision-making, and which clarify the difficult and confusing

definition of impact in s 527E. This should be accompanied by government guidelines on how to include climate change considerations for major projects triggered under the EPBC Act. State and territory level laws would ideally also be reviewed with a view to understanding how well those laws incorporate climate change at the state and territory level within EIA and ensuring that climate change is considered at that level where it is relevant and where no federal-level consideration is likely.

Thirteen years after the Victorian case concerning the expansion of the Hazelwood coal mine, that mine has now closed, and the company that operated it is now operating in renewable energy.[170] The Great Barrier Reef World Heritage Area, the subject of *Wildlife Whitsunday*, *Anvil Hill* and *Adani*, has been significantly and irreversibly impacted as a result of coral bleaching (which was reported to have affected 93% of the Reef in 2016) and other impacts of climate change,[171] such as temperature increase and ocean acidification. Scientific and policy experts have firmly established the position that decarbonisation is required for a viable future,[172] and the link between major Australian fossil fuel projects and climate change can no longer fairly be considered speculative.

As the impacts of climate change become more measurable, the imperative to reduce greenhouse gas emissions will strengthen, and the tolerance level for what quantity of emissions is reasonably acceptable will lower. Actions may be judged in a different light to how they would have been when climate change was not considered as such a pressing problem. Operating case-by-case but with the ability to integrate strategic information, the EIA system is a necessary tool that Australian law has with which to respond to changes in science and changes in policy imperatives. If climate change is not addressed in decisions such as fracking approvals, or if the extent of the relevancy of climate change to decision-making is confusing and unclear, Australia will continue to face difficulties in meeting its international obligations to tackle climate change, even if other measures extraneous to the EPBC Act are put into place.

[170] 'Hazelwood Owners Engie Tender for Large-Scale Solar Projects in Australia' *ABC News* (online), 17 January 2017 <abc.net.au/news/2017-01-17/hazelwood-owners-engie-tender-for-large-scale-solar-projects/8187082>.
[171] James Cook University, 'Only 7% of the Great Barrier Reef Has Avoided Coral Bleaching' (Media Release, 20 April 2016); ARC Centre of Excellence – Coral Reef Studies, 'Scientists Assess Bleaching Damage on Great Barrier Reef' (Media Release, 26 October 2016).
[172] Deep Decarbonization Pathways Project, above n 135.

Chapter 6: Cumulative Impacts

Having addressed the risks of fracking in Chapter 3, and the way in which two particular types of risk – water impacts and climate change – are dealt with by the EIA system in Chapters 4 and 5 respectively, this Chapter now focuses on a specific problem whose existence has already been flagged: cumulative impacts. 'Cumulative impacts' is a term used to describe those impacts which are a result of additive or synergistic contributions, considered together. The term 'cumulative effect' can be used interchangeably.[1] Cumulative impacts are problematic because they are difficult for EIA law to capture, are typically not well managed by regulations outside of EIA, and yet are responsible for a large proportion of environmental harms, including from fracking. Recognition and consideration of cumulative impacts – as opposed to only the contribution to an impact of one particular project in isolation – is imperative to the effective minimisation of environmental risk.

Individual contributions which together cause a cumulative impact might stem from different sources and occur at different times. For example, a water resource could be impacted by a number of different sources of pollution, spatially dispersed (such as multiple fracking operations occurring over an area), temporally dispersed (where contributions accrue over a time period, such as where one source continually pollutes for many years), or both spatially and temporally dispersed (where there are multiple operations over time). Contributions may also stem from various activity types which each contribute in different ways to the overall problem. Poor water quality might be a result of the additive effect of a particular point source of pollution from a fracking operation, together with harmful runoff from diffuse points of origin.

As with all impacts, cumulative impacts are likely to have flow-on effects. Poor water quality, for example, might result in a water resource being not fit for human consumption as drinking water, and also being no longer suitable as habitat for a threatened species which previously relied upon it. In turn, the drinking water issue might be compounded by a local drought in the area, cumulatively contributing to water insecurity. The reduced habitat quality for the threatened species could be considered cumulatively with other pressures such as habitat fragmentation, which together place it at risk of local extinction. As this example demonstrates, cumulative impacts are multi-layered, interconnected, emerge from complex systems interactions, and, in addition, are pervasive rather than exceptional.

Adverse environmental impacts that are cumulatively caused typically result from step-wise degradation over time: harm is occasioned incrementally, on account of individual projects or actions, and the impact may take time to be observable (by which point some degree of irreversibility may already have occurred). The 'death by a thousand cuts' analogy has been used to describe cumulative impacts,[2] because while one project might be considered as contributing a negligible or small amount towards an overall harm, and certainly not as *causing* that harm, many projects together could have a detrimental effect.

It is contended in this Chapter that the inability of the EIA system to deal effectively with cumulative impacts is a key failing, and a limiting factor in EIA law's capacity to manage environmental risk. At least partially, that failing is systemic, and for this reason it is a difficult problem to manage through simple interventions. Yet to ignore cumulative impacts or to deem cumulative impacts as beyond the

[1] 'Effect' is typically more commonly used in the US context.

[2] Jessica T Dales, 'Death by a Thousand Cuts: Incorporating Cumulative Effects in Australia's Environment Protection and Biodiversity Conservation Act' (2011) 20 *Pacific Rim Law & Policy Journal* 149.

scope of what reasonably requires assessment is to adopt a precarious course; these impacts can be equally or, in most cases, more significant and damaging to the environment than impacts emanating from a single contributing action. The existence of other avenues to manage cumulative risk does not negate the need for cumulative impacts to be considered in the context of each individual project that is subject to EIA.

Part I of this Chapter begins by articulating the cumulative impact problem with respect to fracking, identifying types of cumulative impact that are observed in the fracking context, as well as reviewing the types of fracking impacts that are or can be cumulative in nature. Part II then explores the cumulative impact problem as it manifests in the EIA and EIA law context by looking at the problem through a systems lens. It identifies components of systems thinking which are helpful to draw on in seeking to better understand how cumulative impacts affect environmental systems. It also highlights the difficulties that the legal system contributes to the issue of recognising and managing risk from cumulative impacts in EIA, and comments on systems-based approaches that may assist.

Part III analyses the Australian EIA system and the way in which it recognises – or fails to recognise – cumulative impacts, while part IV provides a US comparison. The law in Australia is studied with a view to identifying whether the problem of insufficient cumulative impact recognition in EIA is likely to be due to the scope of legislation not adequately permitting or encouraging cumulative impact recognition; an unwillingness on the part of the executive (and judiciary) to give sufficient recognition or weight to cumulative impacts in decision-making; a lack of legislative or policy guidance on how to give recognition/weight to cumulative impacts; a failure in accurately identifying cumulative impacts at all; and/or some other reason. In the US context, cumulative impacts are specifically deemed relevant to EIA-based decision-making, though challenges are nonetheless faced in managing risk.

Part V draws on the prior discussions and articulates two ways in which cumulative impacts might be better managed within the difficult context of EIA-based decision-making. These suggestions represent a novel contribution to the literature. Broadly, existing literature on cumulative impacts is lacking: while the problem has been recognised (albeit mostly in commentary that is now outdated),[3] effective solutions have not. This Chapter extends beyond identifying that cumulative impacts are problematic and considers, in depth and from legal and systems perspectives, why this is so. This is an important precursor to improving the recognition and incorporation of cumulative impacts in EIA-based decision-making.

[3] See, eg, Dales, above n 2; Allan Hawke, *The Australian Environment Act – Report of the Independent Review of the Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth of Australia, 2009) 106; Ralf Buckley, 'Cumulative Environmental Impacts: Problems, Policy and Planning Law' (1994) 11 *Environmental and Planning Law Journal* 344; Jacqueline Peel and Lee Godden, 'Australian Environmental Management: A 'Dams' Story' (2005) 28 *University of New South Wales Law Journal* 668. The cumulative impact problem was also referred to by Chris McGrath in his analysis of the EPBC Act, however, he noted that it is important to view the EPBC Act alongside other measures which encompass cumulative impacts: 'Key Concepts of the Environment Protection and Biodiversity Conservation Act 1999 (Cth)' (2004) 22 *Environmental and Planning Law Journal* 20. See also, in the groundwater context, Rebecca Nelson, 'Broadening Regulatory Concepts and Responses to Cumulative Impacts: Considering the Trajectory and Future of Groundwater Law and Policy' (2016) 33 *Environment and Planning Law Journal* 356.

I CUMULATIVE IMPACTS AND FRACKING

The following table[4] demonstrates the types of cumulative environmental impact that might be relevant to EIA generally and to fracking specifically.

Table 5.1, *Cumulative Impacts and Fracking*

Type of cumulative impact	*Example*
Marginal impact of a new development in an area with prior impacts	The added impact of a new coal seam gas ('CSG') proposal to an area where CSG projects already exist and have already caused environmental harm
Aggregate impact of developments in a defined area	The total impact of all CSG developments in an area where CSG fracking occurs and has occurred in the past
Overall impact of similar concurrent developments in a defined area	The total impact of currently operating CSG developments, coal mining developments, and shale fracking developments in a given area happening at the same time
Interactive impact from different types of development in close proximity	The total impact resultant from interactions between the effects of mining, fracking, commercial construction, and infrastructure that are near to each other in space
Interactions between contributions from diffuse and point sources	The total impact resultant from interactions between water pollutants from site-specific wastewater disposal as well as from run-off
Increases in contributions over time, from growth in existing activities	The total impact likely to accrue from fracking projects in future as they expand
Joint net impact of multiple developments on particular parameters	The total impact of all extractive industry developments and other developments on water or soil quality
Joint effect of multiple stressors on biological populations	The effect of fracking projects in conjunction with land clearance, habitat fragmentation and pollution on a threatened species

When read together with Chapter 3, the table shows that fracking can be responsible for cumulative impacts in relation to potentially significant changes in numerous parameters and from multiple causes across space and time. This includes with respect to water and soil quality, geological stability, and in relation to accumulated greenhouse gas emissions,[5] among other types of impact. Each of

[4] Adapted from Buckley, above n 3, 344-345.

[5] See the detailed discussion of this aspect with respect to the Marcellus Shale in New York in its fracking EIA: New York State Department of Environmental Conservation, *Final Supplemental Generic Environmental Impact Statement on the Oil, Gas and Solution Mining Regulatory Program – Regulatory Program for Horizontal*

these are impacts which can manifest from the cumulative contributions of multiple projects, multiple time phases, and associated activities and infrastructure (such as for infrastructure transport and disposal), and each can have significant direct and indirect consequences, as those who have reviewed the cumulative environmental impacts of fracking have identified.[6]

The fracking example demonstrates difficulties with cumulative impacts in the EIA context well. As the discussions below will attempt to articulate, sound decision-making where cumulative impacts are likely to occur requires adequate data and information, as well as a decision-making system that is able to respond to uncertainty. Adequate data and information means baseline data with respect to the existing quality of the environment, information regarding the impacts of former, existing and future projects, and sufficient scientific knowledge about the environmental systems which are likely to be impacted – particularly, regarding the likely response of those systems and their resilience capacity. As unconventional extraction through fracking is a relatively new technology to be adopted on a large scale, and because baseline data has not always been collected prior to the commencement of exploratory activity,[7] deficiencies in the regulatory system are compounded with gaps in information. Until adequate information is collected, precautionary options such as rejecting or deferring a proposal pending further information, or imposing conditions relating to monitoring and adaptive management, are important potential tools for responding to uncertainty in the fracking context.

The cumulative impacts of fracking have been recognised in 'generic' (broad-scale, as opposed to project-specific) impact assessment inquiries. An example is the State of New York's detailed impact assessment,[8] which noted likely cumulative impacts from water withdrawals, seismic impacts, traffic, visual amenity, regional emissions, and biodiversity habitat fragmentation across the Marcellus Shale region, and which ultimately influenced New York's fracking moratorium.

In Australia, the State of Victoria recently permanently banned fracking;[9] the inquiry preceding the ban did not cover cumulative impacts in detail, but recognised them to be a concern, and noted the Victorian Environmental Protection Authority's submission that an 'integrated framework' would be required if fracking were to be undertaken in Victoria, meaning 'including cumulative impacts to air,

Drilling and High-Volume Hydraulic Fracturing to Develop the Marcellus Shale and Other Low-Permeability Gas Reservoirs (Volume 1, May 2015).

[6] See generally, Jeffrey S Evans and Joseph M Kiesecker, 'Shale Gas, Wind and Water: Assessing the Potential Cumulative Impacts of Energy Development on Ecosystem Services within the Marcellus Play' (2014) 9 *PLOS* 89210; G Allen Burton Jr et al, 'Hydraulic "Fracking": Are Surface Water Impacts and Ecological Concern?' (2014) 33 *Environmental Toxicology and Chemistry* 1679; Nigel H Wright, 'Dealing with Cumulative Environmental Risk in Unlocking Access to Constrained Resources in Frontier Areas and Unconventional Resources' (Society of Petroleum Engineers International Conference on Health, Safety, and Environment, Long Beach, California, 17-19 March 2014); Jessica Kabaz-Gomez, 'A Looming Fracking Explosion: The Inadequate NEPA Cumulative Effects Analysis for the Keystone XL Pipeline' (2013) 43 *Environmental Law Reporter* 11010.

[7] See previous chapters on this point, and also Ryan King, 'We Need a Fracking Baseline' (2016) 77 *Louisiana Law Review* 545; California Council on Science and Technology, 'Advanced Well Stimulation Technologies in California – An Independent Review of Scientific and Technical Information' (Report, 28 August 2014); Jon Hurdle, 'Science Panel Faults EPA Fracking Probe for Excluding Baseline Water Testing' *Pennsylvania State Impact* (online) 13 January 2013; The Expert Panel on Harnessing Science and Technology to Understand the Environmental Impacts of Shale Gas Extraction, *Environmental Impacts of Shale Gas Extraction in Canada* (Council of Canadian Academies, 2014) 12.

[8] New York State Department of Environmental Conservation, above n 5.

[9] *Resources Legislation Amendment (Fracking Ban) Act 2017* (Vic).

surface water and groundwater into a single approval at every stage of project development'.[10] Neither the Tasmanian inquiry[11] (recall that Tasmania has a moratorium on fracking), nor the South Australian inquiry[12] (South Australia permits fracking), covered cumulative impacts.

Western Australia's inquiry,[13] conversely, found that 'the cumulative impact of the number of shale gas wells is an important factor in assessing the ongoing impact of hydraulic fracturing on land',[14] referring to concerns expressed by 'several' public submissions including a submission from The Wilderness Society.[15]

The Western Australian Environment Protection Authority submitted that

> it is inevitable that we will formally assess a hydraulic fracturing proposal, but it will be based on our determination about whether that proposal is significant. In the meantime, while government is getting its regulatory house in order, isolating…critical issues will be important in understanding whether there are cumulative impacts and risks and how they might be managed… we identified that there are going to be other issues – cumulative impacts and risks – that will need to be managed over time. But the industry is a nascent one and we are in good shape to manage the issues and risks associated with that activity.[16]

The Northern Territory inquiry also demonstrated concern over cumulative impacts, in particular deriving from a review prepared by the Australian Council of Learned Academics ('ACOLA'), which was based on a three-year study. ACOLA noted that '[c]umulative environmental impacts arising from large gas field development may […] vary regionally according to landscape integrity, resilience and irreplaceability.'[17] The Chair of the Inquiry, Justice Rachel Pepper, recommended that if the moratorium that was active at the time of the inquiry were to be lifted, then Northern Territory law should be amended to ensure that cumulative impacts are assessed before fracking approvals are granted.[18] The Northern Territory has recently lifted its fracking moratorium; at the time of writing no legislative amendments had been made.

What is clear from these inquiries and the evidence upon which they were based is that cumulative environmental impacts are clearly considered relevant to addressing fracking by scientists, scientific bodies, and the community, particularly in areas where large-scale and multi-project fracking is likely.

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[10] Parliament of Victoria Legislative Council Environment and Planning Committee, *Inquiry into Onshore Unconventional Gas in Victoria* (Final Report, Victorian Government Printer, 2015); EPA Submission No 841, 21 July 2015, 4.

[11] Tasmanian Department of Primary Industries, Parks, Water and Environment, *Review of Hydraulic Fracturing in Tasmania* (30 October 2014).

[12] Natural Resources Committee, Parliament of South Australia, *Inquiry into Unconventional Gas Fracking* (17 November 2015).

[13] Standing Committee on Environment and Public Affairs, *Inquiry into the Implications for Western Australia of Hydraulic Fracturing for Unconventional Gas* (November 2015).

[14] Ibid, ix.

[15] Ibid 1.7; The Wilderness Society, Submission No 7, 5 September 2013, 2.

[16] Evidence to Standing Committee on Environment and Public Affairs, Legislative Council of Western Australia, 31 March 2014, Paul Vogel, Chairman, Environmental Protection Authority, 4-5.

[17] Scientific Inquiry into Hydraulic Fracking in the Northern Territory, *Report of the Independent Inquiry into Hydraulic Fracturing in the Northern Territory* (November 2014), 76.

[18] Scientific Inquiry into Hydraulic Fracking in the Northern Territory, *Scientific Inquiry into Hydraulic Fracking in the Northern Territory – Final Report* (March 2018), 414.

In some cases, as previously identified, scientific concern has led to policy responses such as bans and moratoria. Scientific concern has not yet led to a reform of the EIA system, nor to significant discussion in literature of how the EIA system contributes to cumulative impacts from fracking.

II CUMULATIVE IMPACTS AND SYSTEMS

Systems thinking can assist in engaging with the problem of cumulative impacts. If cumulative impacts are conceptualised as impacts that result from contributory interactions between elements in a system, then it is possible to see how thinking about the system holistically might provide a better understanding of and, ideally, ability to manage, cumulative impacts. This Part begins in Section A by focusing on the legal system and exploring the difficulties which that system faces when presented with the task of managing cumulative impacts, particularly on account of causation. It continues by drawing on two particular elements of systems thinking – scale (Section B) and resilience (Section C) to unpack issues related to cumulative impacts and to lay the foundations for thinking about possible solutions. It then discusses how systems-based approaches could be useful for recognising and appropriately managing cumulative risk factors (Section D).

A *Cumulative Impacts and the Legal System*

The introductory comments to this Chapter recognised that the difficulty in the legal system's ability to manage cumulative impacts is a failing that is in part due to the nature of the legal system. There are two principal aspects: first, the legal system's focus, through the EIA system, on relatively narrow case-by-case assessment rather than more holistic assessment. Second, the legal system's difficulty with apportioning responsibility unless causation can be fully established and uncertainty is minimised. In essentially all areas of law, placing a burden on someone where it cannot be established that their actions caused or will cause harm, is something that is ideally avoided. The law operates most effectively where causation is linear (rather than multifaceted and systemic) and where uncertainty throughout the causal chain is minimised.

Despite the inclusion within some EIA systems, including Australia's, of 'strategic' assessment (discussed in Part IV below), and in spite of the possibility for broad-scale policy interventions that apply to, say, a given region or a given industry and which are intended to minimise risk within that region or on account of that industry, decision-making on major projects is largely approached on a case-by-case basis. It is not common, as Part III recognises, for strategic assessment to occur at all let alone to cover all of the impacts in an area and to manage them in such a way as to minimise risk. Broad-scale policy responses which deal with an industry or its impacts categorically are more common: the fracking ban and moratorium active in Victoria and Tasmania respectively are examples.

Because causation cannot always be established scientifically, legal responsibility for preventing the materialisation of a particular risk factor, or liability for causing an impact (depending on whether it is predicted to occur or has in fact occurred), is in turn difficult to apportion. Uncertainty can tend to be the enemy of the law. The legal system is one which is uncomfortable with creating obligations on those whose actual or projected contribution to a prohibited action is not able to be definitively proven, or could only be considered speculative. In the context of environmental harms and thus environmental law, the precautionary principle offers a way in which uncertainty can be treated not as a barrier but rather as a reason for taking extra care. However, as Chapter 5 in particular acknowledged, this principle is not a reliable method of risk reduction, particularly in Australia.

Chapter 5 also explained how the law in Australia treats impacts that are only partly or only indirectly caused by an action – namely, by restricting what is legally considered an 'impact' of an action via s 527E. Section 527E is the EPBC Act's way of trying to limit the scope of the possibly large suite of impacts, some of which may not be reasonably foreseeable by a proponent. The need to restrict the scope of what is considered as a significant risk factor associated with a particular project is based on notions of fairness, timeliness, cost-efficiency, and practicability – each of which impact upon the ability of the system to best minimise risk. In other words, the goal of minimising environmental risk, in the cumulative impact context, may conflict with other goals important to the legal system – to the extent that that those other goals operate to trump the attainment of maximum possible risk reduction. The fact that these general system goals are somewhat fundamental is a key reason behind why cumulative impacts are so difficult to manage, from a legal perspective.

B *Scale*

The term 'cumulative' refers to the nature of an impact (as being derived from multiple contributions), rather than denoting a particular magnitude of impact or specifying a particular scale across which an impact is either caused or felt. As a result, a cumulative impact may be insignificant or significant (however those terms are defined) and it may be expressed over a narrow or broad scale.

For example, multiple fracking operations in a region might together cause a seismological impact, though not of sufficient magnitude to be felt by humans or to cause any identifiable damage to social or environmental systems, such as to infrastructure or habitat. At the same time, many fracking operations on a global scale, combined with other sources of greenhouse gases over time, have contributed to dangerous climate change. Both are cumulative impacts.

The broader the scale of observation, the more likely that cumulative impacts will be identifiable. For example, all of the major recognised Earth system scale environmental problems – such as climate change, changes in nutrient cycles, and the presence of harmful pollutants in natural systems – are cumulative impacts.[19] It would be extraordinary, though not impossible, for a global scale impact to result from only one source. At the scale of one small tributary, by contrast, some environmental impacts will be able to be more readily identified as being a result of a simple rather than a complex contributory relationship.

This is logical: the more one restricts the scale at which a system is viewed or defined, the more identifiable are the simple cause-and-effect relationships; the wider the scale – or in other words the greater the scope for many different contributing factors to be included – the more complicated the web of simple linkages combined together. From a legal perspective, this is important, because, as alluded to, the scope of the law in terms of what scale it operates at will influence whether cumulative impacts are likely to be able to be recognised. The scale at which causal influences are scoped and analysed might not match up with the scale at which impacts are felt. Downstream, latent, and aggregated impacts are examples.

Environmental impacts that have resulted from multiple contributory actions on a nation-wide scale in Australia are described through the federal government's 'State of the Environment' reporting.[20] Reporting on cumulative impacts is critical to State of the Environment reporting, which focuses on human interactions with natural systems and how those interactions cumulatively cause harm. The most recent assessment acknowledges that '[r]obust assessments of interactions…is extremely

[19] These were discussed in Chapter 2 with respect to the concept of planetary boundaries.
[20] Australian Government Department of the Environment and Energy, *State of the Environment Report 2016* (Commonwealth of Australia, 2016).

difficult, as interactions are likely to be nonlinear and may be synergistic (working together) or antagonistic (working against each other).'[21]

State of the Environment reporting could play an important role in the identification of impacts at broader scales than might otherwise be considered in a single-project context, but which could nonetheless be linked with individual projects in a contributory, or cumulative sense. The consideration of national-scale reporting in EIA might be able to assist with the identification of complex risks, particularly if further attention is focused on identifying the likely or possible contributory factors when reporting on an impact, so that links can be made in the single-project context.

C *Resilience*

How an impact will manifest in the context of a particular system will depend upon many factors, including the affected system's capacity to buffer the impact and to 'bounce back' from harm – in scientific terms, its resilience capacity.[22] Incremental degradation does not necessarily mean that the magnitude of actions or contributions correlates with the magnitude of harm observed – particularly not over time, or in the context of complex systems. Degradation might be slow to manifest at first, or may even be latent, until a tipping point is reached, after which rapid or 'exponential' decline ensues. If one were to graph the magnitude of an impact against the magnitude (or number or frequency) of contributions, it is unlikely that a straight linear plot would explain the relationship. Understanding resilience means appreciating that environmental systems can withstand change, disruptions and perturbations – but not to indefinite degrees. Thus, an impact from one action might be able to be buffered because the system or systems impacted are sufficiently resilient to do so, but as impacts aggregate and accumulate, resilience capacity can lessen, meaning eventually adverse consequences will be felt – sometimes dramatically.[23]

As Chapter 1 explained, the Australian and US EIA systems are enlivened where a potential impact reaches the threshold of 'significance'. Significance is a threshold below which the relevant legislation will not apply, and above which it will. To match with resilience science, environmental law needs to set the threshold at an appropriate level with respect to a system's capacity to resist or counteract an impact in order to prevent irreversible harm (and eventually collapse). Equally, that threshold needs to be understood and respected when each decision is made in relation to an action that might cause

[21] K Evans, N K Bax and D C Smith, 'Marine Environment: Cumulative Impacts and Management of Multiple Uses' in Australian Government Department of the Environment and Energy, *State of the Environment Report 2016* (Commonwealth of Australia, 2016).

[22] The concept of resilience was introduced in Chapter 2.

[23] There is an entire field of study dedicated to literature on resilience, which was indicated in Chapter 2; in addition to the references in that chapter, see, eg, Fikret Berkes, Johan Colding and Carl Folke, *Navigating Social-Ecological Systems: Building Resilience for Complexity and Change* (Cambridge University Press, 2003); Lance H Gunderson, Craig Reece Allen and C S Holling, *Foundations of Ecological Resilience* (Island Press, 2012); Lance H Gunderson and C S Holling (eds) *Panarchy – Understanding Transformations in Human and Natural Systems* (Island Press, 2012); Reinette Biggs, Maja Schlüter and Michael L Schoon (eds), *Principles for Building Resilience – Sustaining Ecosystem Services in Social-Ecological Systems* (Cambridge University Press, 2015); Joshua Farley and Alexey Voinov, 'Economics, Socio-Ecological Resilience and Ecosystem Services' (2016) 183 *Journal of Environmental Management* 389; Tarsha Eason et al, 'Managing for Resilience: An Information Theory-Based Approach to Assessing Ecosystems' (2016) 53 *Journal of Applied Ecology* 656. For a legal perspective, see Robin Kundis Craig's work, eg, Melissa Harm Benson and Robin Kundis Craig, *The End of Sustainability: Resilience and the Future of Environmental Governance in the Anthropocene* (University Press of Kansas, 2017); Robin Kundis Craig, 'Perceiving Change and Knowing Nature: Shifting Baselines and Nature's Resiliency' in Keith H Hirokawa (ed), *Environmental Law and Contrasting Ideas of Nature: A Constructivist Approach*, Columbia University Press, 2014).

it to be reached. Alternatively, the law needs to ensure that a system's resilience is otherwise relevant to the consideration of an impact. These matters are addressed further in the following discussions.

D *Systems-Based Approaches*

Chapter 3 contextualised EIA law and the EIA system by pointing to various factors which can influence whether proposals are put forth for approval and are ultimately subject to the EIA system. Having regard to the goal of minimising environmental risk, the EIA system should ideally operate in the context of strategic planning and policy developments which influence approvals and provide incentives towards projects that cumulatively minimise risk and provide disincentives away from projects that cumulatively contribute to risk. This broader regulatory system might for example have the effect of incentivising fracking operations that utilise wastewater rather than freshwater, or disincentivising operations that vent methane.

Another way in which the broader regulatory system can support the EIA system to manage cumulative impacts is by facilitating the collection and presentation of scientific information. In the introduction to this Chapter, one of the factors suggested in hypothesising why cumulative impacts are not well accounted for in EIA-based decision-making was that there is simply a lack of understanding about what cumulative impacts exist and why they pose an environmental risk. An example of this kind of measure is the 'state of the environment reporting' that was mentioned above, which occurs periodically in all Australian jurisdictions. State of the environment reporting has the potential to generate information on ecosystems and social-ecological systems ('SES') in relation to specific threats and stressors in the context of past and likely future risks of harm. Generic inquiries, such as the Northern Territory's recent inquiry into fracking, are another way in which scientific information can be collected and interpreted with a view to providing guidance to decision-makers and assisting in important policy decisions.

The 'ecosystem approach', promulgated through instruments such as the international *Convention on Biodiversity*[24] and adopted to a limited extent in Australian environmental legislation,[25] is used in state of the environment reporting. It encourages a systems approach to impact assessment, recognising the interconnectedness of individual species or ecological features and the broader systems within which they live.[26] Adopting an ecosystem approach that considers system dynamics, system resilience and system limits is likely to result in more meaningful impact assessment and in turn facilitate improved environmental decision-making in relation to cumulative impacts. If state of the environment reporting is adequately detailed, it could be drawn upon in EIA-based decision-making in order to assist decision-makers in understanding the nature of the risks posed by the project in question in the context of the state of the environment at the time of the proposal's assessment. Equally, primary decision-makers could request that impact assessment is conducted in relation to the specific proposal using an ecosystem approach that is able to provide information on the state of the environment.

It may be that the environment likely to be affected by a given proposal is fragile, with a weak capacity to buffer impacts. This could be on account of other impacts having already lessened that capacity, for example, which state of the environment reporting or ecosystem-based assessment could

[24] See Convention on Biological Diversity, *Ecosystem Approach Sourcebook*, and the references contained therein, available at <www.cbd.int/ecosystem/sourcebook>.
[25] EPBC Act s 3(2)(e)(iii); s 3A(d); definition of 'environment', s 528.
[26] For further, see David Walter-Towes, James J Kay and Nina-Marie E Lister (Eds), *The Ecosystem Approach: Complexity, Uncertainty, and Managing for Sustainability* (Columbia University Press, 2008).

elucidate.[27] In other areas of law in Australia, namely tort and criminal law, a perpetrator that causes harm must take their victim 'as they find them' – fragility and all. The relevant rule is well-established, known colloquially as the 'eggshell skull' rule:

> [O]ne who is guilty of negligence to another must put up with idiosyncrasies of his victim that increase the likelihood or extent of damage to him; it is no answer to a claim for a fractured skull that its owner had an unusually fragile one.[28]

EIA law is not equivalent to tort law, but concepts central to tort law liability have already been observed: causation, remoteness and reasonable foreseeability.[29] If EIA law adopted the tort law eggshell skull approach to fragility, a principle could be established whereby a proponent asking for permission to conduct an action that poses a risk to the environment must take that environment as it is found, in the context of all other factors that have influenced and will in future influence its capacity to be resilient. Discharging wastewater into a stream, for example, would need to be considered in the context of the current and likely future state of the stream and the other stressors also operating on that stream. In other words, a proposal to conduct an activity likely to impact a degraded environment via a marginal cumulative contribution should be viewed in the same way that a tortious or criminal harm to a person who is fragile is viewed. It would be irrelevant that the proponent is not responsible for having caused the pre-existing or likely future environmental harm associated with relevant environmental systems being closer to their 'tipping points'.

To some, this situation may be viewed as unfair; to others, it would create a worrying race to engage in environmentally harmful activities before the tipping point, and claim as much of a share of allowable degradation as possible. However, this is not so unacceptable as is the alternative consequence that cumulative context be largely dismissed. Dismissing cumulative impacts means that significant impacts are at risk of manifesting and, in what could be considered as less equitable, then becoming the responsibility of the public, which has a broad interest against environmental degradation but limited control over harm prevention and limited recourse in the case of damage. The eggshell skull principle is revisited in Part V as a suggested way in which the law might better manage cumulative impacts, and thus environmental risks, through EIA.

III CUMULATIVE IMPACTS IN AUSTRALIAN LAW

A *The EPBC Act*

The EPBC Act does not specifically address cumulative impacts. However, it is potentially able to encompass cumulative impacts through the definition of 'impact'[30] (discussed in Chapter 5 and reviewed further in Subsection 1, below), in conjunction with the way in which it defines impacts as being relevant (namely as being likely to be significant), discussed in Subsection 2. Because 'cumulative impact' is not defined in the EPBC Act, and nor are cumulative impacts specifically deemed to be potentially relevant or not relevant anywhere in the EPBC Act, whether or not the definitions of impact and of relevant impact will cover a given cumulative impact will strongly influence whether or

[27] Studies on resilience capacity would be necessary for this approach. A similar concept has been advocated in the US, with respect to 'carrying capacity studies': C K Contant and LL Wiggins, 'Toward Defining and Assessing Cumulative Impacts: Practical and Theoretical Considerations' in S G Hilderbrand and J G Cannon (eds) *Environmental Analysis: The NEPA Experience* (Lewis Publishers, 1993) 336, 347.

[28] *Owens v Liverpool Corporation* [1939] 1 KB 394, 400-401 (McKinnon LJ).

[29] See Chapter 5 and, further, the discussions below in Parts III and IV.

[30] Peel and Godden, above n 3, 678.

not that potential impact is required to be considered by the Minister, and to what extent. As a corollary, extending or restricting the scope of these provisions, whether through legislative clarification or through judicial interpretation, would alter the extent to which the EPBC Act covers cumulative impacts.

As previous chapters have explained, there are two ways in which impacts might be considered under the EPBC Act. The first is if the impact triggers the EPBC Act's operation. The situation just described, where an impact meets the specific EPBC Act definition and is considered a relevant impact, relates to the ability of the impact to trigger the EPBC Act. In addition, once the EPBC Act has already been triggered, other matters can be considered on account of s 136, when the decision-maker is weighing up the impacts that triggered the EPBC Act with and against any other relevant matters. Cumulative impacts could potentially be drawn within the scope of the assessment considerations on account of s 136, to the limited extent that the cumulative impacts relate to a triggering impact. Whether this is a likely avenue for cumulative impact consideration is not clear after the recent Federal Court's judgment in the *Tarkine* case.[31] This is discussed further in Section 3.

Two further points are important. First, the EPBC Act discourages the splitting of projects into smaller parts. Proponents are deterred from referring proposals that form part of larger projects on account of s 74A, which allows the Minister to refuse a proposal on the grounds that he or she believes it to be part of a project larger than the one submitted. The Minister can then request a referral of the larger project so as to capture all of the relevant impacts of the project as a whole, as opposed to only a small part. This is a means of facilitating the better accommodation of a particular type of cumulative impact – namely the impact of related project parts that are conducted by one person or operator. Second, the EPBC Act encompasses cumulative impacts to a limited extent via its provisions for strategic assessment. This is addressed in Section 4.

1 *Cumulative Impacts as EPBC Act Impacts*

All impacts must satisfy the definition of 'impact' in s 527E in order to fall within the EPBC Act's purview and thus require consideration under federal EIA law. Section 527E was discussed at length in the previous chapter. Essentially, s 527E requires an impact to either be a direct impact of the project in question, or an indirect impact that is substantially caused by the project in question.[32] Indirect impacts that manifest on account of a secondary action done by a secondary person only amount to a s 527E impact where a primary actor would reasonably foresee the actions of the secondary person and would reasonably foresee the impact, and where the primary action 'facilitates, to a major extent' the secondary action.[33]

An action's contribution to a cumulative impact could be described as a direct or an indirect consequence of that action. It may be a direct consequence if the action contributes to the impact in a simple cause-and-effect fashion, with no intermediate events. It may be an indirect consequence if the action contributes to the impact in a 'multi-step' fashion, where there is a 'chain' of causation with at least one intermediary link between action and impact. There is no reason why this direct/indirect distinction should differ between the cumulative impact context and any other prospective impact.

Rather, whether or not a cumulative impact is covered by s 527E is more likely to instead depend on whether the contribution of the action in question is considered either as remote or as causally weak.

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[31] *Tarkine National Coalition v Minister for the Environment* [2015] FCAFC 89 ('*Tarkine*').
[32] EPBC Act s 527E(1).
[33] Ibid s 527E(2).

Remoteness is addressed by the reasonable foreseeability requirements mentioned above. Causal weakness will depend on:

(1) the meaning of 'substantial cause';
(2) whether or not the 'substantial cause' requirement applies to direct impacts or only to indirect impacts; and,
(3) with respect to indirect impacts caused by a secondary action, whether the primary action facilitates the secondary action to a 'major' extent.

It is important to note that 'substantial cause' and 'facilitates, to a major extent' are not the same requirement and do not apply to the same scope of potential impacts. The latter applies to secondary actions such as flow-on and facilitated actions *not* undertaken by the original actor (for example the proponent), whereas the former either applies to all indirect actions (arguably what a simple textual analysis would infer), or to all direct and indirect actions, despite there being no reference to substantial cause in the paragraph where direct impacts are mentioned (s 527E(1)(b)). Chapter 4 noted that 'substantial cause' has not been authoritatively interpreted since s 527E was inserted into the EPBC Act, and that, on account of the recent *Adani* case,[34] it is possible that direct impacts may need to be substantially caused by the action as with indirect impacts.

Given the above, it is very difficult to comment on the extent to which cumulative impacts are covered as 'impacts' under the EPBC Act, and on how cumulative impacts will be treated by courts with respect to the causal link between the action and impact in future cases. To cover cumulative impacts that are a result of many different influences, 'substantial' would need to be interpreted to mean something along the lines of 'not *de minimis*' or 'not insubstantial', rather than something akin to 'primary', 'major' or 'overwhelming'. Supporting such an interpretation, a parallel may be drawn to the definition of 'likely' in the context of a likely significant impact, which is to be interpreted as meaning a real or remote chance or possibility, rather than a probability,[35] and a contrast may be drawn from the stronger wording in the same provision ('facilitates, to a major extent').

Although dealt with separately by the EPBC Act, the concept of likelihood may also be relevant when considering a potential impact's connection to a proposed action. Once it has been established that there is an impact (ie, once the definition in s 527E has been met), the impact must be 'likely' in order for it to be caught within the EPBC Act's ambit. The likelihood enquiry is typically connected to significance, discussed in the subsection below. But it is worth mentioning here, for in the case of indirect, downstream impacts, if the primary impact's occurrence is uncertain – say the likelihood of water contamination – and the uncertainty accumulates down the chain (it is also uncertain as to whether and to what extent biodiversity would be harmed, and in turn uncertain as to what impact the harm to biodiversity would have on social and economic systems), it seems decreasingly probable that the downstream impact would be considered 'likely' to be a significant consequence of the proposed action, and increasingly appropriate to draw a remoteness line.[36]

Juxtaposing causation with likelihood serves as a reminder that since causation is relevant to whether there is an impact and not to whether that impact is likely, the fact that a cumulative impact's occurrence is uncertain is *not* relevant to its indirect nature or the fact that it is remote from the

[34] *Australian Conservation Foundation Inc v Minister for the Environment* [2016] FCA 1042 ('*Adani*').
[35] Australian Government Department of the Environment, *Matters of National Environmental Significance Significant Impact Guidelines 1.1* (Commonwealth of Australia, 2013), 3.
[36] In the case of *Booth v Bosworth* [2001] FCA 1453, the court considered that a precautionary approach could be taken with respect to the likelihood assessment, and found that likely did not need to be established on a balance of probabilities: 98 (Branson J).

project. That is, the enquiry as to whether or not an impact is reasonably foreseeable is not asking whether or not an impact has a reasonable chance of occurrence, rather, whether it is *predictable*. This is an important distinction, because both unlikely impacts and non-foreseeable impacts could end up being classified as 'too remote', or perhaps 'too speculative', but the remoteness in relation to the former is due to a remote chance rather than a remote causal connection.

From a scientific or factual perspective, indirectness and causation are for the most part far less relevant than is likelihood, because what is relevant to the risk of environmental harm is whether an impact will occur and not who caused it. From a legal perspective, though, one could argue that causation is really the essence of the enquiry. Lawyers are trained to think in terms of equitable apportionment of responsibility, and so are more likely to view a piece of legislation such as the EPBC Act as protecting the environment from harm where it can be established that some person has caused or will cause harm, rather than as protecting the environment from harm, *per se*. Adopting this way of thinking, the EPBC Act cannot effectively prevent against cumulatively caused harm unless there is broad scope as to what activities 'cause' harm, and sufficient avenues for dealing with complex causation issues. These factors will play into the interpretation of s 527E, which, it can now hopefully be appreciated, is a key provision, which commentators and courts are largely yet to grapple with.

Early cases decided under the EPBC Act (*prior* to the insertion of s 527E) gave commentators such as Godden and Peel sufficient optimism to deem the theoretical non-exclusion – and so-called 'inkling' of an intended inclusion – of cumulative impacts as a virtuous attribute of the Act.[37] They cited *Booth v Bosworth*,[38] for example, in which Branson J found that the electrocution of spectacled flying foxes by the defendant on his lychee farm was likely to have a significant impact on the values of the Wet Tropics World Heritage Area, despite apparently minimal evidence that this action alone would cause a problematic decline in flying fox numbers. They also cited the *Nathan Dam* case,[39] in which the Full Federal Court accepted the argument that the potential actions of downstream farmers and irrigators in using the water made available by the proposed dam could be considered as impacts of the overall action in question, meaning that the effects of their actions on the environment were relevant to the proposal's approval decision.

Both of these cases could indeed be interpreted as actively recognising cumulative impacts, however, other reasons also justify the conclusions. In *Booth*, for example, the precautionary principle could be referenced to justify the decision not to allow flying fox culling where there was a lack of scientific certainty regarding the impact of a sole operation, and in the *Nathan Dam* case, the impacts of water use by third parties was simply a relevant indirect impact rather than being relevant in a cumulative sense.[40] This does not detract from the conclusion that there is scope for recognising cumulative impacts under the EPBC Act, and that this is a virtuous aspect, however, there remains no precedent which indicates that a link between a project and proportionally small contributions to an impact require the consideration of the overall impact.

[37] Lee Godden and Jacqueline Peel, 'The Environment Protection and Biodiversity Conservation Act 1999 (Cth): Dark Sides of Virtue' (2007) 31 *Melbourne University Law Review* 106.
[38] *Booth v Bosworth* (2011) 114 FCR 39 (Branson J).
[39] *Minister for the Environment and Heritage v Queensland Conservation Council Inc & WWF Australia* [2004] FCAFC 190 ('*Nathan Dam*').
[40] The definition of impact now found in s 527E of the EPBC Act was inserted following the *Nathan Dam* case.

2 *Cumulative Impacts and Significance*

A 'significant impact' under the EPBC Act is an impact which is important, notable, or of consequence, having regard to its context or intensity.[41] Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment which is impacted, and upon the intensity, duration, magnitude and geographic extent of the impact.[42]

The particular issue with cumulative impacts and significance is whether an individual contribution that is only likely to be significant in a cumulative context amounts to a relevant (significant) impact under the EPBC Act. Recall that in the case of a cumulative impact, it may be that a specific threshold (such as being likely to cause serious or irreversible damage) is only achieved when cumulative contributions are considered together.

There are two ways cumulative impacts can be approached in this context: the first is to consider the cumulative impact irrespective of the contribution of the action under question, and ask whether that is significant. This option is only open where the 'impact' test in s 527E can be satisfied for the cumulative impact. The second is to consider the cumulative impact as part of the *context* in which the individual contributing action is taken. For individual, marginal contributions to cumulative impacts to fall within the EPBC Act's purview where s 527E cannot be satisfied for the cumulative impact as a whole, 'context' needs to include the other associated pressures on whichever MNES is implicated. Alternatively, or in addition, the 'intensity' of an impact needs to be considered in light of other contributions.

The Explanatory Memorandum to the EPBC Act expressed that cumulative impacts were not intended to be considered under the significance test; the Memorandum stated that an action not likely to have a significant impact will not require approval *even if* the overall impact together would be significant, on the basis that cumulative impacts should be assessed through state planning and land management legislation and recovery plans.[43] The Memorandum was released prior to the guidelines and case law which have established that context and intensity are relevant to the consideration of significance under the EPBC Act. With respect to the state/federal division, it does not make sense that states would manage cumulative threats to MNES when MNES are within federal jurisdiction, though naturally there will be overlap given the interconnected nature of MNES with other aspects of the environment.

In rare cases, judges have mentioned cumulative impacts in relation to the significance enquiry, despite lack of any EPBC Act mandate to specifically do so – for example in *Brown v Forestry Tasmania (No 4)*,[44] Marshall J considered that 'present and likely future forestry operations' would have a significant impact on a threatened species of eagle, on the basis of Forestry Tasmania's operations forming 'part of the well-established cumulative impact of native forest harvesting in Tasmania on the eagle'.[45] Here, Marshall J effectively considered the contribution of the logging operation under question with respect to the context of cumulative impacts on the eagle population.

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[41] *Booth v Bosworth* (2011) 114 FCR 39; Australian Government Department of the Environment, above n 35.
[42] Australian Government Department of the Environment, above n 35.
[43] Explanatory Memorandum, Environmental Protection and Biodiversity Conservation Bill 1999 (Cth), paras 51, 61 and 79.
[44] [2006] FCA 1729, 102.
[45] Ibid. See also *Queensland Conservation Council Inc v Minister for the Environment and Heritage* [2003] FCA 1463 (Kiefel J).

When the EPBC Act was independently reviewed a couple of years after this case in the Hawke Review, it was concluded that the EPBC Act's significance test did not adequately account for cumulative impacts, but that cumulative impact consideration was important at the federal level.[46]

Further indication that cumulative context should now be considered relevant when analysing a particular contribution can be found in the most recent government guidelines on interpreting significant impacts, the guidance on the water trigger (discussed in Chapter 4). The guidelines provide that

> [t]he significance of an impact may also depend upon the context of other developments: an apparently small impact may still be a significant impact if there are substantial cumulative effects, factoring in existing and reasonably foreseeable prospective actions.

And, further,

> Cumulative impacts should be considered at the local, aquifer or catchment, and regional scale. […] The term 'cumulative impacts' refers to the impacts of a number of different actions or other broader influences on a matter of national environmental significance which, when considered together, have a greater impact on that matter than each action or broader influence considered individually. Therefore, in considering whether an action has, or is likely to have, a significant impact, the seriousness or intensity of the relevant impacts should be considered in context. This context may include existing developments that have an impact on particular water resources, reasonably foreseeable developments which may have an impact on particular water resources and/or the overall development of a region. Therefore, the potential for the impact of an action to be significant is likely to be greater in a more developed system, or where a number of existing or proposed developments are or will be using or impacting upon a water resource. At the referral stage, cumulative impacts should be assessed qualitatively on the basis of potential risks, and only existing and reasonably foreseeable future uses should be considered.[47]

Although the scope of these guidelines is limited as the guidance only applies to the water trigger (which as Chapter 4 discussed itself has a limited scope), it could be interpreted as indicative of how significance should be considered in other contexts as well, particularly being the most recent – and most detailed – guidance to date, and given that cumulative impacts are not exclusively likely to arise only in the context of coal mining or coal seam gas developments and water resources.

3 *Cumulative Impacts and s 136*

Whether or not cumulative impacts are given weight at the assessment stage depends on whether or not they relate to one of the matters (s 136(1)) or factors (s 136(2)) required to be taken into account or considered (respectively) by the Minister, since the Minister is prohibited from taking into account or considering anything not specifically covered under section 136 (and the Division in which it sits).[48] Section 136(1) allows for a very broad range of matters to be considered - any matter relevant to a MNES, as well as economic and social matters (the subject of Chapter 7) are mandatory to consider.[49] On a plain reading of this provision, cumulative impacts relevant to a MNES or to any social or

[46] Hawke, above n 3, pt 2, ch 4.

[47] Australian Government Department of the Environment, *Matters of National Environmental Significance - Significant Impact Guidelines 1.3: Coal Seam Gas and Large Coal Mining Developments – Impacts on Water Resources* (Commonwealth of Australia, 2013) 20.

[48] EPBC Act s 136(5).

[49] Ibid s 136(1).

economic matter would easily fall within the s 136 ambit.[50] The Federal Court has not specifically ruled that cumulative impacts can be considered under s 136, but it has accepted that cumulative impacts may be relevant to approval decisions.[51]

Section 136(2) specifies what factors should be considered in relation to the matters. This does not serve to broaden the scope of relevant matters in terms of being an avenue to add new matters, but rather, serves to guide the consideration of the matters, a process which may lead to new factors being considered if they relate to a particular matter. Factors include issues and recommendations emanating from the assessment process and documentation, which could naturally include cumulative impacts, and also includes the principles of ecologically sustainable development ('ESD'). These principles, discussed elsewhere in this thesis, encompass values attaching to environmental preservation reflected in international law: equity, conservation, precaution, and cost internalisation.

The values underpinning the principles of ESD could be applied to argue in favour of cumulative impacts' importance to the weighing and balancing under s 136: on the basis that future generations will suffer from cumulative contributions as well as (potentially more than) present generations; that conservation of biological diversity requires cumulative impacts affecting the ability of threatened species to survive to be adequately managed; that a precautionary approach should be taken if it is uncertain whether and to what extent cumulative contributions are likely to influence the severity of an impact; that ignoring cumulative impacts means deeming those impacts to be an externality dealt with at a place or time remote from the initial activity, and by those who likely did not cause the harm.

The issue of cumulative impacts in the context of s 136 was considered in 2015 in the case of *Tarkine*. The appellants argued that s 136(2) requires cumulative impacts to be considered if they are relevant to a MNES that triggered the assessment and approvals process in respect of the proposed action. It was the opinion of Jessup J on behalf of the Full Federal Court that s 136(2) does not so require. His Honour acknowledged that other projects and their impacts on the environment might be a relevant thing to consider pursuant to s 136(2), but that cumulative impacts could not be regarded as a requisite consideration in the case at hand – or, impliedly, any case. In particular, this was because he understood s 136(2) not as requiring new concepts to be considered in the sense that the Minister must go and conduct investigations, but as requiring discrete documents to be considered, whose contents might or might not prompt thinking about cumulative impacts. In this sense, he referred to s 136 as representing a 'closed system'.[52]

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[50] Note that although this provision has been cited in case law, it has not been interpreted insofar as defining the meaning of what matters are relevant to a MNES. Cases that have cited s 136 but interpreted another aspect of that section include *Bat Advocacy NSW Inc v Minister for Environment Protection, Heritage and the Arts* [2011] FCAFC 59, which focused on the relevancy of a recovery plan*; Blue Wedges Inc v Minister for the Environment, Heritage and the Arts* [2008] FCA 399 and *Phosphate Resources Ltd v Minister for the Environment, Heritage and the Arts* (No 2) [2008] FCA 1521, which considered the principles of ecologically sustainable development; *Lawyers for Forests Inc v Minister for the Environment, Heritage and the Arts* [2009] FCA 330, which considered the precautionary principle; and *Buzzacott v Minister for Sustainability, Environment, Water, Population and Communities (No 2)* [2012] FCA 403 which considered the future impacts of radioactive material.

[51] In *Western Australian Land Authority (Landcorp) v Minister for Sustainability, Environment, Water, Population and Communities* [2012] FCA 226, the cumulative impacts of a proposed project in conjunction with nine other developments was a reason for the Minister's decision to reject the proposal. The Federal Court held on appeal that the applicants (proponents) had been denied procedural fairness because they only knew that cumulative impacts would be relevant in a general but not a specific sense, and did not have the opportunity to address the specific cumulative impacts on a species of cockatoo.

[52] *Tarkine* 28.

His Honour did not discuss what he meant by this term or if it was intended to relate to systems theory in law. However, his phrasing prompts consideration of whether s 136 is a provision which 'closes' the EIA system at this point in the decision-making process to new information. When viewed through a systems-thinking lens, the reference to s 136 as a closed system invites reflection as to the way in which laws that operate at the interface of 'real world' biophysical systems, including environmental laws, can be designed to control, in a qualitative sense, and also 'translate' the information from the biophysical system that is deemed to be relevant under the law. If the EPBC Act is in effect partially 'closed' to cumulative impacts, then this must limit its ability to regulate the impacts of fracking.

4 *Strategic Assessment*

Strategic assessments allow the Minister to approve the taking of an action or a class of actions in accordance with 'an endorsed policy, plan or program', and are covered by Part 10 of the EPBC Act. Firstly, a policy, plan or program is endorsed, and subsequently, actions associated with the policy, plan or program are able to be approved. Examples of types of strategic assessment are industry sector policies, water extraction policies, and regional or broad-scale development proposals.[53]

The benefit of strategic assessments for managing cumulative impacts is that strategic assessments can evaluate potential impacts likely to result from multiple actions over a broad geographical scale, covering multiple sources and looking across an appropriate time-scale,[54] thus potentially encompassing numerous of the types of impact listed in Table 5.1. However, because strategic assessments under the EPBC Act centre around specific policies, plans and programs rather than centring around particular MNES, they are not necessarily likely to cover cumulative environmental impacts comprehensively and holistically. Principally on account of this reason, strategic assessments do not compensate for the deficiencies in case-by-case assessment, and should instead complement an EIA system that elsewhere allows cumulative impacts to be recognised and to weigh into decision-making.

It is said that advantages for MNES of strategic assessment are intended to result from its scale, namely through the adoption of a 'landscape' rather than site-specific approach,[55] however, project-specific assessment – as case law clearly demonstrates – is not restricted to a site-specific approach. The advantage for proponents of strategic assessment, conversely, is that actions do not need to be individually assessed,[56] so long as they are in accordance with the policy, plan or program that has been endorsed.

An interesting example of an EPBC Act strategic assessment is that regarding offshore GHG storage. In 2014, the Environment Minister, having conducted a strategic assessment of the environment management authorisation process for offshore petroleum and GHG storage activities under the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (Cth), decided to approve the process as a 'policy, plan or program'.[57] He then decided to approve a class of actions under the program – namely all actions that are petroleum or GHG activities taken in Commonwealth waters until 2040 – except

[53] Australian Government Department of the Environment and Energy, *Strategic Assessment* <environment.gov.au/resource/strategic-assessment-under-epbc-act>.
[54] Australian Government Department of the Environment, *Strategic Assessment Under the EPBC Act* (Commonwealth of Australia, 2013).
[55] Ibid 7.
[56] Australian Government Department of Sustainability, Environment, Water, Population and Communities, *A Guide to Undertaking Strategic Assessments* (Commonwealth of Australia, 2013), 5.
[57] Australian Government Department of the Environment, 'Notification of Decision to Endorse the Program to Streamline Offshore Petroleum and Greenhouse Gas Activity Environmental Approvals' (7 February 2014).

those likely to have a significant impact on a MNES.[58] The caveat means that individual projects could still require specific assessment under the EPBC Act's EIA provisions, providing a level of security in that important impacts are less likely to be left unaddressed than they might be if approvals were categorically allowed. Strategic assessments are also underway regarding offshore petroleum activities in the coastal waters of South Australia and the Northern Territory.

A further example is the strategic assessment that is currently being conducted with respect to the Upper Hunter Valley area of NSW, an area where there is significant coal mining activity and which when the strategic assessment agreement was made in 2012[59] was intended to experience an expansion in the following 20-30 years. The Australian Government has stated that once the assessment is complete,

> [f]uture mining applications that demonstrate consistency with the biodiversity plan and are included in an approved class of actions will not need to obtain individual approval under national environmental law.[60]

Strategic assessment is unlikely to be more beneficial than project-specific assessment from an environmental perspective, unless the law evolves such that project-specific assessment categorically rejects, and strategic assessment is able to include, cumulative impacts. This is not presently the case – as the discussion above demonstrated, there is potentially room for cumulative impact consideration under the EPBC Act. At the same time, there is no guarantee that strategic assessment will adequately account for cumulative impacts, even if they are considered. In a case where cumulative impacts were considered in strategic assessment but a policy, plan or program that could result in cumulative impacts manifesting was endorsed nonetheless, the strategic assessment process could be dangerous from the perspective of managing risk. At least case-by-case assessment is able to include project-specific conditions targeted at minimising risk.

Strategic assessment is a tool used in numerous different countries outside of Australia, and it has been evaluated at an international level to be evolving in a positive way, though its effectiveness in terms of fostering environmentally sustainable outcomes has been questioned.[61] Strategic assessment *not* coupled with a negation of the need for individual approval, such as assessment conducted prior to the development of a policy or as part of a generic enquiry, is likely to be useful to proponents, the public, and the executive, and a helpful informational tool for furthering environmental protection.

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[58] Australian Government Department of the Environment, 'Final Approval Decision for the Taking of Actions in Accordance with an Endorsed Program Under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act)' (27 February 2014).

[59] Agreement between the Commonwealth of Australia and the State of New South Wales, 'Strategic Assessment of a Biodiversity Plan for Coal Mining in the Upper Hunter Valley, NSW' (5 September 2012).

[60] Australian Government Department of the Environment and Energy, *Strategic Assessment of a Biodiversity Plan for Coal Mining in the Upper Hunter Valley* <http://www.environment.gov.au/node/25244>.

[61] Monica Fundingsland Tetlow and Marie Hanusch, 'Strategic Environmental Assessment: The State of the Art' (2012) 30 *Impact Assessment and Project Appraisal* 15. For more on strategic assessment, see, eg, Maria Rosário Partidáro and Ray Clark (eds), *Persepctives on Strategic Environmental Assessment* (Lewis Publishers, 2000); Michael Schmidt, Elsa João and Eike Albrecht (eds) *Implementing Strategic Environmental Assessment* (Springer, 2005); B Sadler and R Verheem, Strategic Environmental Assessment: Status, Challenges and Future Directions (Ministry of Housing, Spatial Planning and the Environment, The Netherlands, and the International Study of Effectiveness of Environmental Assessment, 1996); J J de Boer and B Sadler (eds) Strategic Environmental Assessment 54: Environmental Assessment of Policies: Briefing Papers on Experience in Selected Countries (Ministry of Housing, Spatial Planning and the Environment, The Netherlands, and the International Study of Effectiveness of Environmental Assessment, 1996).

Bioregional assessment is essentially a form of strategic assessment but not one specifically mentioned in the EPBC Act. Rather, it is a type of assessment that is being conducted with respect to the impacts of CSG in Australia by the Commonwealth Scientific and Industrial Research Organisation ('CSIRO') funded by the Australian federal government. As the bioregional assessments that have been commissioned have not been completed, it is not clear how well they will incorporate cumulative impacts, although the incorporation of cumulative impacts is one of the objectives.[62] Perhaps more relevantly, it is not clear to what extent they will be considered under the EPBC Act in decision-making.

B *State and Territory Laws*

State and territory EIA laws tend to be more accommodating of cumulative impact consideration than is federal law, though the extent to which these impacts are given weight will vary between decision-makers.

In NSW, the *Environmental Planning and Assessment Act 1979* (NSW) contains a 'duty' to consider environmental impacts[63] which, according to the Act's regulations, should be read to include a duty to consider relevant cumulative impacts.[64] When an approval decision is made, the decision-maker can refer to cumulative impacts when he or she considers any likely environmental impacts.[65]

In Victoria, cumulative impacts are not mentioned in the *Environment Effects Act 1978*, however, the government guidelines suggest that an Environment Effects Statement prepared pursuant to the legislation should identify the potential for cumulative contributions to have an overall significant impact, encouraging a wide scale approach.[66]

In Western Australia, proposals are assessed by its EPA; when the EPA considers significance, it 'may' refer to cumulative impacts,[67] and similarly, in the EPA's assessment report regarding the proposal, it 'may' cover cumulative impacts.[68] Cumulative impacts were both explicitly referred to and defined in a previous iteration of Western Australia's *Administrative Procedures* on EIA,[69] but these references are omitted in the most recent (2016) version.[70] In practice, the Minerals Council of Australia have observed that

> [t]erms of reference or guidelines for project-specific environmental assessments now almost always include a requirement to provide information on the cumulative impacts of similar, neighbouring, regional or associated projects.[71]

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[62] CSIRO, *Bioregional Assessment Programme* <csiro.au/en/Research/LWF/Areas/Water-resources/Resources-sector/Bioregional-assessments>.
[63] *Environmental Planning and Assessment Act 1979* (NSW) s 111.
[64] *Environmental Planning and Assessment Regulations 2000* (NSW) cl 228(2)(o).
[65] See, eg, *Drake v Minister for Planning [2003] NSWLEC 270*; *Dames and Moore Pty Ltd v Byron Council* [2000] NSWLEC 46.
[66] Department of Sustainability and Environment, *Ministerial Guidelines for Assessment of Environmental Effects Under the Environmental Effects Act 1978* (7th ed, State of Victoria, 2006), 18.
[67] EPA Western Australia, *Statement of Environmental Principles, Factors and Objectives*, (Government of Western Australia, 2016), 5.
[68] EPA Western Australia, *Environmental Impact Assessment (Part IV Divisions 1 and 2) Procedures Manual 2016* (Government of Western Australia, 2016), 4.1.
[69] *Environmental Impact Assessment (Part IV Divisions 1 and 2) Administrative Procedures 2012* (WA), ss 2, 4, 7, 10 and s 11 with respect to strategic assessment.
[70] *Environmental Impact Assessment (Part IV Divisions 1 and 2) Administrative Procedures 2016* (WA).
[71] Tom Kaveney, Ailsa Kerswell and Andrew Buick, *Cumulative Environmental Impact Assessment Industry Guide* (Minerals Council of Australia, 2015).

In Queensland, decision-makers assessing proposals may decide that EIA is triggered on account of cumulative significance rather than individual project significance,[72] and cumulative impacts are generally considered to be important particularly with respect to the mining, petroleum and gas industries.[73]

On account of the bilateral approvals process under the EPBC Act, described previously in this thesis, state and territory assessments which in practice may well have considered cumulative impacts can be federally accredited, although, importantly, not in relation to the water trigger (see Chapter 4). This means that federal approvals will in most cases be based upon impact assessment that did consider cumulative impacts. Although projects triggering the water trigger are not presently able to be assessed solely at the state level, as mentioned previously, the government guidance on the water trigger explicitly refers to cumulative impacts in some detail.

Essentially, the fact that cumulative impacts tend to be relevant under state and territory law may in practice (partially) compensate for the lack of recognition, or at least lack of clarity, under federal law. It is arguably nonetheless important that there be a clarification that cumulative impacts are either relevant or not relevant to federal law and thus to the MNES; this Chapter argues that they should be relevant, regardless of the situation at the state and territory level.

IV CUMULATIVE IMPACTS IN US LAW

The link between environmental decision-making and incremental harm from cumulative impacts has long been recognised in the US,[74] a jurisdiction that was an EIA pioneer and which continues to utilise impact assessment for project-specific decision-making. Although similar key concepts are evident in each of the Australian and US federal jurisdictions – notions of context and intensity affecting significance, and notions of reasonable foreseeability affecting causation – the US legislation is coupled with regulations and guidance which indicate more explicitly that cumulative impacts should be considered in decision-making on project approvals, and which also provide greater detail as to how these impacts should be factored into approval decisions.

NEPA, the US federal law, is discussed below in Section A. A state example which is remarkable with respect to its treatment of cumulative impacts, California, is also presented in Section B. As previous chapters have established, fracking in the US is largely regulated at the state level, and in practice, environmental assessment of fracking projects is likely to happen under state laws (if at all), though there *is* some scope for federal assessment under NEPA. Natural gas pipelines, for example, are a key aspect of fracking projects typically within NEPA's reach.[75] Even though fracking may not often be captured by NEPA, NEPA is nonetheless a useful instrument for comparison to the EPBC Act and

[72] Department of Environment and Heritage Protection, *Triggers for Environmental Impact Statements Under the Environmental Protection Act 1994 for Mining and Petroleum Activities* (Queensland Government) 2.3.
[73] See Department of Environment and Heritage Protection, *The Environmental Impact Statement Process for Resource Projects Under the Environmental Protection Act 1994* (Queensland Government).
[74] See Senator Robert Jackson, Report No 296 to the Senate Interior and Insular Affairs Committee, 91st Congress, 1st sess, 9 July 1969, 5; James Auslander 'Reversing the Flow – The Interconnectivity of Environmental Law in Addressing External Threats to Protected Lands and Waters' (2006) 30 *Harvard Environmental Law Review* 481; Terrence L Thatcher, 'Understanding Interdependence in the Natural Environment: Some Thoughts on Cumulative Impact Assessment Under the National Environmental Policy Act' (1990) 20 *Environmental Law* 611.
[75] See, eg, the discussion in Kabaz-Gomez, above n 6.

the Australian context regarding EIA.

A *NEPA*

A full and extensive consideration of cumulative impacts has been described by one US commentator as 'the best hope to achieve NEPA's mandate'.[76] NEPA, in a similar vein to the EPBC Act, aims to protect the US environment from adverse impacts which might significantly threaten its quality. As previously explained, all aspects of that environment are potentially relevant for consideration under NEPA, but its EIA procedures will only be triggered if the project proposed has a federal nexus. This eliminates many actions conducted by private persons on privately owned land, instead essentially capturing the actions of federal agencies on public lands.[77] The restricted scope naturally limits the opportunity to manage cumulative impacts – which could stem from both private and public actions and could occur on land subject to various tenure rights – using the federal EIA system. However, the two definitions extracted below make clear, when read in conjunction, that cumulative contributions that have arisen from non-federal actions can be relevant when assessing a federal action.

The relevancy of cumulative impacts, or 'effects' as they are interchangeably called,[78] in terms of the scope of impacts that require assessment is dealt with under the definition of 'effect' provided in NEPA's Council on Environmental Quality Regulations ('CEQ Regulations'). That definition is inclusive, and expressly refers to cumulative and indirect effects:

> Effects includes ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historic, cultural, economic, social, or health, whether direct, indirect, or cumulative. Effects may also include those resulting from actions which may have both beneficial and detrimental effects, even if on balance the agency believes that the effect will be beneficial.[79]

A cumulative impact, specifically, is an:

> impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.[80]

The CEQ Regulations explain that cumulative context is relevant to considering an action's significance, providing that a point which needs to be considered in the overall significance determination is:

> [w]hether the action is related to other actions with individually insignificant but cumulatively significant impacts. Significance exists if it is reasonable to anticipate a cumulatively significant

[76] T L Thatcher, 'Understanding Interdependence in the Natural Environment: Some Thoughts on Cumulative Impact Assessment Under the National Environmental Policy Act' (1990) 20 *Environmental Law* 611, 613.
[77] With respect to the fracking context, see *State of Wyoming v Department of the Interior* 2:15-CV-043-SWS (Wyo, 2015), which ruled that the Department of Interior could not regulate fracking through its proposed 'fracking rule' even on federal lands, but stated that oil and gas leases issued by the Bureau of Land Management on federal lands are still subject to NEPA (17).
[78] *Council on Environmental Quality Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act* 40 CFR §1500-1508 ('CEQ Regulations') §1508.8.
[79] Ibid.
[80] Ibid §1508.7.

> impact on the environment. Significance cannot be avoided by terming an action temporary or by breaking it down into small component parts.[81]

Within the boundaries of this guidance, it is for agencies to determine which impacts are cumulative impacts.[82] Cumulative impacts may also need to be considered on the basis of other environmental legislation, such as the *Clean Water Act*.[83]

Indirect impacts ('effects') are relevant to the discussion on cumulative impacts in the US, because indirect effects may contribute cumulatively with direct effects or with existing and future impacts to cause harm. Under NEPA, indirect effects

> are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems.[84]

This definition was discussed in Chapter 4 in relation to climate change impacts. Its relevancy to the cumulative impact context primarily relates to consequences of an action that will occur in future and which will likely result in a more significant level of harm, when added to the harm caused by the project under assessment, than would result from the project in isolation.

Case law interpreting and applying the 'rule of reason' and 'reasonable foreseeability'[85] tests in the cumulative impact context has tended to focus on what would be seen under the EPBC Act as secondary actions. For example, whether the building of one facility is reasonably likely to lead to the building of an adjunct or secondary facility,[86] rather than on broader downstream consequences of the project. Projects whose *intention* is to stimulate broad effects such as growth and development are more likely to require the consideration of those effects than projects connected merely in a 'but for' sense, but not in a more strategic sense, to further projects and thus further impacts.[87]

NEPA's central focus after relevant impacts have been identified is on the preparation of an adequate impact statement which reflects those impacts. There is no equivalent of the EPBC Act's s 136, rather, what the agency must take into consideration in making a decision to go ahead with a proposed action or not is what was found in the impact statement and whether the action represents the environmentally preferable alternative or whether some other alternative might be more environmentally appropriate.[88] Challenges to a decision, therefore, are based on not having included

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[81] Ibid §1508.27(b)(7).
[82] See *Sierra Club v Morton* 405 US 727 (1972).
[83] Lee H MacDonald, 'Evaluating and Managing Cumulative Effects: Process and Constraints' (2000) 26 *Environmental Management* 299.
[84] CEQ Regulations 40 CFR §1508.8.
[85] See Chapter 5.
[86] See, eg, *C.A.R.E. Now v. Federal Aviation Administration* 844 F2d 1569, 1575 (11th Cir, 1988); *Florida Wildlife Federation v Goldschmidt* 506 F Supp 350, 375 (SD Fla, 1981); *City of Shoreacres v Waterworth* 420 F3d 440 (5th Cir, 2005); *Hoosier Environmental Council, Inc v US Army Corps of Engineers* 105 F Supp 2d 953 (SD Ind, 2000); *City of Davis v Coleman*, 521 F2d 661, 676 (9th Cir, 1975).
[87] C Grady Moore III, Leslie Garrett Allen and Mary R Foreman, 'Indirect Impacts and Climate Change: Assessing NEPA's Reach' (2009) 23 *Natural Resources and Environment* 30. And see *Sierra Club v Marsh* 769 F 2d 868, 878-79 (1st Cir, 1985) and *Friends of the Earth Inc v US Army Corps of Engineers*, 109 F Supp 2d 30, 40–41 (DDC, 2000), cited therein.
[88] CEQ Regulations §1505.2.

or not having adequately included relevant factors within the impact assessment, and on the associated reasoning relating to alternatives presented in the impact statement.

The tendency has been for cumulative impacts to be given scant consideration in the documentation prepared under NEPA and in subsequent decision-making, in spite of the clear position that cumulative impacts should be relevant. Failure to discuss cumulative impacts has been found to be more prevalent in reviews conducted around the 1990s[89] than in more recent years,[90] which might be attributed to a series of legal challenges lost by US agencies on the basis of (*inter alia*) failure to perform adequate cumulative impact assessment in their NEPA documents.[91] For example, in the 2004 case *Lands Council v Powell*,[92] the Ninth Circuit, reversing a district court decision, held that a timber harvest plan for the Idaho Panhandle National Forest did not meet the requirements of NEPA and was in fact an arbitrary and capricious decision because it failed to follow proper procedure. Specifically, it did not properly analyse cumulative impacts in relation to past timber harvests and in relation to the Westlope Cutthroat Trout.

In response to this case, the CEQ released a guidance document on cumulative impacts in 2005, clarifying that:

> CEQ interprets NEPA and CEQ's NEPA regulations on cumulative effects as requiring analysis and a concise description of the identifiable present effects of past actions to the extent that they are relevant and useful in analyzing whether the reasonably foreseeable effects of the agency proposal for action and its alternatives may have a continuing, additive and significant relationship to those effects. In determining what information is necessary for a cumulative effects analysis, agencies should use scoping to focus on the extent to which information is "relevant to reasonably foreseeable significant adverse impacts," is "essential to a reasoned choice among alternatives," and can be obtained without exorbitant cost.[93]

Thus, there is essentially a requirement that once cumulative impacts have been identified as being relevant, information pertaining to those impacts must be included in the EIA documentation and considered by the agency. The yardstick provided by the CEQ as to what extent factors must be taken into consideration is what will enable the so-called reasoned choice among alternatives.

B *State Example: California*

California's state-level NEPA equivalent (or 'little NEPA') is the *California Environmental Quality Act* ('CEQA').[94] While it is not within the scope of this thesis to review all state-level EIA requirements, CEQA is noteworthy. Under CEQA, a cumulative impact 'consists of an impact which is created as a

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[89] L N McCold and J Holman, 'Cumulative Impacts in Environmental Assessments: How Well Are They Assessed?' (1995) 17 *Environmental Professional* 2; R K Burris and L W Canter, 'Cumulative Impacts Are Not Properly Addressed in Environmental Assessments' (1997) 17 *Environmental Impact Assessment Review* 5; T A Cooper and L W Canter, Documentation of Cumulative Impacts in Environmental Impact Statements' (1997) 17 *Environmental Impact Assessment Review* 385.

[90] See, eg, the survey conducted by Courtney A Schultz, 'The US Forest Service's Analysis of Cumulative Effects to Wildlife: A Study of Legal Standards, Current Practice, and Ongoing Challenges on a National Forest' (2012) 32 *Environmental Impact Assessment Review* 74.

[91] Schultz, above n 90. On this point see also M D Smith, 'Cumulative Impact Assessment Under the National Environmental Policy Act: An Analysis of Recent Case Law' (2006) 8 *Environmental Practice* 228.

[92] 395 F 3d 1019, 1031 (9th Cir, 2005).

[93] James L Connaughton, Chairman, Council on Environmental Quality, 'Guidance on the Consideration of Past Actions in Cumulative Effects Analysis' (Memorandum to Heads of Federal Agencies, June 24 2005), <energy.gov/sites/prod/files/nepapub/nepa_documents/RedDont/G-CEQ-PastActsCumulEffects.pdf>

[94] Cal Public Resources Code §21000 et seq.

result of the combination of the project evaluated in the [Environmental Impact Report, ('EIR')][95] together with other projects causing related impacts.[96] CEQA's guidelines reiterate that cumulative impacts 'can result from individually minor but collectively significant projects taking place over a period'.[97]

Cumulative impacts need to be discussed in detail in the EIR under CEQA if the contributing effect of the project is 'cumulatively considerable',[98] determined by first deciding whether the impact of all contributions to an impact together are cumulatively significant, and then whether the contribution of the project in question has incremental effects that are 'significant when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probably future projects.'[99] Probable future projects are determined by using the reasonable foreseeability test, [100] considering whether the potential future impacts of probable future projects are 'too speculative to analyse'.[101]

The nature of cumulative impacts as well as their severity and likelihood of occurrence are to be included in the EIR, however, not in as significant detail as those impacts attributable to the project in question alone. The cumulative impact discussion 'should be guided by the standards of practicality and reasonableness, and should focus on the cumulative impact to which the identified other projects contribute rather than the attributes of other projects which do not contribute to the cumulative impact.'[102] The EIR should include a list of past, present and probable future projects producing related or cumulative effects, or a summary of projections from an adopted plan or document that describes conditions contributing to the cumulative effect.[103] If there is no cumulatively significant impact, then the EIR must explain why the impact is not significant and not discussed in detail.[104]

A relevant example of where these provisions were employed is the 'Analysis of Oil and Gas Well Stimulation Treatments in California', a generic EIR conducted to review the environmental impacts of fracking, pursuant to California's Senate Bill 4 ('SB4').[105] SB4 mandated the EIR, thus it is unusual in the sense that it does not relate to a specific project proposal, being instead 'an informational document regarding the potential impacts of well stimulation which may serve to inform other CEQA documents'[106] – more akin to Australia's state-specific inquiry reports than to an EIA in some senses, except that it was prepared in accordance with the EIA provisions as other EIAs would be.

An entire chapter of that EIR is devoted to cumulative impacts, listing the past, present and probable future impacts likely to contribute to cumulative harm relevant to California: namely, impacts to agriculture and forestry resources, impacts to water (ground and surface), aesthetic impacts, air

[95] An EIR is essentially the equivalent of an Environmental Impact Statement ('EIS') under NEPA, stating the relevant agency's findings on environmental impacts.
[96] *California Environmental Quality Act Guidelines*, Title 14, Cal Code of Regulations §15000 et seq, §15130(a)(1).
[97] Ibid §15355(b).
[98] Ibid §15064(h)(1).
[99] Ibid §1506(a)(3).
[100] Ibid §15355(b).
[101] Ibid §15145.
[102] Ibid §15130(b).
[103] Ibid §15130(b)(1).
[104] Ibid §15130(a)(2).
[105] Cal Public Resources Code § 161(b)(3)(A) and (B) of ch 1, div 3.
[106] California Department of Conservation, Division of Oil, Gas and Geothermal Resources, *Analysis of Oil and Gas Well Stimulation Treatments in California* (1 July 2015), ES-3, <conservation.ca.gov/dog/Pages/SB4_Final_EIR_TOC.aspx>.

quality impacts, impacts to terrestrial and coastal/marine biological resources, commercial fishing, cultural resources, paleontological resources, geology, soil and mineral resources, hazardous wastes and materials, greenhouse gas emissions, noise and vibrations, planning, population and housing, public utilities and services, and even environmental justice.[107] Though these cumulative impacts were of significance particularly compared with the alternative of 'no further well stimulation treatments', it was still concluded that allowing stimulation treatments was the environmentally preferable alternative.

California's Council on Science and Technology's report, *An Independent Scientific Assessment of Well Stimulation*, is a separate report which stresses the importance of indirect impacts, noting that the majority of fracking impacts are indirect in nature, and that

> [a]ll activities associated with oil and gas production enabled by hydraulic fracturing or acid stimulation can bring about indirect impacts. Indirect impacts of hydraulic-fracturing-enabled oil and gas development usually occur in all oil and gas development, whether or not the wells are stimulated.[108]

CEQA's treatment of cumulative impacts provides clarity in terms of how to identify and, particularly, address and assess cumulative impacts, and in this sense can be contrasted with NEPA and, to an even greater extent, the EPBC Act.

V LESSONS AND OPTIONS

Comparing the US and Australian federal contexts reveals two different approaches: in the US, cumulative impacts are defined and it is clear that they must be included in impact assessment where it is, essentially, 'reasonable' to do so; in Australia, there is neither adequate guidance nor consistency in how cumulative impacts are to be treated. Very few cases have specifically considered the issue of cumulative impacts in EIA in Australia, which is one reason why the law is not well developed, and why there remains some confusion. A lack of legislative or broadly applicable government guidance is another.

Despite the contrast in approach between the two jurisdictions, there are important similarities. In both jurisdictions it is clear that significance cannot be avoided by breaking an action down into smaller parts. Additionally, both jurisdictions require a consideration of context and intensity when assessing the significance of an impact – an enquiry that could facilitate the consideration of cumulative impacts and of cumulative context with respect to a given contribution to a greater impact. In the US, cumulative impacts are expressly relevant to an action's intensity on account of cumulative context, whereas in Australia, some might interpret the same terms as incorporating cumulative impacts, whereas others might not. The parallel use of the same terms in both jurisdictions is an interesting point of comparison, particularly given that in the US, the jurisdiction to adopt those terms first, the intention that they cover cumulative impacts is now well established.

The US example is not a perfect one, as problems related to inadequate incorporation of cumulative impacts into decision-making still exist, as highlighted in US commentary. However, the example does indicate that the EIA process can be used to incorporate cumulative impacts through explicit recognition of such impacts, and that the scope for which cumulative impacts need to be considered

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[107] Ibid ch 13 <ftp://ftp.consrv.ca.gov/pub/oil/SB4EIR/EIR/13%20Cumulative%20Impact%20Analysis.pdf>.
[108] Jane C S Long et al, *An Independent Scientific Assessment of Well Simulation in California – An Examination of Hydraulic Fracturing and Acid Stimulations in the Oil and Gas Industry (Executive Summary)* (California Council on Science and Technology and Lawrence Berkeley National Laboratory, 2015) 30.

can be somewhat effectively managed through mechanisms similar to those present in Australian law (significance, context, intensity, indirect impacts, causation, and reasonable foreseeability).

The greater clarity that exists in the US context is desirable, because greater clarity increases certainty for proponents, decision-makers and the public. Because decision-making is administrative in nature in both jurisdictions, the law cannot easily extend beyond ensuring that cumulative impacts need to be recognised: how well they are actually incorporated in the sense of influencing decisions is largely a political matter. However, two legal options may be available to improve the problem of addressing cumulative impacts.

The first of these options was introduced in Part II, which discussed the difficulty associated with the legal system not wanting to burden those who are not fully or largely responsible for causing harm, manifesting in the EIA context as reticence to facilitate decisions that a proponent cannot go ahead with a proposal on account of adverse environmental effects that cannot be attributed to the proposal. Section C proposed that a systems-based approach could be used to encourage the adoption of an 'eggshell skull' type principle under which the proponent bears the burden of restrictions on its proposed project due to a likelihood that it will contribute to a cumulative impact on an already fragile environment. Under such a principle, that the fragility of the environment was not the fault of the proponent and in fact was caused in large part by other projects would not be the concern of the law. Similarly, under the proposed principle, if the resilience capacity of even a normal or robust environment would be weakened by the proposal and if this is likely to worsen on account of future approved or future facilitated projects such that a significant cumulative impact is, in the context, likely, then that is something which the proponent must bear. For example, in the form of a decision that the proposal cannot go ahead or must be subject to restrictive conditions.

The second option draws on the discussion of systems thinking in Part II and on the US comparison in Part IV, and it essentially involves (i) amending the EPBC Act to clarify that cumulative impacts are relevant to the assessment of controlled actions, and (ii) ensuring that guidance, either through the EPBC Act or through government guidelines, clearly explain the extent to which cumulative impacts should be considered, and how. The California state example could be drawn on as an exemplar.

One aspect of implementing this option would be for the test of significance to evolve a more concrete definition. Recall from previous chapters and from Part III that the EPBC Act does not actually define 'significant', rather, a definition has emerged through case law and is reflected in non-binding government guidelines.

The United Nations Food and Agriculture Organisation ('FAO') has used a definition of significant impacts in relation to ecosystems which, if employed in the EPBC Act context, would provide greater clarity and certainty to all involved in the EIA process, and would, importantly, more adequately depict a systems-focused view of significance better suited to incorporating cumulative impacts. This definition was cited in the independent 'Hawke' review of the EPBC Act,[109] which has been referred to on a number of occasions already in this thesis. It provides as follows:

> Significant adverse impacts are those that compromise ecosystem integrity (ie ecosystem structure or function) in a manner that:
>
> (i) impairs the ability of affected populations to replace themselves;
> (ii) degrades the long-term natural productivity of habitats; or
> (iii) causes, on more than a temporary basis, significant loss of species richness, habitat or

[109] Hawke, above n 3, 106.

community types.

Impacts should be evaluated individually, in combination and cumulatively. When determining the scale and significance of an impact, the following six factors should be considered:

(i) the intensity or severity of the impact at the specific site being affected;
(ii) the spatial extent of the impact relative to the availability of the habitat type affected;
(iii) the sensitivity/vulnerability of the ecosystem to the impact;
(iv) the ability of an ecosystem to recover from harm, and the rate of such recovery;
(v) the extent to which ecosystem functions may be altered by the impact; and
(vi) the timing and duration of the impact relative to the period in which a species needs the habitat during one or more of its life-history stages.[110]

The Hawke review proposed that this definition could apply in relation to a potential new MNES, namely, ecosystems of national significance. However, it could alternatively be used more broadly to relate to all potentially significant environmental impacts, which by their nature link with ecological systems. A version of the FAO definition could be incorporated into the EPBC Act as an 'inclusive' definition of significance, or into government guidelines. Inclusive definitions of context and intensity could also be provided, such as are provided under the NEPA Regulations, and cumulative impacts could be specifically referred to. A proposed new set of definitions, which draw on the FAO definition, the CEQ Guidelines, and the existing government guidelines,[111] is included as Appendix 2.

An additional provision might also be included, to the effect that where a proponent or the Minister determines that likely future actions are to be proposed, but where information about those future actions is lacking or difficult to access, the proponent could request the Minister to direct, or the Minister could him or herself direct, that a landscape-scale generic, strategic, or bioregional assessment be undertaken, adopting an ecosystem approach discussed in Part III to the consideration of potential adverse environmental impacts. This could assist with the determination of significance in light of a potential impact's context. Either the EPBC Act or government guidance could clarify that these types of assessments, along with, potentially, any relevant state of the environment reports, are also, or alternatively, required to be considered under s 136(2).

For example, consider a situation in which the Minister is referred a proposal to conduct fracking activity and has reason to believe that future proposals to conduct fracking activities in the same area are likely. Or, a situation in which the Minister is not referred a proposal but is considering the environmental consequences of fracking in general. He or she could direct that a generic assessment be conducted prior to issuing any approvals, which would cover the likely impacts of all proposals together and which would reduce the burden on individual proponents and consolidate and streamline scientific research.

Alternatively, consider that a fracking proponent anticipates that cumulative impacts will be relevant to its desired approval. The proponent could request that a generic assessment be undertaken on the basis of an intention to submit a proposal, well in advance of the actual submission (for example, while feasibility studies are still being undertaken). The results of the assessment would provide context in

[110] Food and Agriculture Organisation of the United Nations, *International Guidelines for the Management of Deep-Sea Fisheries in the High Seas: Annex F of the Report of the Technical Consultation on International Guidelines for the Management of Deep-sea Fisheries in the High Seas* (FAO, 2008) 41.
[111] Australian Government Department of the Environment, above n 35.

relation to which the proponent could then put forth its proposal, as well as greater certainty. Additionally, the burden on the proponent would then be limited to submitting the likely significant impacts of its particular project, which it would have an incentive to minimise in light of other potentially competing projects.

VI CONCLUSION

The problem of incorporating cumulative impacts into EIA-based environmental decision-making is one that sits at the science-law interface. It reflects tensions between being able to apportion liability in a clear, fair, and predictable way, and minimising environmental-related risk. The goal is not to find a 'solution', as it would be unrealistic to presume that one exists, but rather to focus on assessing options which might best address and alleviate the conflicting tensions. In this Chapter, options which respect the need to avoid unreasonable burdens associated with infinitely broad-scale EIA but which ultimately favour the minimisation of environmental risk have been preferred, and two novel suggestions were put forward.

The introduction to this Chapter proposed that the cumulative impact problem might, from a legal perspective, be due to, inter alia:

- the scope of legislation not adequately permitting or encouraging cumulative impact recognition;
- an unwillingness on the part of the executive (and judiciary) to give sufficient recognition or weight to cumulative impacts in decision-making;
- a lack of legislative or policy guidance on how to give recognition/weight to cumulative impacts; and/or
- a failure in accurately identifying cumulative impacts at all.

Following an analysis of Australian law, it seems that in the Australian context, the problem is primarily due to lack of recognition and lack of weight given to cumulative impacts by executive decision-makers and by the judiciary, which is likely in turn to be because of both a lack of guidance on how to do so, and a resistance or unwillingness to do so. This is demonstrated by the *Tarkine* case, by the existing guidance which largely does not address cumulative impacts, and by executive decisions which have allowed projects to go ahead in spite of recognised likely and significant cumulative impacts.

The scope of the legislation in Australia arguably does potentially allow for cumulative impacts to be relevant to EIA, as the discussion in Part IV demonstrated. However, at the federal level, the legal position is unsettled, and two clear developments will need to take place before it can be confirmed that the EPBC Act permits or requires cumulative impacts to weigh into decision-making: *Tarkine* will need to be clarified by future analogous cases, and 'substantial cause' in s 527E will need to be interpreted liberally by the courts – for example, as meaning 'not de minimis'.

Employment of the reasonable foreseeability test as a statutory indicator of causation and/or remoteness might not be an adequate way to manage which cumulative impacts fall within the legislation's purview. In most cases, indirect environmental impacts, including indirect impacts relating to the actions of third parties that contribute to an environmental impact in a cumulative fashion, should be foreseeable by anybody who has conducted environmental due diligence, which large companies such as oil and gas companies would have done prior to a major project proposal.

In terms of reasonableness more generally, the US relies on such notions to limit the scope of cumulative impacts, and the cost of undertaking assessment is frankly acknowledged as a contributing

factor in the reasonableness enquiry. Some line, of course, must be drawn to prevent infinitely lengthy and costly assessment. Notwithstanding, it is arguably not 'unreasonable' for costs to be incurred and time spent understanding likely impacts for the purposes of minimising risk – if the amount of cost and time required to gain a reasonable understanding cannot be afforded, then neither can the project. An assessor of reasonableness in terms of cost would need to be well versed in the way that environmental systems operate and in what knowledge, including in relation to cumulative impacts, is required to make valuable and reliable predications. The new definition of 'cumulative impact' proposed and listed in Appendix 2 replaces reasonableness with likelihood.

It was revealed earlier that the government guidelines for CSG and large coal mining developments in Australia specifically mention, and provide advice for managing, cumulative impacts in the EIA context. More specific and helpful guidance that covers this and other MNES is needed to aid both proponents and decision-makers in understanding cumulative impacts and ensuring that the legal process for dealing with cumulative impacts is less overwhelming. This could assist with the problem of an unwillingness to engage with cumulative impacts on the part of executive decision-makers and judiciary. Guidance may for example be able to indicate an appropriate scope for considering different types of cumulative impacts and their relevancy in a given context, or suggest how complex, multi-factorial impacts might be given weight.

Macintosh and Wilkinson have expressed the view that the EPBC Act 'lacks the framework' to enable the Minister to manage cumulative impacts to MNES.[112] This Chapter has attempted to demonstrate that a framework basic framework does exist, but that adjunct measures might also be necessary. It is possible that one of the options discussed in Part V could assist. As development progresses, the cumulative impact problem will only worsen if not adequately addressed. This is particularly true in the fracking context – as Part II demonstrated, many different and important types of environmental risk associated with fracking can be classified as cumulative impacts. In order to minimise risk to the environment from fracking, cumulative impacts need to be more adequately accounted for in EIA-based decision-making.

[112] Andrew Macintosh and Debra Wilkinson, 'EPBC Act - The Case for Reform' (2005) 10 *Australasian Journal of Natural Resources Law and Policy* 139, 164.

Chapter 7: Economic and Social Matters

This Chapter, the final chapter prior to the thesis' conclusion, considers economic and social matters in the context of fracking and for the purposes of EIA law and the EIA system. The term 'matters', as opposed to impacts or risks, appears in s 136 of the EPBC Act. As it relates to EIA-based decision-making under the EPBC Act, 'matters' is sufficiently broad as to incorporate both adverse impacts, or risks, and positive benefits.[1] Section 136 specifically requires a decision-maker to consider economic and social matters when making an approval decision, and when deciding what conditions, if any, to attach to an approval. Particular economic and particular social matters relevant to project proposals may or may not be interrelated, but the two types of impact are often considered at the same time. This Chapter demonstrates that the law creates, through s 136, a pathway for economic and social matters to become decisive factors in favour of or against project approvals. If it were not for s 136, economic and social matters would not be relevant to approval decisions under the EPBC Act.[2] Accordingly, the requirement to consider economic and social matters clearly influences the ability to manage environmental risk through EIA.

The earlier chapters of this thesis clearly established that economic and social matters, irrespective of the law, are important and relevant to the fracking context, as fracking is associated with a milieu of both positive and negative social and economic implications of concern to stakeholders. Some of the economic and social matters associated with fracking projects derive from environmental impacts (for example, the health impacts of contaminated drinking water following pollution of a natural aquifer or stream); others do not (such as an influx of jobs resultant from a project). Adverse impacts include risks to human health, social and economic costs associated with clean-up and rehabilitation of the environment, economic losses and threats to livelihood on account of contamination of productive land, and, more broadly, the social and economic costs associated with climate change. Positive impacts include economic gains on local, regional and federal scales, the creation of jobs, and a more secure energy supply. Unsurprisingly, decisions about fracking projects are not usually made on environmental grounds alone.[3]

The remainder of this Chapter is divided into two key parts: Part I focuses on the relevancy of economic and social matters to environmental decision-making and risk reduction under Australian law, including how the principles and paradigms at the international level, which were summarised in Chapter 2, are expressed in Australian law. Part II focuses on the US and highlights developments in the US context that might be useful for Australia. The Chapter 2 discussions on the relationship

[1] On the breadth of this aspect of s 136, see *Tarkine National Coalition Inc v Minister for the Environment* [2015] FCAFC 89 ('*Tarkine*'), 25-27.

[2] This point was also recognised in *Tarkine*: Jessup J commented that s 136 functions to 'require consideration not only of the matters protected by Pt 3 of the EPBC Act but also of matters that, otherwise, appear to be of no concern under that Act, namely, "economic and social matters"' (at 25).

[3] There are no cases in Australia where an individual project decision, or a moratorium or ban decision, has been made citing only environmental reasons and not also flow-on social reasons; similarly in cases where projects have been approved, decisions have typically made not 'for' but 'in spite of' environmental factors. This is evident from the conditions attached to approvals: see, eg, the approval decision for the Walloons project by Australia Pacific LNG, (Australian Government, 2009) <environment.gov.au/epbc/notices/assessments/2009/4974/approval-decision.pdf>, and from the fact that approval decisions are made in spite of documented social impact risk: see, eg, the impact statement for the approved Surat Basin coal seam gas project by Arrow Energy, *Environmental Impact Statement – Report Under the* Environmental Protection Act 1984 (State of Queensland, 2013).

between humans, their economy and their environment through the lens of sustainable development set an important foundation for this Chapter in particular, which now explores how economic and social matters – or in other words, perhaps, people's wellbeing and their economic prosperity – are matters that are engrained in environmental law. Chapter 2 set critical foundations for understanding why the Australian EIA system is receptive to economic and social matters and thus how so many decisions on major projects have been approved in spite of predicted significant environmental harms or risk.[4]

I THE CONSIDERATION OF ECONOMIC AND SOCIAL MATTERS IN AUSTRALIAN LAW

A *The EPBC Act*

The law *could*, theoretically, operate to exclude economic and social matters from being *legally* relevant to the decision as to whether or not a project should be approved if there is an environmental risk. But generally, it does not. Economic and social matters are recognised by law, in theory and in practice, as being associated with justifiable values, whether the value be related to the promotion of supposedly positive factors (socio-economic development; economic growth), the discouragement of negative factors (food, water or energy insecurity; economic insecurity), or to the process of participation and inclusion of the views of those potentially affected by a decision. While value considerations – and statements or assumptions based on such considerations – can be difficult to define, quantify and even predict over time, they are nonetheless an important component of law and policy.

Under the EPBC Act, economic and social matters do not strictly need to be contemplated as part of a project proposal's initial decision-making stages, nor incorporated within its EIA (as opposed to within EIA-based decision-making). Scoping documents and impact statements are likely to flag relevant economic and social matters in preparation for final assessment in practice,[5] however, the executive decision-maker does not consider economic and social matters until relevant environmental matters have already been identified and it has subsequently been established that a significant impact on one or more environmental matter is likely. Importantly, as a corollary, if there is no relevant environmental matter under threat to trigger assessment, then assessment of economic and social matters does not occur under EIA law. Thus, in the EIA-based decision-making context, economic and social matters are only considered with respect to whether they bolster or weaken the case for a project's ultimate approval in light of environmental risk.

The mandatory consideration of economic and social matters under s 136 of the EPBC Act was an aspect of the EPBC Act which was praised in its independent review.[6] Section 136 – the 'weighing and balancing' section under which matters such as adverse and beneficial impacts are given weight and

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[4] Adam Morton, ''The Franklin Would be Damned Today': Australia's Shrinking Environmental Protections' *The Guardian* (online) 30 January 2018.

[5] For example, the impact assessment documentation prepared on behalf of the Adani Group for its Carmichael Coal and Rail Project, discussed in Chapter 5, has specific chapters devoted to 'Social Impact Assessment' and 'Economies': available from Queensland Government Department of State Development, 'Environmental Impact Statement – Carmichael Coal and Rail Project' <statedevelopment.qld.gov.au/assessments-and-approvals/carmichael-coal-environmental-impact-statement.html>.

[6] Allan Hawke, *The Australian Environment Act – Report of the Independent Review of the Environment Protection and Biodiversity Conservation Act 1999 (Cth)* (Department of Environment, Water, Heritage and The Arts, 2009), 9.

then balanced against each other – reflects, broadly, the principles discussed in Chapter 2, because it gives wide berth for economic and social matters to influence decisions that have environmental impacts, and asks the decision-maker to consider ecologically sustainable development ('ESD') when making his or her approval decision.

Under the EPBC Act, the federal Environment Minister has implied discretion as to how to engage in the fact-finding exercise necessary to establish which economic and social matters are relevant to a proposal. Matters predicted to be of importance may have been addressed by the project's proponent upon referral of the proposal, but the referral documentation may not be exhaustive, and is vulnerable to bias, having been prepared in each case by or on behalf of the proponent who necessarily has an interest in approval (with minimal conditions).[7] Some of the types of documentation that must be taken into account in considering the environmental matters as well as the economic and social matters relevant to the case are listed in subsection (2) of s 136 – including applicable reports, recommendations and inquiries. These may or may not give the Minister significantly more information about what the relevant economic and social matters in a given case are likely to be.[8]

There is also a requirement that the Minister consider any public comments. Public comments can be made on a Minister's intention to approve a project (and on any applicable conditions), if the Minister chooses to make that intention available online.[9] Thus *if* the Minister makes his or her intention to approve the proposal available for comment, then he or she must take any comments received into account.[10] Though the public also has an earlier opportunity to comment on a proposal at its referral stage, only comments as to whether or not the proposal constitutes a controlled action are welcome at that stage,[11] and economic and social matters are not relevant to whether an action is a controlled action (rather, recall that a controlled action is one likely to have a significant impact on a MNES, which is principally a question of environmental risk).

Section 136 does not dictate the *manner in which* the Minister should consider economic and social matters, but subsection (2) lists the principles of ESD as a factor that must be taken into account. While reports, inquiries and advice might be 'taken into account' to find appropriate information about what impacts are relevant and perhaps what weight impacts might have, and while the public opinion might also be 'taken into account' for the same reasons, the principles of ESD are general principles (ie, not case-specific), and therefore must by logical inference be 'taken into account' in order to assist with how to weigh and balance impacts generally to arrive at a final decision – in other words, the ESD principles can assist the Minister in deciding what matters should be prioritised over others, and to what extent. Their function is, in a loose sense, comparable to that of the *Rio Declaration* principles – namely, in the sense of serving to draw attention to potential conflicts, and to provide guidance as to how values might be prioritised.

The principles of ESD have been discussed at different points throughout this thesis. They are found in s 3A of the EPBC Act; most particularly relevant to economic and social matters are the following principles:

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[7] See the comment on extensive but biased documentation in *Phosphate Resources Ltd v Minister for the Environment, Heritage and the Arts (No 2)* [2008] FCA 1521, 42 (Buchanan J).

[8] Note that the Minister is not expected to read all the relevant documentation, and is instead permitted to rely on departmental summaries: see *Minister for Aboriginal Affairs v Peko-Wallsend Limited* (1986) 162 CLR 24, 30-31; *Bushell v Environment Secretary* [1981] AC 75, 95.

[9] EPBC Act s 131A.

[10] Ibid s 136(2).

[11] Ibid s 74.

(a) decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations; […]

(c) the principle of inter-generational equity--that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations; […]

(e) improved valuation, pricing and incentive mechanisms should be promoted.

The other two principles, which relate more directly to environmental conservation (namely the precautionary principle and the biodiversity conservation principle), are also relevant to economic and social matters in the sense that they may provide justification for prioritising an environmental concern above an economic or social concern.

The first-listed principle, (a), specifically deems economic and social matters to be relevant to environmental decision-making when read in conjunction with s 136. The principle asks the decision-maker to integrate both short-term and long-term impacts, a question of scale, and to think about equity in this context as well. It is a common critique of political decision-making that longer-term implications tend to be heavily discounted, or even ignored, in favour of implications likely to arise in the short-term (particularly, in Australia, the four-year political term).[12] This principle encourages decision-making to be equitable across time-scales in relation to each type of impact.

The second listed principle, (c), is also focused on equity – this time between generations of human beings. It is narrower than (a), because it focuses on preservation of the environment *for* human beings – thus, for social and economic reasons (reflecting the same anthropocentrism evident in the sustainable development principles and requirements discussed previously). It does not ask for environmental protection for ecological reasons, but rather for the protection of the social benefits that the environment offers to humans. This principle echoes the analogous intergenerational equity principle discussed in Chapter 2.

Finally, principle (c) relates to economic impacts, by operating to promote the benefits that the environment can have in economic terms. In being able to better value, 'put a price on', and then create incentives in relation to environmental assets, the benefits of environmental conservation for economic reasons can be translated to create a further justification for environmental protection. Economic benefits of conservation squandered by a project can be translated as economic costs of the project, able to be more easily balanced against the project's financial benefits. This is based on the notion of a positive economic impact being the benefit that would have been enjoyed if the proposal was not approved and the status quo retained, translated as a negative economic impact of the proposal in the form of an opportunity cost. This principle echoes the semi-analogous polluter pays principle discussed in Chapter 2.

A scant body of case law provides little detail as to how economic and social matters should be weighed and balanced, taking into account the above principles, under federal law. As decisions made under the EPBC Act are essentially only open to judicial review, it is not surprising that courts have not

[12] For a sample of some of the literature on long-term decision-making in the environmental context, see, eg, Louis Meuleman and Roeland Jaap in't Veld, 'Sustainable Development and the Governance of Long-Term Decisions' in Roeland Japp int't Veld (ed), *Knowledge Democracy – Consequences for Science, Politics, and Media* (Springer, 2009) 255; Thomas Princen, 'Long-Term Decision-Making: Biological and Psychological Evidence' (2009) 9 *Global Environmental Politics* 9, and the other articles in that edition (9) of *Global Environmental Politics*.

delved into extensive detail about the task. In the context of judicial review, it is effectively only possible to challenge a social or economic matter and how it was considered in a particular case by arguing that a relevant consideration was not taken into account;[13] an irrelevant consideration was taken into account;[14] or that the decision was so unreasonable as to lack an evident and intelligible justification.[15]

In *Blue Wedges Inc v Minister for the Environment, Heritage and the Arts*,[16] a case concerning the approval of channel deepening via dredging in Port Phillip Bay in Victoria, an environmental group challenged the dredging approval on the basis that the principles of ESD were not considered when taking into account relevant economic and social matters, and that the decision not to take into account comments from other ministers was unreasonable. The project had attracted significant attention and more than 500 public submissions were received, expressing significant concerns. The Minister, in approving the project, had stated:

> I carefully considered all the information before me that related to economic and social matters relevant to the proposal. I recognised that the proposal was highly controversial in Victoria, however, I found that, on balance, there was a net economic benefit and that there were no economic and/or social matters to indicate I should decide not to approve the proposed action.[17]

The court was not able to consider whether this weighing and balancing that clearly favoured positive economic gains over widely held social and environmental concerns was correct or preferable, and it was held that economic and social matters were adequately considered under the EPBC Act.[18] The court found that the evidence demonstrated that the Minister had taken into account the principles of ESD. A similar finding was made in *Phosphate Resources Ltd v Minister for the Environment, Heritage and the Arts (No 2)*,[19] which concerned an approval of an application to extend mining operations on Christmas Island.[20]

Applying the above, in relation to a potential fracking case, economic and social matters would be relevant at the federal level, and any public opposition to the fracking project would likely need to be considered and taken into account by the Minister. The Minister would also need to consider the impacts – both beneficial and adverse – on short- and long-term scales. Social matters might include aspects relevant to equity within and between generations; economic matters might include those that do not necessarily have a present market value. In theory, any relevant social and economic implications of environmental concerns such as climate change impacts and water impacts should be relevant to a fracking decision *even if* those are not relevant environmental matters (so long as there is at least one MNES implicated, and thus s 136 is enlivened). This is an important point that might be drawn on in future cases.

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[13] *Administrative Decisions (Judicial Review) Act 1977* (Cth) s 5(2)(b).
[14] Ibid, 5(2)(a).
[15] Ibid, 5(2)(g); *Minister for Immigration and Citizenship v Li* (2013) 249 CLR 332, 76; see also *Associated Provincial Picture Houses Ltd v Wednesbury Corporation* [1948] 1 KB 223.
[16] [2008] FCA 399.
[17] Ibid, 51.
[18] Ibid, 89.
[19] [2008] FCA 1521.
[20] Yvonne Rydin, Maria Lee and Simon J Lock found a similar issue in their analysis of UK legislation – namely, that decision-makers can sometimes tend to take a 'how not whether' approach to approvals when approvals match with policy objectives, in spite of public concerns: 'Public Engagement in Decision-Making on Major Wind Energy Projects' (2015) 27 *Journal of Environmental Law* 139.

B *State and Territory Consideration of Economic and Social Matters*

State and territory impact assessment legislation, like its federal counterpart, incorporates economic and social matters (which may be called social/economic impacts or effects) into environmental decision-making as well as, to differing extents, the principles of ESD. Although this thesis does not focus on state/territory law, it is useful to refer to here because no federal nexus is required with respect to economic and social matters under the EPBC Act – thus, the way in which economic and social matters are considered in state/territory EIA might be analogous to the way in which they are considered under the EPBC Act.[21] Other than in relation to the water trigger,[22] state and territory assessments and approvals can be accredited pursuant to bilateral agreements between the state or territory and the federal government.[23] This means that the consideration of economic and social matters may happen at the state or territory level, and that this assessment count towards federal approval. For example, assessment under the *Environmental Planning and Assessment Act* (NSW) is accredited to count for federal assessment (in lieu of specific EPBC Act assessment), pursuant to the NSW-Commonwealth bilateral agreement.[24]

1 *Case Law*

The leading state/territory-level case on economic and social matters, or impacts, is the *Warkworth* case,[25] which concerned an approval to expand an existing coal mine in the Hunter Valley region of NSW. The initial decision was handed down by Chief Justice Brian Preston, who has played a major role in the development of EIA law. Preston CJ sits in the NSW Land and Environment Court, a specialised court with no exact equivalent in other Australian jurisdictions, and which can engage in merits review of decisions made under NSW law, in some cases.[26] The *Warkworth* case was one such case. That the case involved a merits review, or a remaking of the decision afresh, is significant because it afforded the opportunity to garner rare insight into (a member of) the judiciary's view of the executive decision-making process and how it should be conducted.

The social impacts of the case were principally categorised as noise impacts, air quality impacts, visual impacts, and intangible impacts to the community,[27] including solastalgia[28] and an altered community fabric,[29] as well as negative impacts on individuals' health and wellbeing, including stress, anxiety, sleep deprivation, impacts on family relationships and friendships, and impacts on social and

[21] State/territory law is not binding at the federal level and may have no bearing on a federal decision, however, the consideration of economic and social matters could well be similar. Economic and social matters do not need to be federal in scope (unlike environmental matters) in order to be considered at the federal level.
[22] Discussed in Chapter 4.
[23] EPBC Act pt 4, div 1.
[24] *Bilateral Agreement Made Under Section 45 of the* Environment Protection and Biodiversity Conservation Act 1999 (Cth) *Relating to Environmental Assessment*, sch 1.
[25] *Bulga Milbrodale Progress Association Inc v Minister for Planning and Infrastructure and Warkworth Mining Limited* [2013] NSW LEC 48 ('*Warkworth*').
[26] The benefits of having merits review available to litigants has been argued using this case as an exemplar: Sue Higginson, 'Legal Challenges Like Bulga Key to Safeguarding Against Corruption' (2014) 1 *Law Society of New South Wales Journal* 74.
[27] *Warkworth* 430.
[28] This case was the first time the concept of 'solastalgia' featured strongly in a court decision, having been expressed in academic literature previously by the expert called in to provide evidence to the case, Glen Albrecht: see G Albrecht, ''Solastalgia': A New Concept in Health and Identity' (2005) 3 *Philosophy Activism Nature* 41. Its significance has been highlighted in commentary: see Amanda Kennedy 'A Case of Place – Solastalgia Comes Before the Court' (2016) 12 *Philosophy Activism Nature* 23.
[29] *Warkworth* 442.

recreational activities.[30] Public submissions that helped to establish these impacts were specifically cited in the case;[31] because the proposal was for an extension to an existing project, the residents' 'experiential' evidence was treated as important.[32] Experiential evidence is likely to be more relevant in cases where existing activity in the area (particularly by the same operator, but not necessarily) has already occurred and has already caused social impacts. In such cases, the proposal's impacts may be cumulative upon the existing impacts.[33] Chief Justice Preston, in considering these types of impacts, criticised the more objective and simplistic social assessment that had been presented to him by Warkworth, considering 'basic' indicators to be too narrow to warrant a conclusion to be drawn that the social impacts of the case would overall be positive.[34]

Regarding economic impacts, Preston CJ was also presented with tools to assist in his analysis - namely, an 'input-output analysis' and a 'cost-benefit analysis,' again presented by Warkworth. He rejected both as not adequately accounting for important factors such as those costs and benefits with non-market values,[35] as well as the way in which costs and benefits were likely to be distributed (as opposed to their aggregation): distributive justice and issues of equity were important to Preston CJ's decision.[36] While Preston CJ considered the positive economic factors such as the influx of jobs and money into the region as a whole, he was not able to find that these outweighed other negative social and economic factors associated with the mine, including the negative impacts to the residents of Bulga specifically.

Essentially, a decision-maker's task (whether a Minister or a judge stepping into the shoes of the Minister) is to operate in a space where markets are imperfect and market failures exist. If all impacts could be valued and all valuations were perfectly represented, the decision-maker's weighing and balancing task would be easier. But neither the average *homo economicus*[37] nor human society more generally has perfect information on what factors contribute to wellbeing, and how, nor the public interest generally – and therefore what needs to be afforded value. For this and other reasons the 'perfect market' scenario is fictitious, and the role of a decision-maker who can operate not in deference to but in spite of economic markets is important.

Many of the 'non-economic' (social and environmental) impacts associated with major projects can be thought of as market externalities (for example, contribution to climate change, pollution, water contamination, harm to human health, etc, whose associated risks are not or are only to a limited extent factored into the cost to the proponent of undertaking the proposal); the weighing and balancing exercise conducted by decision-makers does not correct the problem but rather provides an avenue for impacts to be quasi-internalised (to the extent that the proponent is required to account for the impacts through for example project conditions). It is not the task of the decision-maker,

[30] Ibid 256.
[31] Ibid 270, 416-417, 431 (etc).
[32] Ibid 408.
[33] The cumulative nature of the impacts in the *Warkworth* case were discussed at 343, 346; cumulative impacts generally were discussed in this thesis in the previous chapter (Chapter 6).
[34] *Warkworth* 413.
[35] Preston CJ argued that '[t]he decision-maker needs to evaluate the relative importance of the relevant matters, each compared to the others [and] cannot delegate that task to others or subordinate it to the marketplace', noting that what is required of the decision-maker is an 'intuitive synthesis': *Warkworth* 39; 41. See also his comments at 469, 482.
[36] *Warkworth* 485-495.
[37] This term is used in economic theory to represent the rational, self-interested decision-maker; it is related to rational choice theory.

however, to assign non-market values to matters which presently have no market value - Preston CJ warned that doing so risks 'imperfectly captur[ing] and undervalu[ing] these matters'.[38]

The social and economic impacts considered in the *Warkworth* case could broadly be applicable to a fracking case, since fracking, like mining, creates noise and local air quality impacts, changes landscapes, and because it attracts new workers that will inevitably change a community's 'fabric' and potentially place stress on existing community members' lives and relationships. Where fracking occurs in places that have already experienced social impacts from other projects, cumulative impacts will also be important, as they were in the *Warkworth* case.

Two further aspects of state/territory case law are worth noting. Firstly, it has established that public submissions can be valuable forms of evidence in the establishment of potentially relevant economic and social matters – however, where they are used to establish a factual matter, public submissions may be subject to a 'reasonableness' evaluation, involving the 'identification of evidence that can be objectively assessed to ascertain whether it supports a factual finding of an adverse effect'.[39] Fears and concerns should be based on logically probative evidence in order to be relevant.[40] It has been held that 'mere local prejudice' or 'the resistance of uninformed opinion to innovation' is not a basis for rejecting a proposal,[41] and that decision-makers 'must not blindly accept the subjective fears and concerns expressed in the public submissions'.[42] The case law that has supported this aspect represents a series of cases all brought in the Land and Environment Court. In theory, a similar reasoning could also apply at the federal level, and could certainly apply to fracking cases, where public submissions often represent community fears – whether or not those fears are unfounded could be a matter of debateable contention. If public concern is reasonable, and if public opposition is significant, this could (but need not necessarily) be a persuasive factor weighing against a project's approval.

Second, the principles of ESD are also often considered at the state/territory level, and the sentiments and arguments expressed in cases that consider them might also be echoed in federal decisions. For example, the inter-generational equity principle has been judicially applied by Preston CJ in a NSW case in the energy context:

> The attainment of intergenerational equity in the production of energy involves meeting at least two requirements. The first requirement is that the mining of and the subsequent use in the production of energy of finite, fossil fuel resources need to be sustainable. Sustainability refers not only to the exploitation and use of the resource (including rational and prudent use and the elimination of waste) but also to the environment in which the exploitation and use takes place and which may be affected. The objective is not only to extend the life of the finite resources and the benefits yielded by exploitation and use of the resources to future generations, but also to maintain the environment, including the ecological processes on which life depends, for the benefit of future generations. The second requirement is, as far as is practicable, to increasingly substitute energy sources that result in less greenhouse gas emissions for energy sources that result in more greenhouse gas emissions, thereby reducing

[38] *Warkworth* 41.
[39] *Telstra Corporation Ltd v Hornsby Shire Council* (2006) 146 LGERA 10, 193-195.
[40] *Warkworth*, 65.
[41] *Cecec (No 8) Pty Ltd v Mosman Municipal Council* (1960) 5 LGRA 251, 263; *Foreman v Sutherland Shire Council* (1964) 10 LGRA 261, 269.
[42] *New Century Developments Pty Ltd v Baulkham Hills Shire Council* (2003) 127 LGERA 316, 61.

> the cumulative and long-term effects caused by anthropogenic climate change. In this way, the present generation reduces the adverse consequences for future generations.[43]

This passage illustrates how the intergenerational equity principle might be applied in a fracking case. Preston CJ has written extra-judicially on intergenerational equity[44] and has been cited by judges in other state courts - for example in the Land Court in Queensland in a recent coal mine case, where it was held that likely groundwater depletion over time meant that the principle of intergenerational equity would be breached:

> [i]t is very easy to look [at an issue] simply through the timeframe of this year or the next ten years and look at short term economic benefits. It is much harder to step back and take a more holistic view as to whether or not [a project] is in breach of intergenerational equity.[45]

2 *Government Guidelines*

Government guidelines on economic and social matters may be helpful in terms of preparing for EIA, and in forecasting what impacts might be considered relevant at the decision-making stage.

In December 2016, the NSW Government released draft guidelines on social impact assessment applicable to the extractive (including fracking and mining) industries. The guidelines define social impacts as those which involve changes to way of life, culture, community, political systems, people's environment, health and wellbeing, personal and property rights, and/or people's fears and aspirations.[46] They explain that social impacts might not be tangible, but rather may be 'perception-based', and experienced differently among different members of the community; further, that social impacts may be indirect, interdependent, and cumulative.[47]

In the Northern Territory, government guidance on social and economic impacts requires that impact assessment reports on contributions to the Northern Territory and Australian governments, contributions to business development and to regional development, and social risks which may include safety, employment and training opportunities, housing availability and affordability, amenity, service provision and potential for overloading services (including public transport, road networks, health services, education and police services), recreational and cultural opportunities, and community cohesion and inclusion.[48] This guidance is aimed at proponents rather than decision-makers, though decision-makers will be guided as to what impacts are relevant by documents such as the impact assessment prepared by those proponents.

Queensland also has guidelines for proponents in preparing an impact assessment that covers social and economic matters.[49] The economic impact assessment guidelines, published in April 2017,

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[43] *Taralga Landscape Guardians Inc v Minister for Planning and RES Southern Cross Pty Ltd* (2007) 161 LGERA 1, 74 (Preston CJ).

[44] Brian Preston, 'The Role of the Judiciary in Promoting Sustainable Development: The Experience of Asia and the Pacific' (Paper presented at the second Kenya National Judicial Colloquium on Environmental Law, Mombasa, Kenya, 17-22 April 2006).

[45] *New Acland Coal Pty Ltd v Ashman & Ors and Chief Executive, Department of Environment and Heritage Protection (No 4)* [2017] QLC 24, 1343 (Smith PA).

[46] NSW Government - Planning and Environment, *Social Impact Assessment - Draft Guidelines for State Significant Mining, Petroleum Production and Extractive Industry Development* (December 2016), 6.

[47] Ibid.

[48] Northern Territory Environmental Protection Agency, *Guidelines for the Preparation of an Economic and Social Impact Assessment* (NT EPA, November 2013), 3-5.

[49] Queensland Coordinator General, *Social Impact Assessment Guideline* (Queensland Government, 2013); Queensland Coordinator General, *Economic Impact Assessment Guideline* (Queensland Government, 2017).

specifically mention tools that might be employed, including input-output analysis and cost-benefit analysis: although the *Warkworth* case that rejected analyses conducted using these tools was not a Queensland case, proponents may need to exercise caution to ensure that if these tools are employed, that they are able to report on complex, intangible and qualitative impacts as well as more easily calculable quantitative impacts.[50]

II THE US: SOCIAL AND ECONOMIC COSTS AND BENEFITS

The US' federal EIA legislation,[51] NEPA, introduced and discussed in previous chapters, is worded in such a way as to render it more anthropocentric, on a textual account, than is Australia's EPBC Act. Social benefits are expressed as being at the forefront of the need to protect the environment. The purpose section, §2, declares a four-fold purpose; to

> encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; to enrich the understanding of the ecological systems and natural resources important to the Nation; and to establish a Council on Environmental Quality.

In this section, drafted in the late 1960s, the environment is referred to in reference to the human race, and the justification for preventing and eliminating environmental damage is to stimulate the health and welfare of human beings. Recalling the *Stockholm Declaration* of around the same time period (Chapter 2), the language used is similar, as are the underlying connotations. A social rationale clearly underpins NEPA, even though the intrinsic value of the environment may be recognised as important in contemporary US decision-making.[52]

NEPA's Congressional Declaration states that it is the continuing policy of the US federal government

> to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans,[53]

explicitly referring to social and economic factors as being not only relevant but of primary importance. This is supported by NEPA's CEQ Regulations, whose definition of 'effect'

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[50] Queensland Coordinator General, *Economic Impact Assessment Guideline* (Queensland Government, 2017), 4-7. See also the judgment in *New Acland Coal Pty Ltd v Ashman & Ors and Chief Executive, Department of Environment and Heritage Protection (No. 4)* [2017] QLC 24, where input-output analysis and cost-benefit analysis were discussed in detail.

[51] Note that state legislation will also generally encompass a weighing and balancing of economic and social matters with environmental impacts: see, eg, New York's *State Environmental Quality Review* 6 CRR-NY §617.11.

[52] For commentary on environmental valuation including intrinsic environmental value in the US context, see, eg, 'The Meaning of Value and Use of Economic Valuation in the Environmental Policy Decision-Making Process' in Water Sciences and Technology Board, *Valuing Ecosystem Services: Toward Better Environmental Decision-Making* (The National Academic Press, 2004).

[53] NEPA §101, 42 USC §4331.

> includes ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historic, cultural, economic, social, or health, whether direct, indirect, or cumulative.[54]

The CEQ Regulations specifically state that an EIA does not need to be prepared for social and economic effects, rather, '[w]hen an environmental impact statement is prepared and economic or social and natural or physical environmental effects are interrelated, then the environmental impact statement will discuss all of these effects on the human environment.'[55] Social and economic impact analysis is interwoven with environmental impact analysis in the US, as it is in Australia. Also similar to the situation in Australia is the role of the US decision-maker in weighing and balancing the various social, economic and environmental impacts. However, US law is more encouraging of quantitative values being attributed to various types of harms.

A *Cost-Benefit Analysis Under NEPA*

NEPA was initially interpreted by courts and commentators as either requiring or at least encouraging a cost-benefit analysis ('CBA')[56] – primarily on account of §102(2), which sets out what federal agencies must do when proposing and approving major federal actions, and also on account of an early case which interpreted NEPA as requiring a 'finely tuned and systematic balancing act to determine *whether costs [are] outweighed by benefits*' (emphasis added).[57] Section 102 of NEPA requires agencies to take an interdisciplinary approach to considering the relevant environmental impacts of a proposal, while the CEQ Regulations more specifically require that agencies '[i]dentify environmental effects and values in adequate detail so they can be compared to economic and technical analyses,'[58] in order to decide on which is the preferable approach between the proposal and any alternatives that might minimise environmental harm.

The generally accepted view appears to be that NEPA does not *mandate* a CBA, but that CBAs coupled with attempts to define values in as tangible terms as possible are encouraged. Indeed, the CEQ Regulations contain a specific provision on CBA which requires that the EIA documentation should discuss the relationship between a CBA, if one is being relied upon, and 'any analyses of unquantified environmental impacts, values, and amenities',[59] noting that 'the weighing of the merits and drawbacks of the various alternatives need not be displayed in a monetary [CBA] and should not be when there are important qualitative considerations.'[60]

CBA is not considered judicially reviewable on the merits of the analysis 'per se', although it may be possible for courts to review whether or not environmental costs were adequately presented in the EIA (specifically, the Environmental Impact Statement), as well as whether other important components of the analysis were also prepared adequately.[61] This more or less reflects the Australian situation with respect to the reviewability of the s 136 balancing exercise under the EPBC Act.

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[54] *CEQ Regulations for Implementing the Procedural Provisions of NEPA,* 40 CFR §§1500-1508 ('CEQ Regulations'), §1508.8.
[55] Ibid §1508.14.
[56] See, eg, Edward D Burmeister Jr, 'Cost-Benefit Analysis and the *National Environmental Policy Act of 1969*' (1972) 24 *Stanford Law Review* 1092; David R Buntain, 'Judicial Review of Cost-Benefit Analysis Under NEPA' (1974) 53 *Nebraska Law Review* 540, and the cases referred to therein.
[57] *Calvert Cliffs v AEC* 44 F 2d 1109, 1103 (DC Cir, 1971).
[58] CEQ Regulations, §1501.2
[59] Ibid §1502.23.
[60] Ibid.
[61] Steven Ferrey, *Examples & Explanations for Environmental Law* (Wolters Kluwer, 7th ed, 2016).

There are mixed views as to whether CBA is beneficial or not in the environmental decision-making context generally and with respect to EIA more specifically – some, for example, believe that it leads to better or more economically efficient decision-making, while facilitating transparency.[62] Baram, echoing others, has argued that the approach 'suffers major methodological limitations and institutional abuses'.[63] To a large degree, the CBA debate pertains to whether or not and to what extent it is appropriate to rely on economic analysis tools to make decisions about the acceptability of sacrificing environmental harms for other gains. Both supporters and opponents of the method believe their view is aligned with better decision-making, thus it is arguable that the difference of opinion depends on the varying degrees of faith willing to be placed in economic efficiency as being able to solve environmental problems. Chief Justice Preston has expressed his view, for example in the *Warkworth* case, that economic tools may be useful but will unlikely be determinative of an outcome in the Australian context, a position that the CEQ Regulations ultimately also reflect with respect to the US context.

Nonetheless, CBA is ingrained to a greater extent in US law and policy than it is in Australian law and policy, even if the ultimate positions are not entirely dissimilar. Perhaps on account of this, greater research efforts have been invested in the US in improving the validity of CBA and balancing exercises more generally (though not necessarily for that explicit purpose). Namely, there has been significant research on 'natural capital' and on pricing of environmental goods and services, which has allowed environmental costs to be better compared with economic ones, and thus environmental value to be compared, on some basic level, with economic value. This field of research, now conducted worldwide, has roots in California on account of the work of biologist Gretchen Daly and many others under what is now the Natural Capital Project.[64] Valuing natural capital involves costing of *environmental* resources, thus potentially, in the EIA context, partially translating an environmental impact into an economic one; work is also being done in the US on costing *social* resources and on quantifying social harm. This is of particular relevance to the fracking context.

B *Social Cost of Greenhouse Gases*

A key tool that has been developed and utilised in the US, and which is interlinked with cost-benefit analysis (although it does not necessarily have to be), is social impact costing. Social impact costing can be used to aid environmental decision-making – whether in EIA with respect to specific projects, or in regulatory impact analysis to weigh the benefits and costs of new policy measures – by attempting to quantify the value of social harm that would be caused as a result of environmental harm.

Specifically, the 'Social Cost of Carbon' ('SC-CO_2', sometimes referred to as 'SCC') is a metric used to quantify the negative impacts of carbon pollution on society, calculated in economic terms as the

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[62] See, generally, OECD, *Cost-Benefit Analysis and the Environment: Recent Developments* (OECD, 2006); Lisa Heinzerling and Frank Ackerman, *Pricing the Priceless – Cost-Benefit Analysis of Environmental Protection* (Georgetown University, 2002).

[63] Michael S Baram, 'Cost-Benefit Analysis: An Inadequate Basis for Health, Safety and Environmental Regulatory Decisionmaking' 8 *Ecology Law Quarterly* (1979-1980) 473, 473.

[64] See <naturalcapitalproject.org/>; and see, eg, Gretchen Daly (ed) *Nature's Services: Societal Dependence on Natural Ecosystems* (Island Press, 1997); Gretchen Daly et al, 'The Value of Nature and the Nature of Value' (2000) 289 *Science* 395; Andrew Balmford et al, 'Economic Reasons for Conserving Wild Nature' (2002) 297 *Science* 950; Water Sciences and Technology Board, *Valuing Ecosystem Services: Toward Better Environmental Decision-Making* (The National Academic Press, 2004); Davide Geneletti and Lisa Mandle, 'Mapping Ecosystem Services for Impact Assessment' in B Burkard and J Maes (eds) *Mapping Ecosystem Services* (Advanced Books, 2017).

equivalent cost of emitting an incremental unit (eg ton/tonne) of carbon dioxide.[65] It is generated by modelling tools such as the Dynamic Integrated Model of Climate and the Economy ('DICE'). The most recent estimate of one of the more prominent research groups, the Interagency Working Group on the Social Cost of Greenhouse Gases, is that the SC-CO_2 will be approximately $42 USD per ton in 2020 (figure includes a 3% discount rate),[66] though this estimate has been challenged, for example by van den Bergh and Botzen, who have argued that it is too low.[67] The value of the SC-CO_2 is associated with, inter alia, broad consequences such as more extreme weather events, declining crop yields, and rising sea levels.[68]

One commentator described the SC-CO_2 as 'admittedly a gross oversimplification of a complex underlying reality; but it is a defensible simplification',[69] reflecting that its limitations have been well recognised, but are not nonetheless prohibitive to its use as a beneficial decision-making aid. Its use in the US policy context has been to assist in quantifying the costs and benefits of regulations,[70] a use that has been endorsed by the courts.[71] Some, however, have argued that since the metric was introduced as a part of US policy, as a tool for influencing regulation, it was not in fact causing changes to the status quo.[72]

The tool has been acknowledged by US courts within and beyond the broader regulatory policy context. In *Center for Biological Diversity v NHTSA*,[73] the ninth Circuit Court of Appeals found a US agency's analysis of fuel economy standards arbitrary and capricious because it did not account for the benefits of carbon emissions reduction. The court, which specifically referred to the SC-CO_2, said that agencies, 'cannot put a thumb on the scale by undervaluing the benefits and overvaluing the costs of more stringent standards'.[74] Rather, agencies were required to consider holistically the true benefits associated with environmental measures (in the particular case, stricter fuel economy standards), and thus the proper opportunity cost of taking a more lax approach.

In *High Country Conservation Advocates v United States Forest Service*,[75] the Colorado District Court found an agency's decision with respect to mining exploration activities was arbitrary and capricious, essentially because it did not properly quantify the costs of carbon. The court held:

> The agencies do not argue that they could ignore [the effects of greenhouse gases ('GHGs') on climate change]. In fact, they acknowledged that there might be impacts from GHGs in the form of methane emitted from mine operations and from carbon dioxide resulting from

[65] William D Nordhaus, 'Revisiting the Social Cost of Carbon' (2016) 114 *Proceedings of the National Academy of Sciences of the United States of America* 1518, 1518.
[66] Interagency Working Group on the Social Cost of Greenhouse Gases, 'Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis – Under Executive Order 12866' (Technical Support Document) US Federal Government, August 2016.
[67] J C J M van den Bergh and W J W Botzen, 'A Lower Bound to the Social Cost of CO_2 Emissions' (2014) 4 *Nature Climate Change* 253.
[68] Editorial, 'Base the Social Cost of Carbon on the Science' 541 *Nature*, 18 January 2017.
[69] Susan E Dudley, 'President Trump Takes on the Social Cost of Carbon' (opinion piece) *Forbes* (online), 30 March 2017.
[70] Paul Watkiss and Chris Hope, 'Using the Social Cost of Carbon in Regulatory Deliberations' (2011) 2 *Interdisciplinary Reviews* 886.
[71] See *Zero Zone v United States Department of Energy* 2016 WL 4177217 (7th Cir, 2016).
[72] Robert W Hahn and Robert A Ritz, 'Does the Social Cost of Carbon Matter?: Evidence from US Policy' (Economic Studies Working Paper Series, July 2014), <https://www.brookings.edu/wp-content/uploads/2016/06/social_cost_carbon_hahn.pdf>.
[73] 538 F 3d 1172 (9th Cir, 2008).
[74] Ibid, 1198.
[75] 52 F Supp 3d 1174 (D Colo, 2014).

> combustion of the coal produced. …Beyond quantifying the amount of emissions relative to state and national emissions and giving general discussion to the impacts of global climate change, they did not discuss the impacts caused by these emissions. Instead, they offered a categorical explanation that such an analysis is impossible…But a tool is and was available: the social cost of carbon protocol.[76]

At this point the court cited the Interagency Working Group. This case is significant as it linked the SC-CO_2 metric to a specific proposal, indicating that its use in the EIA context could be important in future.[77] Given that there is a requirement under NEPA that costs and benefits be estimated and articulated (in whatever monetary or non-monetary form), if there are tools available to assist in calculating those costs and benefits, then this case supports the notion that they should be utilised in favour of vague statements or claims that costs cannot in fact be calculated.

Nonetheless, President Trump, through an executive order signed early in his presidency, has disbanded the Interagency Working Group on Social Cost of Greenhouse Gases and deemed key documents issued by that group on the SC-CO_2 as 'no longer representative of governmental policy'.[78] The order does not require agencies to stop monetising the harm caused by greenhouse gas emissions, and it does not nullify the work of the group or of others on the topic, but it does call into question the future usage of the SC-CO_2 in the US.

Even if the SC-CO_2 is not a part of US regulatory analysis policy any longer, provided it is still supported by science and has the support of the peer reviewed scientific community as a useful way of quantifying costs, it might still have lingering significant influence both within and outside of the US, particularly in the EIA context. The metric, though most often used in the US context, has also been used in the UK[79] and globally.[80] Social costs were highlighted in the Intergovernmental Panel on Climate Change (IPCC)'s *Fifth Assessment Report*, which discussed in detail various costly aspects of climate change both economically and socially, and cited literature discussing the SC-CO_2.[81]

The SC-CO_2 is not considered able to be translated to represent other greenhouses gases by simply taking into account the differing global warming potentials of the different gases. Separate calculations need to be undertaken in order to generate values for each gas. This has been done for methane by authors such as Marten,[82] and the Interagency Working Group referred to above. Cost estimates for methane are referred to by the term Social Cost of Methane ('SC-CH_4', or sometimes 'SCM'). The SC-CH_4 is particularly relevant to fracking, because the main gas emitted from fracking

[76]Ibid, 1190, citing the Interagency Working Group.
[77] Kathryn S Ore, 'High Country Conservation Advocates v. United States Forest Service, 52 F. Supp. 3d 1174 (D. Colo. 2014)' (2014-2015) 0 *Public Land and Resources Review*, Case Summaries, article 3.
[78] The White House Office of the Press Secretary, *Presidential Executive Order on Promoting Energy Independence and Economic Growth* (28 March 2017) 5.
[79] See Richard Clarkson and Kathryn Deyes, 'Estimating the Social Cost of Carbon Emissions', Government Economic Service Working Paper No 140, January 2002, HM Treasury, London; David Pearce, 'The Social Cost of Carbon and its Policy Implications' (2003) 19 *Oxford Review of Environmental Policy* 362.
[80] Watkiss and Hope, above n 70.
[81] Michael Oppenheimer et al, 'Emergent Risks and Key Vulnerabilities' in *Climate Change 2014: Impacts, Adaptation, and Vulnerability - Part A: Global and Sectoral Aspects*, contribution of Working Group II to the *Fifth Assessment Report of the Intergovernmental Panel on Climate Change*.
[82] Alex L Marten and Stephen C Newbold, 'Estimating the Social Cost of Non-CO_2 GHG Emissions: Methane and Nitrous Oxide' (Working Paper No 11-01, National Center for Environmental Economics Working Paper Series, 2011); A Marten and S Newbold, 'Estimating the Social Cost of Non-CO2 GHG Emissions: Methane and Nitrous Oxide' (2012) 51 *Energy Policy* 957; A L Marten et al, 'Incremental CH4 and N2O Mitigation Benefits Consistent with the US Government's SC-CO2 Estimates' (2015) 15 *Climate Policy* 272.

operations is methane (natural gas). In the same way that the SC-CO_2 has been used to inform regulatory policy and to some extent individual project approvals, the SC-CH_4 could also be used in both contexts.

The SC-CH_4 was specifically referred to and discussed in detail in the Regulatory Impact Analysis underlying the Obama administration's New Source Performance Standards for the oil and gas sector that sought to limit methane pollution,[83] for example, and can be viewed as a justification supporting the standards. Those standards were amended in March 2018.[84]

Applying the same three per cent discount as the SC-CO_2 estimate above, the 2020 present estimate for the SC-CH_4 has been quantified as $1200 USD per tonne ($1323 USD per US ton) in a leading scientific work on SC-CH_4.[85] In a 2017 manuscript, Shindell, Fuglesvedt and Collins estimated the SC-CH_4 as $3600 USD per ton (also with a discount value of three per cent).[86] On either estimate, clearly the SC-CH_4 is much higher than the estimates for the SC-CO_2, even considering the range in those estimates.

Disbandment of the Interagency Working Group may mean that further research on these social costing metrics and further integration of the metrics into law is likely to slow. However, the SC-CH_4 could still be a useful tool for the courts and the public to understand in quantitative terms how methane pollution is costly to society, as compared with carbon pollution and as compared with even lower emissions alternatives (such as renewable energy sources). Creating a quantifiable cost in dollar terms of pollution on society is an endeavour inevitably subject to significant limitations, however, the 'dollar values' represented by the US' social costing metrics are economic costs which exist *in addition to* other qualitative costs. In other words, the social costing metrics do not purport to wholly represent social costs.

Such quantitative costing can be particularly important for those who do not identify qualitative values as being important or do not understand the qualitative values expressed by others – an economic aspect can be separated out from values that are more subjective; social costing metrics represent the economic rather than total cost likely to be imposed on society. Social costing might be thought of as an educational and informative tool rather than a solution, but it is an important tool which, alongside other tools, could be beneficial in the EIA context both within and beyond the US and within and beyond the fracking context. Thus, it is a way in which the legal system might better manage particular types of risks, by ensuring the more effective weighing and balancing of a project's different impacts.

III CONCLUSION

It was established in Chapter 1 that EIA-based decision-making can be thought of as a decision-making system that facilitates analysis of the environmental impacts of project proposals and which helps incorporate those impacts into final project assessment decisions. Beneficial economic and social

[83] US EPA, *Regulatory Impact Analysis of the Final Oil and Natural Gas Sector: Emission Standards for New, Reconstructed, and Modified Sources* (EPA-452/R-16-002, May 2016).
[84] *Oil and Natural Gas Sector: Emission Standards for New, Reconstructed, and Modified Sources; Amendments*, 83 Fed Reg 10628, 10629 (12 March 2018).
[85] Alex L Marten et al, 'Incremental CH4 and N2O Mitigation Benefits Consistent with the US Government's SC-CO2 Estimates' (2015) 15 *Climate Policy* 272, table 5.
[86] D T Schindell, J S Fuglesvedt and W J Collins, 'The Social Cost of Methane – Theory and Applications' (2017) *Faraday Discussions*, advance article, doi 10.1039/C7FD00009J.

matters are typically drivers for project proposals, but on account of the EIA system and its assessment procedures, potential adverse environmental impacts might offset or completely negate those benefits in the mind of the relevant decision-maker, as guided by the law. This Chapter has demonstrated how other beneficial and adverse impacts can weigh into the final decision as well. Through s 136 of the EPBC Act, economic and social matters are given a pathway to enter into the weighing and balancing exercise that the decision-maker undertakes when deciding to reject or approve a proposal, and on what conditions.

Various theoretical underpinnings can help to explain why economic and social matters are able to balance with or against environmental impacts, either to create a stronger case against allowing a proposal, or to balance out negative impacts and ultimately weigh in favour of a proposal. First, there has historically been a strong social impetus and anthropocentric rationale behind environmental protection instruments, as evidenced by legislation, declarations and treaties from the 1960s and 1970s in particular, including the US' NEPA and the international *Stockholm Declaration*. The ideas expressed in those instruments were refined and more specifically articulated in the 1990s through the *Rio Declaration* and, in Australia, the EPBC Act, which each incorporate specific socially and economically oriented principles, including the public participation principle, the intergenerational equity principle, and the polluter pays principle.

There is no reliable way to predict clearly how social and economic impacts are likely to be considered, weighed and balanced in EIA decision-making. The reasons for this are twofold: first, the task of the decision-maker in conducting the weighing and balancing exercise is highly discretionary, more so than with regard to environmental impacts, and the law not highly prescriptive in terms of what should be taken into account, or how. Second, the process is largely non-reviewable, except under limited circumstances. This means that, particularly at the federal level, courts will not stand in the shoes of an executive decision-maker, ie, the Minister, and decide how he or she could better have made his or her decision. Accordingly, it is only possible to forecast in a general but limited sense from legislation and from prior case law what factors might be important to decision-making in future cases, such as equity in terms of distributive justice within and between generations, and the need to consider the reasonably held views of the public.

A significant implication of the discretionary and largely non-reviewable nature of the consideration of economic and social matters is that it creates an opportunity for decision-makers not to be entirely transparent with respect to which factors were considered influential in their decision, and to what extent. In Australia as compared with the US, decisions are, arguably, able to be even more opaque, because Australian law shies away from economic valuation and quantification – an implication of the desire to protect inherent and intangible values from being reduced to economic terms. If an impact is seen as not able to be given a precise value, then it is difficult to challenge a decision that the impact is outweighed by some other value. This, in turn, means that the ability of the EIA system to guarantee protection from environmental risk materialising is limited, depending very heavily, instead, on the particular decision-maker and how he or she decides to apportion value at least quasi-subjectively. There is certainly an argument to be made that the administrative law system is not the best system to house the EIA system on account of these limitations.

The above does not suggest that all economic and social matters should be given economic value in pursuit of transparency. As critics have recognised,[87] present tools cannot possibly fit all values within present markets, nor can valuation ever be accurate without perfect knowledge. What Australia might learn from the US context, however, is that pursuing avenues to express impacts not necessarily in a

[87] Such as Preston CJ in *Warkworth*.

common, fungible currency, but simply in such a way as to more coherently convey the more objective aspects of value, should be an important future priority for so long as economic and social matters are able to influence environmental decision-making. That is, *if* the legislation does not operate to the extent of allowing environmental risk to be a stand-alone factor justifying a project's refusal, where for example something with intrinsic value is threatened (which, as mentioned, would be the most effective way to protect against environmental risk), then efforts need to be pursued to ensure that the value of what is being threatened can be conveyed more coherently to those proposing to make decisions that might cause the threat to materialise. The 'costs v benefits' CBA approach has limitations but also has the potential to offer greater transparency in decision-making, provided (critically) that it is able to flexibly include costs and benefits that are difficult to quantify in a common currency, and provided also that efforts to continue to better express adverse and beneficial effects as costs and benefits are pursued.

The SC-CO_2 and SC-CH_4 metrics serve as good examples of quantification tools which, while not perfect, highlight likely economic costs without completely quantifying social impacts in economic terms. With SC-CO_2 and SC-CH_4, a social harm is not converted into an economic one, rather, the economic flow-on implications from an impact to the social system are identified so that they may be able to be compared, at least, with other economic aspects such as positive economic gains. For example, a project that emits *x* additional tonnes of methane that would not be emitted in the absence of the project might cost *y* dollars as a result of social costs, in addition to incurring other economic costs, environmental costs, and qualitative social and environmental costs. The SC-CH_4 could be a useful tool to assist decision-makers in determining whether or not to approve fracking projects in Australia, which could be incorporated as a relevant method of considering social and economic impacts under s 136 of the EPBC Act and equivalent avenues in state and territory legislation. It could also be a tool used to justify and to evaluate regulatory policy.

In concluding, it is important to remember that EIA is not the only forum for adverse economic and social impacts to be recognised by the law. In the fracking context, for example, social harm can be remedied through tort law and potentially criminal law, depending on the facts of the case. In tort law, it is the norm for social harms to be remedied in economic terms where the harm has already occurred, and for injunction remedies stopping an action from occurring to be potentially available where harm has not occurred yet but is at risk of occurring. EIA law is a unique area of law that can operate in a preventative fashion, having the capacity to protect qualitative values before any harm is occasioned. It is thus a very important tool for safeguarding social values. There is scope for it to operate in pursuance of goals like sustainable development and keeping planetary systems within defined limits, or at least for its effectiveness to be measured against such parameters. As Chapter 1 acknowledged, however, the EIA system is a procedural system.

The following Chapter is the final chapter of this thesis, which will draw together the discussions, arguments and evidence that have been presented and synthesised thus far in this and previous chapters, attempting to articulate overarching messages, lessons and future priorities for EIA system research and practice, particularly in the fracking context.

Chapter 8: Conclusion

In this final concluding chapter, four tasks are approached: summarising the findings and lessons of the research discussed in the preceding chapters (Part I); briefly reviewing the regulatory picture that contextualises EIA with respect to fracking, which was first set out in Chapter 2 (Part II); commenting on recommendations and future research applications for the material discussed in the thesis (Part III); and providing some final closing thoughts (Part IV).

I SUMMARY OF FINDINGS

In Chapter 1, three research questions were posed:

(1) Taking an interdisciplinary, systems-based approach, what are the environmental risks associated with the fracking process?
(2) How well is federal Australian law equipped to minimise or otherwise manage environmental risks from fracking through EIA?
(3) Which specific gaps or weaknesses in the present legal framework for EIA in Australia need to be addressed from the perspective of minimising risk or reducing the chance of adverse impacts from fracking, and how might that be achieved?

Chapter 1 explained that a doctrinal and comparative analysis was employed as the thesis methodology, which included adopting interdisciplinary and systems thinking lenses. These components were applied together in order to answer each research question. Adopting this type of methodology allowed the research questions to be approached holistically, and facilitated a well-rounded, considered enquiry that was driven by, but not limited to the confines of, doctrinal law. Chapters 3-7 explored and evaluated material relevant to answering the research questions, under the headings of fracking, water resources, climate change, cumulative impacts, and economic and social matters.

Findings in relation to research question 1 were established primarily through a review of scientific literature, and a scientific analysis of material safety data relating to fracking chemicals, integrated with a regulatory impact analysis. Scientific information relating to physical processes, the nature of chemicals, the nature of ecosystems, and actual data from previous impacts helped to inform an understanding of fracking risks. Legal frameworks and information regarding practical implementation were drawn upon in order to assess the potential likelihood of these risks, and the impact of the law and regulation on risks occurring. Findings in relation to research question 2 were principally established by analysing and interpreting existing Australian law, through a doctrinal analysis.

To answer research question 3, the findings in relation to research question 1 were considered in light of the findings in relation to research question 2. Essentially, establishing the most important gaps and weaknesses that need to be addressed to minimise risk could be deduced by knowing the nature and probability of risk (from research question 1) and knowing the ways in which Australian federal law is not so well equipped to minimise risks (from research question 2). To determine how change could be achieved, creative solutions were proposed by (a) looking to the US context and interpreting relevant lessons (b) building upon and thinking laterally about the successes and failings of previous policy discussions in Australia, and (c) drawing on various relevant international materials to generate new options for Australia (for example, the definitions presented in Appendix 2). Below, the key findings are summarised, and the lessons that arose are reviewed.

A *The Environmental Risks Associated with Fracking*

The three principal environmental risks of fracking are:

- Water contamination;
- Changes in hydrology; and
- Climate change

Flow-on effects include downstream impacts to biodiversity within and beyond the immediate vicinity of the fracking site; impacts to agriculture, the food system, and the livelihoods of farmers on account of soil and water contamination; impacts to people's health on account of contamination of drinking and recreational water resources; and widespread impacts to environments and societies, or social-ecological systems ('SES') on account of climate change. These may traverse state/territory and even national boundaries, sometimes as a result of a chain of intermediate impacts. Localised impacts to health and amenity on account of air pollution, noise, and change in landscape or character, and seismological impacts, are also important risk categories.

The potential impacts or risks of fracking, including flow-on effects, were ascertained by reviewing scientific and interdisciplinary literature, incident reports, media releases, and material safety data information. A considerable body of information that was reviewed came from the US, where fracking has occurred on a large scale for many years. The number and magnitude of reported incidents has tended to be greater in states with a longer and more prolific history of fracking, such as Pennsylvania, Texas, North Dakota and Oklahoma.

Chapter 3 explained that which environmental risks are associated with a given fracking project, and the extent to which harm is likely to be significant, will depend on the given project. The project's surrounding environment will be a key determinant. Affected environmental systems' capacity for resilience, or ability to buffer any impacts, will be highly influential on whether and how environmental impacts materialise. The broader context, including the legal, political, and social aspects of that context, is also important, however. Taking a systems approach was found to be helpful in identifying the broader contextual elements relevant to the materialisation of environmental risk.

For example, government decision-makers will be more likely to approve a project in spite of potential adverse impacts in jurisdictions where there are strong financial incentives to frack, but take a more cautious approach in jurisdictions where the practice is heavily opposed or where risk is perceived as particularly serious (because of, for example, controversial social consequences). This is especially so where the decision is made in the context of an EIA system that affords significant discretion to the decision-maker, as in Australia under the EPBC Act. Similarly, stricter environmental laws that address fracking impacts and are appropriately enforced, and/or a higher degree of future regulatory risk, are likely to either motivate proposals that are conscious of minimising environmental impact (in line with regulatory requirements), which in turn will reduce environmental risk, or be a deterrent from proposals in that jurisdiction, which will also reduce risk.

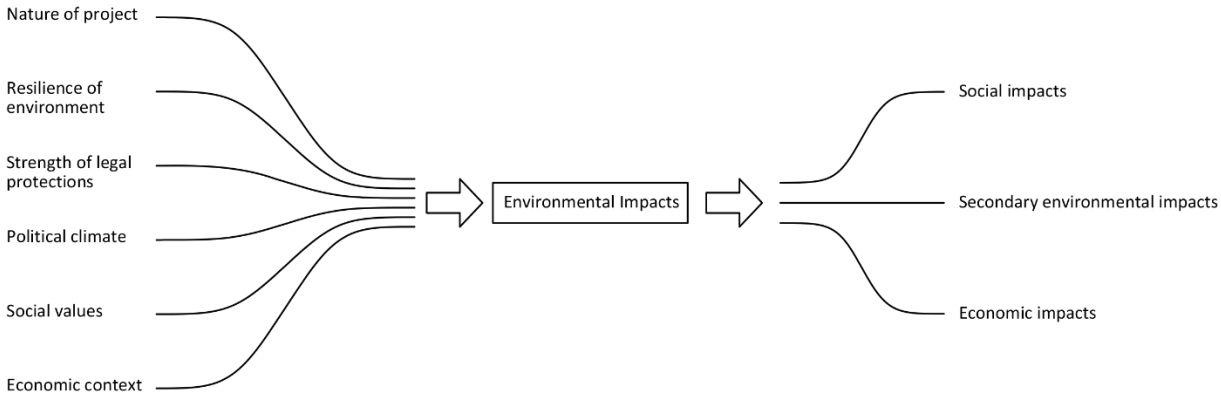
Further, the availability and use of technology and practices that minimise risk will also influence whether risk materialises. Poor well construction, for example, is more likely to lead to leakage, and disposal of wastewater in open pits or directly onto the environment as opposed to in underground wells is more likely to lead to water contamination. Referring to the US context highlighted the

correlations between environmental harm and factors such as public opinion, political stances, and extent of regulation.[1]

Figure 7.1, below, represents some of the risk factors that can cause environmental impacts. Although not shown on this diagram, balancing and reinforcing feedback loops can exist whereby an impact has a positive or negative influence on a causal factor. For example, if an impact materialises that raises public concern, this might change the social climate and ultimately reduce the likelihood of further impacts.

[1] See particularly Olga Schenk et al, 'Unconventional Gas Development in the US States: Exploring the Variation' (2014) 4 *European Journal of Risk Regulation* 436.

Figure 7.1, ***Environmental Impacts – Cause and Effect***



B *Australian Federal EIA Law's Capacity to Manage Risk*

Federal Australian EIA law under the EPBC Act creates a system whereby risk can be managed through the decision-maker's (Minister's) power to refuse project proposals that are likely to cause the materialisation of risk, and to attach conditions on proposals which *are* approved, in order to minimise the chance of risk occurring and reduce the severity of potential harm.

However, the Minister's power is limited, in that it is only enlivened where the EPBC Act is triggered. In addition, the Minister is only allowed to make his or her decision based on a limited set of factors, and must take certain particular factors into account.

EIA law in Australia thus has capacity to minimise or otherwise manage the environmental risks of fracking. However, this capacity is limited by the nature of Australian EIA law and EIA-based decision-making in the following ways:

- EIA law, and thus the EIA system, is triggered only in particular circumstances;
- EIA-based decision-making is discretionary administrative decision-making; the merits of a decision are largely unreviewable by courts;
- EIA law requires that economic and social matters are considered alongside environmental risks, and allows those matters to take precedence over potential impacts to the environment; and
- EIA-based decision-making is project-specific.

As was explained in Chapter 1, the EPBC Act is triggered only where either a Commonwealth federal agency or Commonwealth land is implicated, or where one of the nine matters of environmental significance ('MNES') are likely to be significantly affected. This limits the extent to which risk can be managed by the EIA system to risk that falls within the EPBC Act's ambit. As a corollary, key gaps exist where environmental impacts are likely to occur, but the EPBC Act is not triggered – a situation which could apply in the fracking context. These gaps are reviewed below in Section C.

Decision-makers are required to take into account factors relevant to environmental risks in the context of particular MNES. They are also required to take into account factors and values that promote conservation and risk minimisation – namely, the principles of ecologically sustainable development ('ESD')). The principles of ESD, which were discussed throughout the thesis' chapters, embody values such as biodiversity conservation, and precaution in the face of uncertainty. Together,

these requirements are important features which might persuade decision-makers toward a course of action that would minimise environmental risk.

Nonetheless, decision-makers are allowed freedom to choose how they weigh and balance and ultimately incorporate environmental matters and the ESD principles into their decision, and whether or not conflicting factors take precedence. The fact that environmental decision-making is afforded significant discretion means that even where the potential to minimise risk exists, fulfilment of that potential is not guaranteed by the legal system. The Australian Federal Court offered a frank reminder in the *Adani* appeal decision: '[t]here are no criteria as to which the Minister must be satisfied in order to grant approval.'[2] In other words, there are no substantive prerequisites, only a procedural process to follow.

Reviewing courts have some scope to say that, for example, a particular matter or principle could not have been effectively taken into account just because a decision-maker stated that it was, if the decision completely contradicts it or if there is no record of it. The Federal Court (the reviewing court under the EPBC Act) has tended to avoid questioning whether a matter or principle was really considered or applied in effect, though, preferring strong deference to decision-makers regardless of the environmental outcomes. This was highlighted particularly in Chapter 5 through the case law on climate change.

Economic and social matters must be taken into account by the Minister when making his or her decision. As above, the Minister ultimately has discretion to weigh and balance these factors in the manner that he or she chooses. However, it is significant that there is a requirement to consider economic and social matters which may not be at all relevant to environmental matters. This requirement can operate against the capacity to manage environmental risk, by creating an avenue for weakening the case for the most environmentally protective course of action and the course which best minimises risk. Factors like economic benefits and the creation of new jobs, typically short-term in nature, can be politically attractive and render a decision to approve a risky project more popular.[3] This is particularly so if the economic and social gains are appreciated by the public but the environmental risks, and the implications of those risks, are not well understood. The most environmentally protective course of action that is associated with the least environmental risk might actually have significant economic and social benefits, because a healthy environment has a positive effect on people and the economy. However, this is not always well recognised. These issues were discussed in Chapter 7.

A further and final aspect of the capacity to manage risk relates to EIA-based decision-making being project-specific in nature. The capacity to manage risk is limited by the fact that decision-makers decide on approvals one project at a time. Although this is an inherent feature of EIA-based decision-making, the extent to which EIA law facilitates and encourages the consideration of cumulative impacts will directly influence the capacity to manage risk. Cumulative impacts are critical in understanding how risk materialises; if small contributions are ignored by the law and so are able to accrue, an adverse impact is far more likely to occur than if cumulative contributions could be factored in and ultimately managed. There is uncertainty around the status of whether or not cumulative

[2] *Australian Conservation Foundation Incorporated v Minister for the Environment and Energy* [2017] FCAFC 134 ('*Adani*'), 28.

[3] The public popularity of a decision on a major project can be important because the decision-maker is a representative of an elected political party, that has an interest in re-election and maintaining public support. The issue of regulatory capture may also arise, however, where there is a failure to actually effect the public interest.

impacts caused in part from sources other than the project are allowed to be considered under federal Australian EIA law, and to what extent. To the extent that they are or can be considered, there is no clear method for ensuring, through EIA, that they are appropriately recognised and managed. Accordingly, any existing capacity to manage cumulative impacts is not being well realised. This was demonstrated in Chapter 6.

C *Addressing the Gaps and Weaknesses*

To optimise the capacity of the legal system to manage risk associated with fracking, certain key issues need to be addressed, and in some cases, legal reforms are required. Specifically recommended legal reforms are summarised in Part III, Section A, below. This section articulates which gaps and weaknesses should be the subject of further discussion or reform and how this would benefit the capacity of the legal system to manage risk, and it highlights key points from each particular chapter. The intended outcome of this work is broader than simply to have produced suggestions for reform; in addition, it is hoped that a contribution to the theoretical and philosophical discussions on the nature of the law and how it operates within the context of ecological and social-ecological systems to manage risk will also be meaningful.

1 *Impacts that Do Not Trigger the EPBC Act*

It was contended in this thesis that EIA law needs to be addressed to the extent that the triggering circumstances do not encompass fracking and fracking's key impacts. Matching up the impacts identified above in Section A, two key gaps were identified in the Australian context: climate change is not a triggering MNES, and water resources, which are a MNES, are only within the EPBC Act's scope in certain limited circumstances.[4]

(a) Water resource impacts

The EPBC Act's application to water resources is narrow – too narrow, it was argued in Chapter 4, to protect adequately against the impacts of fracking projects. Incomplete coverage by the water trigger limits the capacity to manage risk to risk from coal seam gas ('CSG') fracking, rather than all types of unconventional gas fracking, or risk to other MNES (such as Ramsar wetlands).

Chapter 4 established a case for federal-level assessment of water resources, discussing water resources in the context of broader SES, the hydrological cycle, and networks of cross-jurisdictional resources. It argued that there is a danger in the law treating water impacts as affecting discrete, isolated places, as this betrays the definition of what a 'water resource' can be understood as meaning from a contemporary scientific, or integrated-systems perspective.

Chapter 4 proposed a more comprehensive protection of water resources through an expansion of the existing EPBC Act provisions that draw water resources within federal scope so as to cover all types of unconventional gas fracking, including fracking for shale and tight gas. It also endorsed the role of an independent scientific body in influencing decision-making, as another avenue to assist in minimising risk.

The US context was also noted in Chapter 4. In that context, EIA law is able to be triggered for all types of water impacts. At the same time, EIA law is supplemented by a greater array of other environmental protection legislation. However, important carve-outs apply to the fracking industry. The lesson for Australia is that while environmental protection laws can be important supplements to EIA law if EIA law is not triggered, they need to be comprehensive in coverage in order to be effective;

[4] Impacts to water resources include both from contamination and through altered hydrology.

an EIA system that is broad in scope and which is also appropriately supported by regulation is ideal best practice. Water contamination incidents in the US demonstrate that risk to water resources is not adequately managed in that jurisdiction, and reiterate the need to target this avenue of risk.

(b) Climate change impacts

Chapter 5 identified that climate change is not an EPBC Act trigger, and it evaluated existing law to conclude that climate change is poorly accounted for in EIA-based decision-making, even with respect to the way in which climate change impacts other MNES. Climate change can be – and has been – argued as being a relevant and significant impact in major project cases, but such arguments have had to be couched in terms of climate change's flow-on effects to existing MNES, like the Great Barrier Reef Marine Park, or vulnerable species that are listed as threatened. Courts have struggled with how to interpret these arguments, and whether to accept that the link between a project in question, climate change, and climate change's effects on a MNES is strong enough to warrant mandatory consideration by the decision-maker, offering confusing and at times illogical reasoning.

Existing climate change case law in Australia mostly relates to coal projects and not natural gas projects. It is likely to be relevant, if and when new natural gas projects are considered under the EPBC Act, that unlike coal, natural gas contributes to climate change in an appreciable way at the point of extraction, rather than only at the point of combustion. This is important because it means that a greater proportion of total emissions happen at the source rather than downstream (and potentially in a foreign jurisdiction). This might mean that courts are more willing to consider climate change impacts in fracking cases.

Nonetheless, Chapter 5 recommended that in order for risk to be better able to be managed within the EIA system, climate change impacts need to be able to trigger the EPBC Act directly. It established a case for climate change being of federal importance in its own right, ie, without being linked to an existing MNES. The incorporation of climate change in EIA-based decision-making would allow large polluting projects to be rejected on the grounds of intensive CO_2e contribution, or, perhaps more likely, it would allow conditions to be placed on large polluting projects such as that the best available technology for reducing emissions must be utilised. In the fracking context, conditions might prevent venting and flaring of methane, and mandate that local emissions be closely monitored and recorded. Adaptive management conditions might then require that if large volumes of methane are being leaked, the project must be reviewed.

If fracking regulations were to be developed which required that these or similar conditions be a mandatory aspect of all licensing and permitting decisions, eg under state/territory oil and gas law, this would make the decision-maker's task simpler in EIA in the applicable jurisdiction(s). It would give the decision-maker freedom to choose whether to impose equivalent conditions in states/territories without mandatory regulations, depending on the case at hand. Similarly, if further federal climate change policies were developed, these could also operate in tandem with EIA-based decision-making to manage risk. EIA could be used as a tool to provide information on the proposed emissions of projects and thus help Australia's contribution to climate change to be managed project-by-project.

Chapter 5 specifically articulated how climate change might be incorporated into the EPBC Act, by suggesting a climate system trigger. Commenting on previous suggestions in the literature and in public submissions of a 'greenhouse gas trigger', a case was made for including the climate system as a MNES rather than adopting a greenhouse gas trigger, which would be less flexible and which would pre-determine significance. The climate system trigger is based on a project's contribution toward adverse impacts to the climate system. It could be applied to fracking projects, other energy projects,

and additionally to other actions such as deforestation and land clearance which also impact the climate system and influence climate change.

Reference to the US context helped to demonstrate how climate change might be considered in decision-making; in the US, climate change concerns can trigger NEPA. Climate change is increasingly being discussed in US courts in an open manner and in the context of case-specific, EIA-based decision-making. This includes in the fracking context, where courts have recognised the link between fracking and the flow-on impacts of climate change.

2 *Cumulative Impacts*

If cumulative impacts are excluded from or are not well incorporated into EIA-based decision-making, then important aspects associated with the risk of environmental harm will be more likely to be ignored. A principal drawback in the regulation of environmental impacts on a case-by-case basis is that it is difficult to account for cumulative impacts – at least, within the established principles of legal causation and remoteness that apply to limit which impacts are considered sufficiently linked with the action or project under consideration. This issue was alluded to in the discussions on water and climate change, but was given separate consideration in Chapter 6.

Chapter 6 recognised that a cumulatively caused significant impact could manifest through just one project, which might act as the 'tipping point' that triggers an impact that has been building up, and that the underlying problem is often attributable to multiple project approval decisions that ignored external factors and at the same time dismissed small individual contributions to environmental harm, as this is what facilitates tipping points being reached. Chapter 6 explained this by referring to concepts such as resilience and systems limits, which might be employed to encourage lawyers to view cause-and-effect relationships in a more lateral sense than is customary under legal doctrines of causation.

When cumulative impacts are clearly included within the scope of EIA, a more holistic and ultimately accurate picture of how the environment is likely to be affected by a project can be obtained. However, the inclusion of cumulative impacts, in requiring an expansion of scope, is also likely to command a greater expenditure of resources. Thus in thinking about how the law should prescribe the consideration of cumulative impacts, it was necessary to consider how lines should be drawn in terms of how broadly an assessment should be conducted – whether for example based on impacts' foreseeability, remoteness, or simply based on 'common sense'.

Chapter 6 approached this task by reviewing the problems with the Australian system and comparing the approach taken by the US system. It found that a fundamental problem in Australia is that no consensus has been reached even on the point of whether cumulative impacts are to be incorporated into EIA, let alone the manner in which this might be done. As with Australia, the US also faces challenges with respect to cumulative impacts, because their consideration adds time and expense to decision-making, and it is not always clear where to draw the line in terms of scope in each case. However, under the US' EIA legislation, cumulative impacts are specifically defined, and their consideration is required as a matter of course.

This contrasts with the EPBC Act, which, as discussed above, leaves Australian decision-makers to grapple with whether, where and how to consider cumulative impacts. Although the area is still difficult in the US context, the fact that explicit discussion is required by agencies when making decisions means that analysis by courts and commentators can be more fruitful in addressing possible ways forward, and a greater – even if imperfect – understanding of how the environment is likely to respond to the project in question can be garnered through EIA. The US example indicates that the

issue of scope can be addressed through mechanisms similar to those that exist in Australian law already, for example, significance, context, intensity, causation, and reasonable foreseeability.

Chapter 6 suggested options for dealing with cumulative impacts in the future: requiring that potential impacts are analysed with greater reference to context, including particularly the state of the environment 'as it's found' at the time of the proposed project's commencement, and (re)defining 'significance'[5] for the purpose of assessing the nature and magnitude of a potential environmental impact. Significance, it was argued, should be determined by examining the extent of compromise to ecosystem integrity (ie, ecosystem structure or function), and it should be informed by a view of 'context' that includes the affected environmental systems' vulnerability and resilience. Employing such changes would not necessarily be easy and assessment would not suddenly become straight-forward; challenges will likely persist in this area of EIA, but progression is nonetheless important, particularly as more about the nature of cumulative impacts and the complex causal relationships behind them are understood.

Conducting enquiries and strategic assessments might help supplement the deficiencies in EIA law, particularly if measures such as bioregional assessments can be clearly and explicitly linked to the EIA process. At present, strategic assessment in Australia does not have the capacity to solve the cumulative impact problem.

3 ***Economic and Social Matters***

That economic and social matters are required to be considered alongside environmental impacts is an important aspect of decision-making under the EPBC Act which could be considered a weakness in the law in the sense that it allows beneficial economic and social matters to easily outweigh environmental risk. As Chapter 7 explained, it is for the decision-maker how to weigh and balance economic and social matters with environmental risk – he or she is not required to prioritise economic or social benefits over environmental ones, but has the opportunity to do so, and, from a political perspective, that option can be tempting. It could be argued that the law does not do enough, therefore, to safeguard the environment in situations where a significant adverse impact is likely. Statistics on the approval of major projects in Australia indicate that it is extremely rare that a project would be outright rejected on environmental grounds.[6]

Balancing beneficial and adverse economic and social matters against environmental risk inevitably requires value judgments and a need to reconcile conflicting priorities. The ESD principles provide a way to help with this reconciliation exercise, although, as Chapter 7 argued, the principles themselves can be interpreted as conflicting, and in practice on account of s 136 of the EPBC Act require little of the decision-maker other than that he or she considers them. With respect to a fracking case, including economic and social matters and ESD in the s 136 required considerations could have either a positive or negative impact on the way in which risk is managed, but through allowing matters not

[5] 'Significance' is not actually defined in the EPBC Act, rather, interpretations have emerged over the years through government guidelines and a developing body of precedent.

[6] Only 2.2% of projects referred under the EPBC Act and 0.4% of extractive industry projects were rejected for any reason between 2000-2015 when the EPBC Act came into effect: Oliver Milman and Nick Evershed, 'Australia has Denied Approval to Just 18 Projects Since 2000' *The Guardian* (online) 12 August 2015; since the present (at the time of writing) coalition government in Australia was elected in 2013, just prior to the commencement of research for this thesis, only one project has been rejected under the EPBC Act: a project to construct and erect wind turbines: Adam Morton, ''The Franklin Would be Damned Today': Australia's Shrinking Environmental Protections' *The Guardian* (online) 30 January 2018.

related to environmental risk to take precedence over matters that do relate to environmental risk, the likelihood that environmental risk will be minimised is reduced.

Chapter 7 argued that the EIA system in Australia could be improved with respect to recognising the interlinkages between environmental, social and economic harms. Particularly neglected is the connection between environmental harms and corresponding economic harms. This link could, however, be important, it was argued, and it is within the EPBC Act's objectives that improved valuation and pricing be pursued. An example explored in Chapter 7 was the social cost of carbon metric, and the related social cost of methane metric. These could be useful ways in which to recognise the costs that fracking will have on a broader federal (and global) scale through its contribution to climate change.

US courts have referenced such metrics and actively encouraged their use, showing a limited tolerance for agency statements such as that the economic consequences of social harms that stem from environmental impacts cannot be calculated, when in fact tools do exist that could help with such calculations. A more inclusive assessment of social costs in Australia which is data-driven and relatively easy to understand may help facilitate decision-making which is better equipped to minimise environmental risks by couching environmental risks in terms of flow-on social and economic risks.

4 *Beyond the Checklist Mentality*

Not all of the identified factors limiting the capacity to manage risk were treated by this thesis as appropriate targets for EIA-related reform or as needing to be addressed in a particular tangible way. Namely, that decision-making is discretionary in nature is an inherent aspect of EIA law being administrative law. This might be seen as an impetus, nonetheless, to improve a decision-making system whose exposure to review by the courts is only limited. The limited exposure to review by courts as being restricted to judicial review is liable to promote a checklist mentality for decision-makers rather than encouraging an in-depth consideration of problems and risks. Thus, the EIA system demonstrates a relationship of tension between the law's capacity to facilitate freedom of political decision-making and at the same time maximise the achievement of environmental outcomes such as minimising risk. Whether this means that the administrative system is perhaps not the best system to house EIA law is a question that might be the subject of fruitful further research and debate. Its answer would require an in-depth review of administrative law that was not within the scope of this particular thesis.

This thesis did, however, identify commentary on the topic of what the essential objective or point of EIA is, in Chapter 1. The literature review presented in that chapter summarised that EIA can be viewed as a procedural process that lacks a substantive goal, but whose effectiveness can be measured by reference to higher ambitions such as the attainment of the elusive 'sustainable development'. In Chapter 2, it offered a way in which sustainable development could be conceptualised by the law for the purposes of the EIA system and of project-specific decision-making. It was argued that cumulatively, project-specific decision-making, along with other policy decisions required or facilitated by the law, should operate under the overarching need to keep humanity with the safe and just operating space demarcated by planetary boundaries and a social baseline. That space should be a reference point for the minimisation of environmental risk not in an absolute sense but within the paradigm of protecting the human race from societal collapse.

II THE REGULATORY PICTURE REVISITED

As Chapter 3 initially set out, and each subsequent chapter emphasised, the broader regulatory picture surrounding fracking is complex. EIA is a regulatory tool, but it does not regulate fracking directly; rather, it influences a critical aspect of fracking – project approval decisions – by governing the decision-making process which leads to such approvals. Governance over the decision-making process is important – as has been demonstrated, this type of governance has the ability to lead to beneficial or adverse environmental (as well as social and economic) outcomes by facilitating pathways through which various matters can be considered and ultimately become influential on the way in which a project is allowed to operate.

Outside of EIA, a milieu of other processes and standards also govern fracking – some directly and others more indirectly. Chapter 4 pointed out that water laws and water quality standards may operate to regulate the water impacts of fracking; chemical disclosure and restrictions laws may similarly influence the same type of impacts. Chapter 5 noted that there is an array of laws and policies targeting greenhouse gas emissions and climate change that supplement and potentially interact with EIA law. And Chapter 3 noted the importance of state and federal general environmental laws, threatened species laws, and protected areas laws in also potentially applying to fracking projects. Chapter 3 furthermore outlined how fracking can be more directly regulated, through the oil and gas permitting processes, and through specific legislation that bans or controls fracking or fracking-related practices, providing tables (Table 2.1 and Table 2.2) that set out the legal status of fracking in each Australian and US jurisdiction.

In both Australia and the US, the division between federal and state responsibility over controlling or mitigating the impacts of fracking is complicated and fragmented, without clear distinctive lines of separation. The question, both with respect to EIA laws and more broadly, is not simply whether it is state/territory or federal laws that apply, but more typically: in what ways do each apply to a given project? Particularly in the Australian context, there is likely to be overlap, with both federal and state laws playing an operative governance role. If a project is ultimately approved, the conditions on which it is approved can be expected to include those identified as relevant at the state and territory level *as well as* those relevant at the federal level – *if* it has been subject to federal assessment. However, as this thesis has demonstrated, fracking projects are at risk of 'falling through the gaps' and not attracting federal control through EIA even where federal control should (arguably) be warranted – as, at least, a supplement to state/territory-level EIA. Environmental protection laws might operate to effectively fill some of the gaps in EIA, but may not always work as well in a preventative sense, and they are not targeted to each project.

Chapter 1 explained the role of bilateral agreements in Australian EIA law, noting that assessment is usually conducted at the state/territory level, which can then be accredited at the federal level if federal control is implicated. There is nothing inherently wrong with this process, in *theory*, from the perspective of optimising environmental outcomes and minimising risk. However, it relies on adequate competency at the state and territory level, including that a certain degree of objectivity can be brought to the approach taken in balancing social and economic factors with environmental factors across scalar levels.[7] The recent review of the EPBC Act's water trigger unearthed strong opinions that reliance on solely state and territory-level processes was inadequate to protect water resources;[8] stakeholders, it would appear, are not satisfied as to this competency. If Australia is going to retain its present system of state and territory-level approvals and accreditations agreements, it must thus

[7] These are considerations which are also relevant at the federal level.

[8] Discussed in Chapter 4.

continue to scrutinise the effectiveness of this process through regular monitoring and reviews, including reviews of environmental outcomes. A systems-wide view of environmental resources (and not a view that is limited to looking at resources within state and territory jurisdictional areas) should be encouraged at whichever level of assessment the EIA is conducted wherever federal matters of significance are triggered. It may be that a return to greater federal-level input in the assessment process is ultimately warranted in order to better guarantee that this process is linked with the best environmental outcomes and lowest level of risk.

Although not the focus of this thesis, the final aspect of the regulatory picture surrounding fracking is voluntary environmental compliance and mitigation measures, which may be pursued independently by a fracking company, or as a result of pressure from stakeholders, shareholders, and/or investors. Even throughout the course of preparing this thesis, progress in respect of this voluntary aspect has been made. For example, investors in the fracking sector were encouraged in an 'engagement' guide published pursuant to the UN Global Compact to put pressure on fracking companies to monitor and report on water availability and quality, report on and reduce methane emissions, and facilitate adequate stakeholder communication and grievance mechanisms.[9] Environmental risk is an economic liability for those with financial stakes in fracking, while fracking might at the same time also pose a liability for social and ecological reasons to a diverse array of vulnerable stakeholders. Non-binding or voluntary principles and codes pertaining to responsible investment and/or operating practices could supplement regulation and, if adopted, go some way toward creating a stronger protective baseline in the face of wide regulatory and EIA/approval-related discrepancies between jurisdictions.

III APPLICATIONS AND RECOMMENDATIONS

The novelty of the research conducted for this thesis and its contributions to the literature were articulated in Chapter 1, and reiterated throughout the thesis. A summary of research contributions is provided below; following this, future applications are considered.

A *Summary of Research Contributions*

This thesis makes a contribution to, inter alia, the following subject areas and debates:

- natural gas fracking, as it demonstrates the role of (federal) environmental law in the fracking debate, and more specifically how and why EIA is an important tool in better managing fracking-induced risk;
- EIA, as it adds to a somewhat stagnant body of literature by exploring novel aspects including how EIA can be used as a risk management tool, the role of costing and quantification in EIA, as well as how EIA is relevant to the governance of energy projects;
- climate change law, as it proposes novel amendments to federal law that would have the effect of better managing climate change risk;
- environmental law as a discipline, as it demonstrates the need for and benefits of interdisciplinarity and systems-focussed approaches (through application of such approaches);
- environmental law in the context of cumulative impacts, as it proposes new ways to think about cumulative impact governance in the context of systems thinking (including suggesting new legal definitions);

[9] UNPRI, *Engaging with Oil and Gas Companies on Fracking* (UNPRI, 2016) <unpri.org>.

- risk management, as it examines EIA as a risk management tool in specific novel contexts such as water governance; and
- the debate around federal versus state-level regulation, as it demonstrates the importance of federal-level control when environmental systems are at risk

B *Specific EIA Reforms*

Perhaps the most evident application of the research conducted in this thesis is regarding EIA law reform of the EPBC Act. To improve the capacity to manage fracking risks, it is recommended that:

With respect to Part 3,

- the water trigger (ss 24D-24E) is expanded to include all types of unconventional gas projects; and
- a new climate system MNES is added as a tenth MNES and trigger (new subdivision FC).

With respect to Part 23,

- the definition of impact (s 527E) is clarified so as to explicitly encompass cumulative impacts;
- a definition for 'significant' is added as per Appendix 2; and
- the meaning of substantial cause in s 527E is clarified in such a manner as to be able to include contributions to climate change or to Australia's total emissions.

With respect to Part 8,

- economic matters are specifically defined within s 136 as including the adverse economic effects of social impacts and the adverse economic effects of environmental impacts;
- social matters are specifically defined within s 136 as including the adverse social effects of environmental impacts;
- the existing role of the IESC is strengthened by including a requirement in s 136 that the Minister explain why he or she deviated from the IESC's recommendations if that is the decision that has been made, rather than simply requiring the recommendations to be considered; and
- a provision is included which states that if there is scientific uncertainty about whether a significant impact is likely to occur, then either approval shall be withheld or conditions shall be attached to any approval decision which require monitoring, reporting and adaptive management.

These suggested reforms would target fracking impacts, but have wider benefits too. In particular, adding a climate system trigger to the EPBC Act would make it easier for courts to consider climate change arguments when reviewing all major projects. It would also help to complement any national policy aimed at reducing emissions or complying with the *Paris Agreement* (and Australia's NDCs)[10] by facilitating the collection of information in relation to project emissions, and allowing the individual project emissions of each proposed development to be reviewed case by case. Meanwhile, improving cumulative impact consideration by for example including the proposed definitions and establishing a concrete role for cumulative impacts in EIA would address a key problem that is faced with respect to project-specific decision-making and EIA more generally. Finally, a provision actually specifying how a precautionary approach should be taken in the face of scientific uncertainty would partly remedy

[10] 'Nationally Determined Contributions': *Paris Agreement*, FCC/CP/2015/L.9 (12 December 2015), art 3 (inter alia).

the issue of the ESD principles being largely unenforceable in a substantive sense, and would help to minimise risk in the case of new technologies.

C *Broader Implications of Research and Future Research Priorities*

1 *Fracking and Climate Change Law*

This thesis may have broader implications for fracking law beyond EIA, given that it has demonstrated that EIA law is at present not well equipped to manage the risks of fracking impacts, and has highlighted the role of the broader regulatory context. Specifically, the work presented in this thesis could prompt discussions on what other measures might be required to manage fracking risk – such as whether specific fracking legislation is needed in jurisdictions that are considering allowing the practice. It could also prompt specific research on state/territory law and the extent to which fracking risks are able to be managed at the state/territory level in a given jurisdiction. Such research should include, however, whether state/territory law is able to manage impacts that were considered here to be of federal importance, such as climate change and the contamination of water resources. In Chapter 4 it was explained that the water trigger was introduced because of identified incapacity at the state/territory level to consider and manage water impacts; a critical examination of how to improve state/territory capacity might be helpful. This should include some reference to systems-scale approaches, and commentary on the extent to which state/territory law is able to manage a state or territory's contribution toward a broader-scale impact.

Chapter 5 contributed to the literature on climate change law by summarising the implications of the *Adani case* for climate change law and postulating what it might mean for the natural gas context. *Adani* reiterated the reluctance of Australian courts to accept links between projects' indirect emissions and climate change, but from a doctrinal perspective, it did so in a markedly different manner to previous case law. Although it might seem subtle, *Adani* signals a new era in climate change law – one in which it has been accepted by courts that climate change will significantly impact the Australian environment, including MNES. If a similar challenge is brought in relation to other fossil fuel projects, the net contribution argument will have a chance to be retested. US courts have rejected this argument outright, and it would be beneficial if climate change commentary in Australia addressed specific potential pathways forward for Australian litigants in light of this.

2 *The Science-Law Interface and the Future Role of Environmental Law*

The science-law interface was a recurring focal point in this thesis. This was in part because EIA law by its nature mediates human-induced environmental change, and in part because the science-law interface, in the environmental law context, is an important interdisciplinary interface whose relevancy to many of the problems and challenges faced to life on Earth today is evident and ever increasing.

The science-law interface was approached by using a novel methodology: one that wove together traditional doctrinal analysis with systems and interdisciplinary approaches. What is particularly novel about this methodology is that it does not integrate *governance* with science, but *law* with science – in the black letter, doctrinal sense as opposed to the philosophical or normative sense. This thesis has shown how practical solutions to contemporary problems can be generated by adopting such a methodology. An application of this thesis could be for environmental scholars to adopt and refine this methodology in future.

In Chapter 4, the role of an independent scientific committee was discussed. The requirement to include expert scientific advice in decision-making as an extension of the need to consider EIA is

relatively new to Australian EIA law (at the federal level). Only in the context of the most recent trigger to be added to the EPBC Act is scientific expertise explicitly required. Submissions on the retention of the water trigger indicated that the public are interested in the idea of the law giving science a stronger role in political decision-making. This is a potential area for future research to consider: what is the normative role of science in political decision-making – specifically with respect to EIA law as a tool to govern that role?

The discussions in Chapter 2 on the safe and just operating space for humanity representing the goal of sustainable development could prompt further evaluation of whether interdisciplinary concepts, including this one, might be able to give direction to environmental law generally and to case-by-case decision-making more specifically. It would be helpful for commentary to emerge on the legal aspects of how the Holocene-like global state which equitably houses the human race that was described in Chapter 2 might be maintained or regulated by the law – perhaps a law-based framework for the consideration of national-level legislators and policymakers. The law, for example, might play a role in helping to maintain the safe and just operating space through human rights law, through environmental protection laws, through integrative (sector-specific) policies, and through an EIA system which integrates the social, economic and environmental aspects of the impacts likely to result from individual project proposals in a manner that can incorporate interactions between potentially affected systems and stakeholders.

3 ***Risk and New Technologies***

In analysing risk in one particular context, this thesis might be used to demonstrate that it would be beneficial if future research were to consider how the EIA system influences risk in different contexts. More broadly, future research could also look at the connection between certain aspects of EIA and approvals tendencies in general across different socio-political contexts. Risk, whether expressed to mean a general source of uncertainty with respect to the occurrence of an event or impact, or to mean an unknown that is, or could be, expressed in more quantifiable, measurable or probabilistic terms,[11] is an important concept to environmental law, because the purpose – or at least *a* purpose – of environmental law is to reduce the chance that harm will be occasioned to the environment. The likelihood of an environmentally-harmful industry developing or expanding, the likelihood of an individual project being approved, and the likelihood of a particular environmental harm materialising are all relevant categories of 'risk' that could be explored with a view to linking EIA with environmental protection outcomes.

An ideal exemplar would be one where regulatory responses differ markedly in spite of the same body of scientific evidence – with fracking, regulatory responses range from outright bans on one end of the scale; facilitatory legislation such as which creates carve-outs from environmental protection laws at the other; and moratoria and restrictive legislation in between. Genetic modification of foods is another example that has elicited a scale of regulatory responses, and newly emergent issues might also be interesting to consider, such as developments in nuclear technologies, renewable energy technologies, climate engineering technologies, agriculture/food-production systems technologies, and other forms of bioengineering. A study of how EIA treats risk in the chosen context, and at the same time helps determine risk, would facilitate a better understanding of the connections between law, politics and science in the context of EIA. Arguments could be made around how EIA *should* treat

[11] 'Risk' has adopted a more specific meaning in relatively recent times: on this see Ulrich Beck, *Risk Society* (Sage, 1992); Ortwin Renn, 'Concepts of Risk: A Classification' in Sheldon Krimsky and Dominic Goldings (eds), *Social Theories of Risk* (Praeger, 1992) – but can still have meaning in an environmental law context in a general sense as well: see Jacqueline Peel, *Science and Risk Regulation in International Law* (Cambridge, 2010).

and determine risk, articulating what an appropriate or ideal role for the EIA system in the risk minimisation context might look like.

Already in the risk and new technologies context, the law has been described as 'crucial for managing the tension between innovation and risk';[12] the law in a general sense is expected to be able to deliver protection to society and assign responsibility for potential damage, while at the same time operating in such a manner as to reduce the burdens and lower the hurdles which might prevent helpful new technologies from becoming operational.[13] Future research might explore how EIA law plays a part in achieving these dual goals, shifting the focus from broad policy to case-by-case decision-making.

IV FINAL COMMENTS

Fracking is an example of a relatively new technology associated with uncertainties and high stakes. Its prospects for alleviating pressures around energy insecurity and for assisting with energy transitions pathways have afforded it attention from those seeking commercial opportunity, and its ecological, social and economic consequences have also attracted attention from a diverse range of stakeholders. This has made it an interesting and also topical study.

While many issues, laws, case judgments and studies relevant to this thesis have emerged and evolved since research began, and while Australian states and territories have been conducting generic studies on the risks of fracking, Australia has not seen a suite of new fracking projects put forward for EIA assessment. Thus, analysis of how the EIA system applies to fracking has necessarily been based on an application of the existing law in a hypothetical sense, with little in the way of case law able to be interpreted at this stage, because the system, which has been tested many times in for example the coal context, has not been tested in the fracking context. This has been a challenge, but it also underscores the importance of the research at this pivotal point in time.

Coming years will reveal whether fracking will start to expand in states that are facilitating exploratory activity. If and when this happens, the EIA system will become even more critical as a pathway to manage risk. Addressing the problems and gaps identified in this thesis by that stage will place the law and Australian decision-makers in a better position to be equipped to adequately manage environmental risks. Even if fracking does not expand in Australia, the problems that were identified by using it as a study are problems which need to be addressed in the broader context of energy projects and other developments for the sake of environmental protection in future.

It is worth reiterating that EIA law does not create penalties for harm or prohibit behaviour except in the case where permission to undertake an activity was not sought. At the very least, the EIA system therefore needs to be equipped to facilitate *consideration* of important impacts for it to be of any utility. To the extent that it is not so equipped, namely with respect to the matters that have been discussed in this thesis, law reform is required. The additional costs and delays that the appropriate reforms might cause, especially given that they would be largely borne by companies who would undoubtedly still stand to gain commercially in spite of them, are justified if it means avoiding critical risks to the environment and flow-on social and economic risks as well.

The issues around scientific uncertainty, values conflicts, and the law-science interface that were explored in this thesis are ongoing issues that will continue to shape the law for years and decades to

[12] Maria Weimer and Luisa Marin, 'The Role of Law in Managing the Tension Between Innovation and Risk' (2016) 3 *European Journal of Risk Regulation* 469, 469.
[13] Ibid.

come. How they are addressed will in turn influence the capacity of environmental law to serve as a protector of the environment into the future, for the benefit of environmental systems per se, and for future generations.

Appendices

Appendix 1, *Selected State and Territory Laws*

Petroleum Laws

Petroleum (Onshore) Act 1991 (NSW)

Petroleum (Onshore) Regulation 2007 (NSW)

Petroleum and Gas (Production and Safety) Act 2004 (Qld)

Petroleum and Gas (Production and Safety) Regulation 2004 (Qld)

Petroleum Act 1923 (Qld)

Petroleum Regulation 2004 (Qld)

Petroleum and Geothermal Energy Resources Act 1967 (WA)

Petroleum and Geothermal Energy Resources Regulations 1987 (WA)

Petroleum Act 1984 (NT)

Petroleum Regulations 1994 (NT)

Mineral Resources Development Act 1995 (Tas)

Mineral Resources Regulations 2006 (Tas)

Environmental Protection Laws

Environmental Planning and Assessment Act 1979 (NSW)

NSW State Environmental Planning Policies and Local Environment Plans

Environmental Protection Act 1997 (ACT)

Petroleum and Gas (Production and Safety) Act 2004 (Qld)

Plant Protection Act 1989 (Qld)

Public Health Act 2005 (Qld)

Queensland Heritage Act 1992 (Qld)

Recreation Areas Management Act 2006 (Qld)

Soil Conservation Act 1986 (Qld)

State Development and Public Works Organisations Act 1971 (Qld)

Vegetation Management Act 1999 (Qld)

Water Act 2000 (Qld)

Wild Rivers Act 2005 (Qld)

Sustainable Planning Act 2009 (Qld)

Clean Energy Act 2008 (Qld)

Coastal Protection and Management Act 1995 (Qld)

Iconic Queensland Places Act 2008 (Qld), *Mineral Resources Act 1989* (Qld)

Native Title (Queensland) Act 1993 (Qld)

Nature Conservation Act 1992 (Qld)

Environment Protection Act 1986 (WA)

Environmental Protection Regulations 1987 (WA)

Clean Air (Determination of Air Impurities in Gases Discharged to the Atmosphere) Regulations 1983 (WA)

Waste Management and Pollution Control Act (NT)

Waste Management and Pollution Control (Administration) Regulations (NT)

Water Act (NT)

Water Regulations (NT)

Environmental Assessment Act (NT)

Environmental Offences and Penalties Act (NT)

Environment Protection Act 1993 (SA)

Coast Protection Act 1972 (SA)

Development Act 1993 (SA)

Groundwater (Border Agreement) Act 1985 (SA)

River Murray Act 2003 (SA)

Aboriginal Heritage Act 2006 (Vic)

Environment Protection Act 1970 (Vic)

Environmental Effects Act 1978 (Vic)

Pollution of Waters by Oils and Noxious Substances Act 1986 (Vic)

Climate Change and Environment Protection Amendment Act 2012 (Vic)

Environmental Management and Pollution Control Act 1994 (Tas)

Land Use Planning and Approvals Act 1993 (Tas)

Pollution of Waters by Oil and Noxious Substances Act 1987 (Tas)

State Policies and Projects Act 1993 (Tas)

Appendix 2, *Definitions Relevant to Cumulative Impacts*

Significance, in relation to a potential impact, may be determined by considering whether the impact is important, notable, or of consequence, having regard to its **context** or **intensity**. Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment which is impacted, and upon the intensity, duration, magnitude and geographic and temporal extent of the impacts. Impacts should be evaluated individually, in combination and cumulatively.

In relation to the ecological systems ('ecosystems') associated with potential impacts on a Part 3 matter, significance relates to impacts which compromise ecosystem integrity (ie ecosystem structure or function) including in a manner that:

(i) impairs the ability of any affected populations of species to replace themselves;
(ii) degrades the long-term natural productivity of the system; and/or
(iii) causes, on more than a temporary basis, significant loss of any aspect of the system related to the integrity of the Part 3 matter, including species richness, loss of habitat quality, loss of aesthetic or amenity value or loss of heritage value.

Context means the significance of an action in relation to various contexts including society as a whole, the impact's locality and the affected area on local, regional and extended geographical scales, the impact's effects on both long and short term temporal scales, and the sensitivity/vulnerability of the environment including any associated ecosystem to the impact. In considering the sensitivity/vulnerability of the environment to the impact, regard should be had to the resilience of any associated environmental system including its ability to recover from harm, and the rate of such recovery; the extent to which ecosystem functions may be altered by the impact and extent to which this alteration is or is likely to be irreversible; and the timing and duration of the impact relative to the period in which any affected living component of the system relies on the system's integrity, for example, on account of a critical life-history stages of an affected or potentially affected species. Context includes the cumulative context of an action in relation to other past, proposed and likely future actions.

Intensity refers to the severity of the impact. The following should be considered in evaluating intensity:

(i) Unique characteristics of the geographic area and the relevant ecosystems' dynamics;
(ii) The degree to which the impacts on the quality of the human environment are likely to be highly controversial;
(iii) The degree to which the possible impacts on the human environment are highly uncertain or involve unique or unknown risks;
(iv) The degree to which the action may establish a precedent for future actions with significant impacts or represents a decision in principle about a future consideration; and
(v) Whether the action is related to other actions with individually insignificant but cumulatively significant impacts. Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment. Significance cannot be avoided by terming an action temporary or by breaking it down into small component parts.

Cumulative impact is the impact on the environment which results from the incremental impact of the action when added to other past, present, and likely future actions. Cumulative impacts can result from individually minor but collectively significant actions or broader influences on a matter of

national environmental significance taking place over a period of time. In considering the significance of cumulative impacts, intensity should be considered in context.

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