BEFORE THE INDEPENDENT PLANNING COMMISSION

PUBLIC HEARING 20-25 JULY, 1 AUGUST 2020

FOR THE NARRABRI COAL SEAM GAS PROJECT

CLOSING SUBMISSIONS

FOR

NORTH WEST ALLIANCE

10 AUGUST 2020

NOTE: These closing submissions replace the Opening Submissions provided to the Commission prior to the Public Hearing.

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INTRODUCTION

1. The North West Alliance (**NWA**) is an affiliation of groups across North West New South Wales who have an interest in education and advocacy around extractive industries projects. It is comprised of local, regional and state-wide community groups including groups based in Narrabri, Bellata, Maules Creek, Coonabarabran, Gilgandra, Dubbo, Coonamble, Burren Junction, Walgett, Tamworth, Armidale, Mullaley and the Liverpool Plains.

2. NWA seeks a determination that the Narrabri Gas Project (**Project**) be refused development consent.

3. The applicant and DPIE have not been able to demonstrate a **need for the Project** on the grounds of either achieving security of supply or driving down gas prices, or that any need outweighs the significant environmental impacts that are likely to be caused. In particular, it has not been satisfactorily explained why security of future gas supply into NSW cannot be achieved by importing gas into NSW from the Cooper Basin in QLD or via the newly approved Port Kembla LNG Terminal; if gas was imported into NSW via either of those options, it would have the significant advantage of not requiring the opening up of new gasfields, but of utilising already approved and exploited gas reserves. The evidence demonstrates that gas cannot accurately be described as a 'transitional fuel', either domestically or internationally. The clear established trend is towards the use of more renewables in the production of electricity and less gas.

4. The Project is **not in the public interest**, and should be refused. The Project has aroused substantial and unprecedented community interest. The Department of Planning, Industry and Environment's (**DPIE**) assessment report notes that it has received nearly 23,000 submissions, including 133 from special interest groups and 22,721 from the general public. 98% of the submissions are opposed to the Project. The public opposition is supported by substantial expert evidence, and significant weight should be afforded to the public submissions.

5. There is no demonstrated need for the Project. The primary beneficiary is the applicant, while the costs and risks of the Project are predominantly borne by the local community and the public, both current and future generations. The **principles of ecologically sustainable development (ESD), in particular the principles of intragenerational and intergenerational equity, the precautionary principle, the principle of conservation of biological diversity and the polluter pays principle,** dictate that the Project should be refused.

6. The production of coal seam gas (**CSG)** carries with it significant environmental risks which have not been adequately addressed in the applicant's EIS. The production of CSG requires the extraction of large volumes of 'dirty' water in order to allow gas to flow. The evidence shows sufficient risk that this will worsen the state of groundwater resources which are already under pressure from current users. Also, given that CSG is composed primarily of methane, a potent greenhouse gas (**GHG**), direct emissions to the atmosphere will exacerbate anthropogenic climate change, the effects of which are already been felt by communities across NSW and Australia. The extent of knowledge around environmental impacts from CSG production generally, and from this Project in particular, remains poorly

documented and highly contentious.

7. The application of the **precautionary principle**, in particular when applied to the potential groundwater impacts, dictates that the Project should be refused development consent. The precautionary principle is squarely engaged in this case because there is a *threat* of serious or irreversible damage to groundwater, including significant aquifers and there remains scientific uncertainty as to the environmental damage. The evidence will demonstrate that the applicant has been unable to demonstrate that the threat of environmental damage does not exist or is negligible. Having regard to the significance of the threat of irreversible damage to vital groundwater resources, the most proportionate response is to refuse development consent.

8. Approval of the Project would also be in breach of the **public trust doctrine**. Just as the state has a duty to ensure the continued availability and existence of its water resources, including within the Pilliga aquifers, for present and future generations, so it has a duty to protect the air, atmosphere and the climate from substantial impairment. Approval of the development is fundamentally inconsistent with each duty.

9. In summary, NWA's case is that the Project should be refused approval on the basis of the following environmental impacts:

    a. **Groundwater impacts**: The evidence demonstrates three major environmental risks associated with the Project. These are (i) groundwater and surface water contamination, particularly with CSG produced water and/or other wastewater and salt waste produced as a result of the Project and (ii) fugitive gas migration into aquifers overlying the target coal seams (a groundwater contamination and safety hazard) and (iii) uncertainty as to the impacts of depressurisation and groundwater removal on productive groundwater resources, while there remains a real possibility that this risk is serious and irreversible and would not be mitigated by draft conditions of consent that leave this uncertainty unresolved. These are significant and real risks which have not been adequately accounted for in the EIS and subsequent information. In these circumstances, approval of the Project would be contrary to the public interest and the principles of ESD, including the precautionary principle and the principles of intergenerational and intragenerational equity.

    b. **Ecology impacts:** The Pilliga forests and woodlands represent the largest, relatively intact, unfragmented block of dry sclerophyl forest and woodland in eastern Australia. As such they provide a crucial refuge for biodiversity in a landscape largely cleared for agriculture. The applicant's EIS virtually ignores these attributes. The EIS does not provide an appropriate and adequate assessment of the likely impacts of the Project on vertebrae and aquatic fauna. In these circumstances, approval of the Project would be contrary to the public interest and the principles of ESD, including the precautionary principle, the conservation of biological diversity, and the principles of intergenerational and intragenerational equity.

    c. **Climate change impacts**: The Project is not in the public interest and contrary to the principles of ESD, including the principles of

intergenerational equity and intragenerational equity, the conservation of biological diversity and the polluter pays principle, because, in order to ensure that the rise in global temperatures will be limited to well below 2 degrees Celsius above pre- industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius, the Project should not be approved at this time.

d. **Bushfire risk impacts**: The Project itself will be both a direct source and indirect source of bushfires in its vicinity. Moreover, there is an increased risk of bushfire as a result of climate change, which the IPC must consider vis-a-vis the principles of intergenerational and intragenerational equity and the conservation of biological diversity.

e. **Social impacts**: The Project will have a significant negative social impact on residents and the local communities, contrary to the public interest and the principles of ESD, including the precautionary principle and the principles of intergenerational and intragenerational equity. The Project assessment has overstated the economic and jobs benefits of the Project.

f. **Salt waste disposal impacts**: The Project will generate a significant amount of salt waste, the perpetual management of which will shift the burden to another location and time. This is inconsistent with the principles of intergenerational and intragenerational equity and the polluter pays principle.

10. NWA and its members were assisted in the presentation of its case by the following independent experts, each of whom has provided independent expert reports detailing the likely environmental impacts of the Project:

- Associate Professor Matthew Currell – Groundwater impacts
- Dr Kevin Hayley – Groundwater modeling
- Ms Andrea Broughton – Groundwater assessment
- Professor Stuart Khan – Water treatment processes
- Dr Alistair Davey – Economics
- Professor Penny D Sackett – Climate change
- Mr Tim Forcey – Fugitive Emissions
- Dr Karl Mallon – Climate risk
- Dr Alison Ziller – Social impacts
- Mr David Milledge – Faunal ecology
- Mr David Paull – Terrestrial ecology
- Dr Peter Serov – Aquatic and Groundwater Dependent Ecosystems

THE PROJECT IS NOT NEEDED TO ENSURE GAS SECURITY WITHIN NSW

11. The DPIE's Assessment Report asserts that the Project 'is critical for energy security and reliability in NSW' as it would 'provide essential gas supplies to the domestic market to address forecast shortfalls from 2024' and would 'put downward pressure on gas prices'.

12. In oral evidence, Mr David Kitto rightly conceded that '*we're certainly not saying in our assessment that [the Project] will reduce gas prices…it will produce a small amount of gas in – in relation to the whole of the market, the whole of the domestic gas market.*'[1] The evidence is that gas produced at Narrabri will be high compared to gas produced in QLD and elsewhere in the world.

13. Nevertheless, Mr Kitto maintained the assertion that '*the critical advantage is that – is that it would produce that gas locally, and it would certainly the – the gas that's closest to the key – the key markets.*'[2]

14. The DPIE's response to the IPC's request of 29 June that it provide *'Details on how the Net Zero Plan Stage 1: 2020-2030 relates to the Narrabri Gas Project*' is not yet available and the information before the IPC so far has not included the specific target of up to 10% of the gas in the network being hydrogen by 2030.

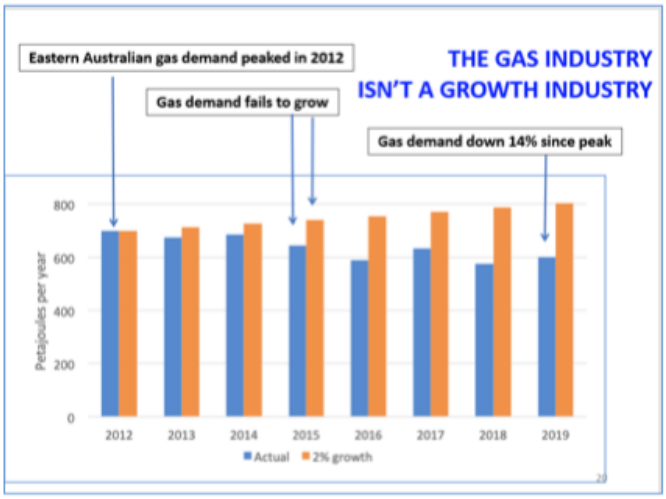
15. The evidence presented on behalf of NWA demonstrates the fallacy of the 'need' argument. The Project is not needed to ensure gas security within NSW and therefore is not in the public interest.

16. Mr Forcey's evidence demonstrates that there is no threat of imminent gas shortages in NSW. Gas demand in eastern Australia peaked in 2012 and has declined since:

[1] Transcript, IPC Public Hearing – Narrabri Gas Project, 20 July 2020, p. 13 at 40-45.
[2] Transcript, IPC Public Hearing – Narrabri Gas Project, 20 July 2020, p. 13 at 40-45; DPIE, *Net Zero Plan Stage 1: 2020-2030* (2020) https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Climate-change/net-zero-plan-2020-2030-200057.pdf (accessed 10 August 2020).

Gas demand in eastern Australia down 14% from 2012 peak

37. The following chart illustrates that gas demand in eastern Australia peaked in 2012 and has declined 14% since. Less gas is being burned in all sectors of the eastern Australian economy. (10,11) Gas demand is not keeping pace with Australian population or GDP growth.

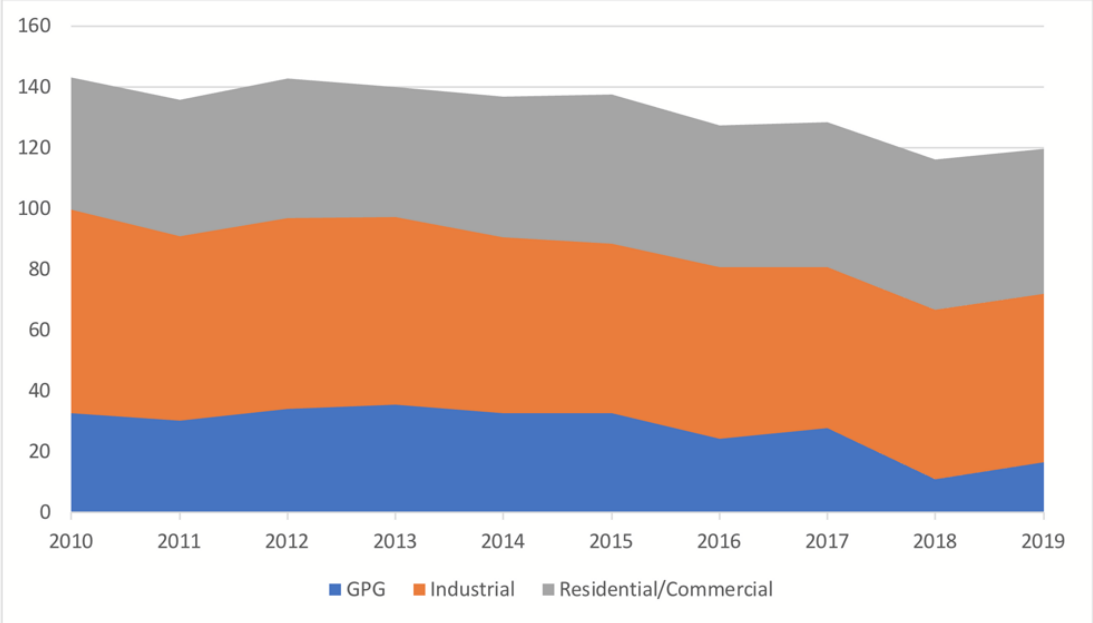


Declining gas consumption, compared with a 2% GDP growth trendline.

17. Bruce Robertson, Energy Analyst IEEFA, in his evidence dated August 2020, gives a clear analysis of what he describes as the 'depression in the global gas industry' and fall in gas prices caused by the 'massive global glut in gas supply'.

18. The declining consumption of gas within NSW is also illustrated by Dr Davey of Pegasus Economics:

Figure 5: New South Wales Natural Gas Consumption by Sector – 2010 to 2019 (PJ)



Source: AEMO (2020).

19. At the same time, production of gas in eastern Australia has tripled in just a few years. As Mark Ogge[3] explained in his evidence (footnotes omitted):

> *There is no shortage of gas in Australia. Production in eastern Australia has tripled in just a few years to feed three new liquefied natural gas (LNG) export facilities in Gladstone Queensland. However, if gas continues to be exported at the rate of double Australia's domestic consumption every year, reserves will inevitably deplete, and the addition of the NGP would make no difference. Because the east coast gas market is interconnected, the more gas extracted, the more can be exported. The Queensland LNG terminals have never reached their full capacity. Even if they did, additional LNG trains could be built and the capacity increased.*

20. The importance of the interconnection of the Australian gas market to this issue must be emphasized, and is not addressed by the proponent or the Department. Once again, it was addressed by the evidence of Bruce Robertson and Mark Ogge, who gives his opinion that ***'there is no reason to believe that [production of gas from the Project] would make any difference to "energy security and reliability" as the [DPIE] Assessment asserts'.***

21. Advice from The Australia Institute shows that New South Wales does not have its own autonomous gas market where New South Wales can somehow make decisions on how much gas it imports or exports. The gas market is an interconnected system where gas is "sold and transported under bilateral agreements between produces, pipeline owners, retailers and major users" irrespective of the state of those parties are from. Since the opening of gas export terminals in Gladstone, this market is also connected to the global LNG market. As such, if the project does produce 70 PJ per year of gas, and it is supplied to New South Wales consumers, Santos could, for instance, simply send 70 PJ less gas to New South Wales customers from the Cooper Basin and export it instead.

22. Mr Ogge's evidence demonstrates that any suggestion that there are insufficient gas reserves in the Cooper Basin to supply New South Wales are incorrect. He proves that the Cooper Basin gas reserves dwarf those of the Gunnedah Basin and that the gas reserves within the Cooper Basin could supply NSW for decades if the gas was not diverted to Gladstone for export. Therefore, if the Project goes ahead it will simply displace this Cooper Basin gas that is currently supplying New South Wales customers, allowing the Cooper basin gas to be exported. As such, Santos' undertaking (and the proposed condition of development consent) that the gas would be made available to the domestic market is a meaningless undertaking from an energy security and reliability perspective.

23. Furthermore, there are currently 5 proposed LNG import terminals that could supply gas into the NSW market, if supply became an issue in the future (eg from 2024 onwards). Of most importance to the NSW gas market is the approved Port Kembla Gas LNG Terminal, which would inject up to 100/PJ of gas per annum or 500/TJ a day into NSW at a comparatively cheaper price to the Project of $6-8/GJ.[4] By contrast, the AEMO (2020) states that production only costs at the Project will be approximately $6.40 per GJ.[5] The modification

[3] The Australia Institute, Mark Ogge submission dated July 2020.
[4] Sydney Environment Institute, submission dated 22 July 2020, p. 11.
[5] Davey (Pegasus Economics), Expert Report dated May 2020.

to the Port Kembla consent (which has the effect of expanding the size of the terminal and thus increase the amount of gas that can be imported) was approved by the NSW Government in April 2020 and commercial operations are predicted to start as early as 2022.

24. From 2022, a time prior to any possible gas shortfall from 2024, Port Kembla LNG imports will equate to the meeting of 75% of all NSW gas needs, at a price cheaper than any gas produced from the Project. Port Kembla gas will therefore satisfy the NSW Government MOU commitments with the Cth Government to inject an additional 70PJ/per annum into the NSW gas market. The approval of the Port Kembla LNG import terminal, coupled with the potential Port of Newcastle LNG import terminal,[6] will provide up to 110PJ per annum into the NSW gas market – this represents security of supply of gas within NSW without requiring the need to approve the Project.

25. In summary:

- Gas is no longer serving a role as a transition fuel either domestically or globally;
- There is a global supply cloud of gas that will continue until late this decade, cause by overbuilding of LNG plants and overproduction of uneconomic shale and coal seam gas.
- Globally the LNG industry is in a deep depression.
- Globally gas prices are very depressed.
- Domestically gas usage has shrunk.
- There is no security of supply issue within New South Wales.

26. Accordingly, the Project is not in the public interest and development consent must be refused having regard to the likely significant environment impacts of the Project, which are addressed below).

[6] This project has also been declared Critical State Significant Infrastructure and Deputy Premier Barilaro has stated that this terminal could be operational by 2022-23: NSW Government, Ministerial Media Release, *Newcastle gas terminal given critical status* (14 August 2019) https://www.nsw.gov.au/media-releases/newcastle-gas-terminal-given-critical-status (accessed 10 August 2020).

FACTUAL BACKGROUND

The assessment process

27. On 3 March 2020 the Minister for Planning and Public Spaces wrote to the Independent Planning Commission (**IPC**) with the following request:

> *1. Conduct a public hearing into the carrying out of the Narrabri Gas Project (SSD 6456) prior to determining the development application for the project under the Environmental Planning and Assessment Act 1979, paying particular attention to:*
> *a) the Department of Planning, Industry and Environment's assessment report, including any recommended conditions of consent;*
> *b) key issues raised in public submissions during the public hearing; and*
> *c) any other documents or information relevant to the determination of the development application.*
> *2. Complete the public hearing and make its determination of the development application within 12 weeks of receiving the Departments assessment report in respect of the project, unless the Planning Secretary agrees otherwise.*

28. As such, the IPC is the consent authority for the Project: s 4.5(a) of the EP&A Act & clause 8A of the State and Regional Development State Environmental Planning Policy (**SEPP SRD**).

29. DPIE's assessment report was published on 11 June 2020. The referral letter from the Planning Secretary sending DPIE's assessment report to the IPC stated that '*based on this assessment the Department considers that the Project is in the public interest and is approvable subject to strict conditions.'*

30. The evidence will demonstrate that DPIE has underestimated the likely environmental impacts of the Project, including the impacts of the Project on vital groundwater resources in the Pilliga, and has not engaged lawfully with the precautionary principle, which, on the facts of this case, dictate a refusal of the Project. DPIE has misunderstood and misrepresented the alleged 'need' for the Project and has overestimated the economic benefits of the Project, both to the local community and to NSW as a whole. Insufficient consideration has been given to community responses opposed to the Project, an important aspect of the public interest, and to the social impacts of the Project, all of which decisively tell against the approval of the Project.

ROLE AND POWERS OF THE IPC

31. The IPC is a statutory agency: s 2.7(3) of the EP&A Act. It is independent from, and not subject to the direction or control of, the Minister and DPIE: s 2.7(2).

32. The Statement of Expectations published by the Minister for the period from 1 May 2020 to 30 June 2021 confirms the importance of the independence of the IPC from Government and from DPIE (emphasis added):

> *The [IPC] plays an integral role in **upholding the integrity** of the NSW planning system, by fulfilling its **primary purpose of providing independent decision making on contentious State significant development applications** …*

33. The Memorandum of Understanding between DPIE and the IPC (**MoU**) dated 5 May 2020 notes the 'independence' of the IPC and expressly states that it is to bring *'a high level of independence and transparency to the assessment and determination of State significant developments.'* Members of the IPC are appointed by the Minister but are *'not subject to the direction or control of the Minister, except in relation to procedural matters.'* Further the MoU expressly identifies that the IPC is *'also independent of DPIE and other government agencies, and plays an important role in strengthening public confidence in the planning system…'*

34. The MoU identifies the IPC's objectives which are to build public trust in the NSW planning system by:

    - *being independent and objective in its decision-making;*
    - *being fair, open and transparent in its operations;*
    - *delivering robust and timely determinations within the legislative and government policy framework to best serve the people of New South Wales; and*
    - *encouraging effective community and other stakeholder participation to inform [the IPC's] determinations.*

35. To the extent that cl 5.4.2 of the MoU, which states *'The Commission will use the DPIE assessment report as the starting point for its determination',* seeks to depart from the text of s 4.15, it is bad in law; the IPC is bound to make its decisions in accordance with s 4.15 of the EP&A Act, and not the MoU. The EP&A Act does not identify that DPIE's assessment report should be given precedence over other evidence. DPIE's assessment report is not a mandatory relevant consideration. Whilst it is no doubt a relevant consideration to be taken into account by the IPC, it is of no greater import than other relevant evidence placed before the IPC, including by objectors to the Project.

36. The IPC has the functions of the consent authority under Part 4 for State significant development: s 2.9(1)(a) of the EP&A Act.

37. In its role as consent authority, the task of the IPC is not to consider whether the recommendations of DPIE in its assessment report are correct or preferable on the material available to it, but rather to determine, based on the evidence now before the IPC, what is the preferable outcome.[7]

RELEVANT MATTERS TO BE CONSIDERED

38. The IPC is a statutory body. It can have no wider powers than those conferred by the EP&A Act which created it. As consent authority, the matters for consideration by the IPC in determining a State Significant development application[8] are those expressly stated in section 4.15(1) of the EP&A Act, but also those matters, which by implication from the subject matter, scope and purpose of the EP&A Act, are required to be considered.[9]

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[7] *Bulga Milbrodale Progress Association Inc v Minister for Planning* (2013) 194 LGERA 347, [28], [7]-[11].
[8] Defined in EP&A Act, s 4.40.
[9] *Bulga Milbrodale Progress Association Inc v Minister for Planning* (2013) 194 LGERA 347, [52].

39. Section 4.15 relevantly provides*:*

> ***Matters for consideration—general***
> *In determining a development application, a consent authority is to take into consideration such of the following matters as are of relevance to the development the subject of the development application:*
> *(a) the provisions of:*
> *(i) any environmental planning instrument, and*
> *(ii) any proposed instrument…*
> *(iii)any development control plan, and*
> *(iiia) any planning agreement…*
> *(iv) the regulations*
> *that apply to the land to which the development application relates,*
> *(b) the likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality,*
> *(c) the suitability of the site for the development,*
> *(d) any submissions made in accordance with this Act or the regulations,*
> *(e) the public interest.*

40. As well as the provisions of any relevant environmental planning instrument (**EPI**) (for which see below), s 4.15 requires that the IPC must take into account the likely environmental impacts of the development, the likely social impacts, the economic impacts, the suitability of the site for the development, and any submissions made in accordance with the EP&A Act. The IPC must also take into account the public interest: section 4.15 EP&A Act. The considerations relevant to the public interest are summarised below.

41. The Minister's Statement of Expectations states that he expects the IPC '*to make decisions based on the legislation and policy frameworks and informed by the Planning Secretary's assessment*'. To the extent that this statement seeks to depart from the text of s 4.15, it is bad in law; the IPC is bound to make its decisions in accordance with s 4.15 of the EP&A Act, and not the Statement of Expectations. In particular, there is no reference to the phrase 'policy frameworks' in s 4.15. Further, contrary to the suggestion in the Statement of Expectations, the EP&A Act does not identify that DPIE's report should be given precedence over other evidence. DPIE's report is not a mandatory relevant consideration. Whilst it is no doubt a relevant consideration to be taken into account by the IPC, it is of no greater import than other relevant evidence placed before the IPC, including by objectors to the Project.

42. Further, the Statement of Expectations states that the Minister encourages the IPC to *'seek guidance from the Planning Secretary to clarify policies or identify policy issues that may have implications for State significant development determinations.'* Again, this statement is inconsistent with the proper role of an independent IPC, which is required to determine the Project according to law, and not by reference to any guidance from the Planning Secretary on policy issues that may have implications for the Project.

The public interest

43. The public interest is of a 'wide ambit'.[10] A consent authority may range widely in the search for material as to the public interest.[11] According to Preston CJ, '*A requirement that regard be had to the public interest operates at a high level of generality*.'[12] The public interest must be applied having regard to the scope and purpose of the relevant statute.[13]

44. The objects of the EP&A Act include:

    a. facilitating ESD by integrating relevant economic, environmental and social considerations; and

    b. promoting the social and economic welfare of the community and a better environment, and to provide increased opportunity for community participation in environmental planning and assessment.

45. The considerations relevant to these objects are detailed below.

The public interest and ESD

46. Decisions of the Land and Environment Court, and the Court of Appeal, have held that the public interest requires consideration of principles of ESD at the stage of merits assessment of projects which are equivalent to State significant development,[14] including coal mines.[15]

47. In *Minister for Planning v Walker* (2008) 161 LGERA 423, Hodgson JA stated at [56]:

> *… I do suggest that the principles of ESD are likely to come to be seen as so plainly an element of the public interest, in relation to most if not all decisions, that failure to consider them will become strong evidence of failure to consider the public interest and/or to act bona fide in the exercise of powers granted to the Minister, and thus become capable of avoiding decisions. It was not suggested that this was already the situation at the time when the Minister's decision was made in this case, so that the decision in this case could be avoided on that basis; and I would not so conclude.*

48. In *Barrington-Gloucester-Stroud Preservation Alliance Inc v Minister for Planning and Infrastructure* (2012) 194 LGERA 113, Pepper J stated at [170] (emphasis added):

> *I therefore reject the submission of AGL and the Minister that there was no*

[10] *Shoalhaven City Council v Lovell* (1996) 136 FLR 58, [63].
[11] *Terrace Tower Holdings Pty Limited v Sutherland Shire Council* (2003) 129 LGERA 195, per Mason P [81].
[12] *Warkworth Mining Ltd v Bulga Milbrodale Progress Association Inc* (2014) 200 LGERA 375, [298].
[13] *Patra Holdings v Minister for Land* (2002) 119 LGERA 231, [11].
[14] *Bulga Milbrodale Progress Association Inc v Minister for Planning and Infrastructure and Warkworth Mining Ltd* (2013) 194 LGERA 347, [58].
[15] *Hunter Environmental Lobby Inc v Minister for Planning* [2011] NSWLEC 221.

requirement to consider ESD principles. ***In the words of Hodgson JA in* Walker*, the time has come that "the principles of ESD" can now "be seen as so plainly an element of the public interest"*** *(at [56]).*

49. The public interest also includes community responses to the Project. In *Bulga Milbrodale Progress Association Inc v Minister for Planning and Infrastructure and Warkworth Mining Ltd* (2013) 194 LGERA 347, Preston CJ stated at [63]:

> *The public interest also includes community responses regarding the project for which approval is sought. In Telstra Corporation Ltd v Hornsby Shire Council (2006) 67 NSWLR 256; 146 LGERA 10, I confirmed (at [192]) that community responses are aspects of the public interest in securing the advancement of one of the express objects of the EPA Act in s 5(c), being "to provide increased opportunity for public involvement and participation in environmental planning and assessment" (see also Kulin Holdings Pty Ltd v Developments Pty Ltd v Baulkham Hills Shire Council (2003) 127 LGERA 303 at [58]). I said, however, that in considering the community responses, an evaluation must be made of the reasonableness of the claimed perceptions of adverse effect on the amenity of the locality (see also Foley v Waverley Municipal Council [1963] NSWR 373 at 376; (1962) 8 LGRA 26 at 30). An evaluation of reasonableness involves the identification of evidence that can be objectively assessed to ascertain whether it supports a factual finding of an adverse effect on the amenity of the locality. A fear or concern without rational or justified foundation is not a matter which, by itself, can be considered as an amenity or social impact: Telstra v Hornsby Shire Council at [193] and [195].*

50. In the Court of Appeal proceedings, (*Warkworth Mining Ltd v Bulga Milbrodale Progress Association Inc* (2014) 200 LGERA 375), the Court endorsed this approach, and held at [295]:

> *Likewise, we consider that community responses to the project were relevant to the public interest. As his Honour pointed out, at [430], the evidence of the community responses was relevant to a consideration of noise impacts, air quality, visual impacts and more generally, the social impacts on the community. All of those factors were aspects of the overall public interest.*

Principles of ESD

Intergenerational equity

51. Section 1.4 of the EP&A Act provides that ESD *'has the same meaning it has in section 6(2) of the* Protection of the Environment Administration Act 1991*'* (**POEA Act**). Section 6(2) of the POEA Act provides:

> *For the purposes of subsection (1) (a), ecologically sustainable development requires the effective integration of social, economic and environmental considerations in decision-making processes. Ecologically sustainable development can be achieved through the implementation of the following principles and programs:*
>
> *(a) the precautionary principle—namely, that if there are threats of serious or irreversible environmental damage, lack*

of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by:

(i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and

(ii) an assessment of the risk-weighted consequences of various options,

(b) inter-generational equity—namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations,

(c) conservation of biological diversity and ecological integrity—namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration,

(d) improved valuation, pricing and incentive mechanisms—namely, that environmental factors should be included in the valuation of assets and services, such as:

(i) polluter pays—that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,

(ii) the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,

(iii) environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.

52. ESD includes two ethical elements: concern for the present – intragenerational justice or equity; and concern for the future – intergenerational equity. Intragenerational equity describes equity within the present generation while intergenerational equity describes equity between the present and future generations. The needs that are to be equitably shared relate to the three components of ESD: economic development, social development and environmental protection. Equity is not limited to the use or exploitation of natural resources. It extends to maintenance and enhancement of the environment. The importance to ESD of the component of environmental protection is made clear in Australia (and NSW) where intergenerational equity is defined by section 6(2)(b) of the POEA Act to require '*that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations*'.

53. The principles of intergenerational equity and intragenerational equity were discussed in *Bulga Milbrodale Progress Association Inc v Minister for Planning and Infrastructure and Warkworth Mining Ltd* (2013) 194 LGERA 347, where Preston CJ stated at [492] (emphasis added):

> *In an assessment of the equity or fairness of the Project's distribution of benefits and burdens, assistance can be gained by consideration of* ***two distinct principles of ecologically sustainable development, inter-generational equity and intra-generational equity****. The principle of inter-*

generational equity provides that the ***present generation should ensure that the health, diversity and productivity of the environment are maintained or advanced for the future generations*** *(see s 6(2)(b) of the* Protection of the Environment Administration Act*). The principle of intra-generational equity involves* ***people within the present generation having equal rights to benefit from the exploitation of resources as well as from the enjoyment of a clean and healthy environment****: see* Telstra v Hornsby Shire Council *at [117]. A decision-maker should conscientiously address the principles of ESD in dealing with any application for a project under the former Pt 3A of the EPA Act: see* Minister for Planning v Walker *at [62], [63].* \

54. In *Taralga Landscape Guardians Inc v Minister for Planning and RES Southern Cross Pty Ltd* (2007) 161 LGERA 1, a merits appeal against the approval of a large wind farm, the Court recognised that achieving intergenerational equity involved a consideration of the conservations of options subprinciple. Preston CJ stated at [74] (emphasis added):

> *The attainment of intergenerational equity in the production of energy involves meeting at least two requirements. The first requirement is that the timing of and the subsequent use in the production of energy of finite, fossil fuel resources needs to be sustainable. Sustainability refers not only to the exploitation and use of the resource …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 the cumulative and long-term effects caused by anthropogenic climate change. In this way, the present generation reduces the adverse consequences for future generations.***

55. It is NWA's submission based on the expert evidence that the benefits of the Project, which are overstated by the applicant, are *'distributed to the current generation'*, while the *'burdens are distributed to the current as well as future generations'*.[16]

Precautionary principle

56. A principle of ESD is the precautionary principle.[17] The precautionary principle is a tool for decision makers to manage environmental risks. The most widely employed formulation adopted in Australia is that stated in s 6(2)(a) of the POEA Act, which provides:

> *…If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.*

[16] *Gloucester Resources Ltd v Minister for Planning* [2019] NSWLEC 7, [416].
[17] *Telstra Corporation Ltd v Hornsby Shire Council* (2006) 67 NSWLR 256, [108], [113].

57. As the submissions demonstrate below, the precautionary principle is a particularly relevant consideration in this case which is triggered because:

    a. there is a threat of serious or irreversible environmental damage (including likely or probable direct and indirect threats, secondary and long-term threats and the incremental or cumulative impacts of multiple or repeated actions or decisions), based on the expert evidence of Dr Hayley, Assoc Prof Currell, Dr Ziller, Mr Milledge, Mr Paull and Dr Serov; and

    b. there is considerable or substantial scientific uncertainty as to the environmental damage, based on the expert evidence of Assoc Prof Currell, Dr Hayley, Dr Ziller, Mr Milledge, Mr Paull and Dr Serov.

The public trust doctrine

58. There is another avenue by which the IPC should refuse the development on groundwater impacts and climate change grounds; that is, the doctrine of the public trust. The state is subject to a public trust duty to protect the air, atmosphere and water resources, including groundwater. The assets are held in trust for the people. That duty is breached by a determination to grant development consent in circumstances where the development will contribute to anthropogenic climate change and will likely cause harm to important aquifers within the Pilliga. The public trust doctrine regulates the IPC's exercise of power under s 4.15 of the EP&A Act to determine the development application for the Project, either as part of the 'public interest', or separately under the common law.

59. This argument arises from the particular application of the public trust doctrine to essential natural resources. With respect to these core resources, the state's public trust obligations prevent it from depriving a future legislature of the natural resources necessary to provide for the well-being and survival of its citizens. The roots of the public trust doctrine are in Roman law, the Institutes of Justinian, part of the Corpus Juris Civilis. The Institutes of Justinian declared 'the following things are by natural law common to all – the air, running water, the sea, and consequently the seashore.'

60. The public trust operates similar to basic trust principles, which impose upon the trustee a duty to protect the trust property against damage or destruction. The trustee owes this duty equally to both current and future beneficiaries of the trust. In natural resources cases, the trust property consists of a set of resources important enough to the people to warrant public trust protection (see Mary Wood, A Nature's Trust: Environmental Law for a New Ecological Age 167-75 (2014)). The government, as trustee, has a duty to protect the trust assets from damage so that current and future trust beneficiaries will be able to enjoy the benefits of the trust.

61. Of the nature of the public trust doctrine as it relates to natural resources, Preston CJ writes:[18]

[18] Chief Judge Preston, 'Protected Areas in the Courts: An Overview' (IUCN World Parks Congress, Sydney, 13 November 2014) 29-35.

The public trust doctrine has its origins in Roman law, specifically in the property concept of res communis. *These are things which, by their nature, are part of the commons that all humankind has a right in common to access and use, such as the air, running water, the sea and the shores of the sea, and that cannot be appropriated to private ownership. Ownership of these common natural resources is vested in the state as trustee of a public trust for the benefit of the people. The state, as trustee, is under a fiduciary duty to deal with the trust property, being the communal natural resources, in a manner that is in the interests of the general public, who are the beneficiaries of the trust.*

62. The Institutes of Justinian included the air in the list of assets "*by natural law common to all*". Just as the state has a duty to ensure the continued availability and existence of its water resources, including within the Pilliga aquifers, for present and future generations, so it has a duty to protect the air, atmosphere and the climate from substantial impairment. Approval of the development is fundamentally inconsistent with each duty.

THE LIKELY ENVIRONMENTAL IMPACTS

A. GROUNDWATER IMPACTS

The precautionary principle is activated by the groundwater impacts of the Project

63. The circumstances of the Project and the expert evidence adduced by groundwater experts Assoc Prof Currell and Dr Hayley enliven the precautionary principle, contrary to the position of the applicant and DPIE.

64. In the seminal case *Telstra Corporation Limited v Hornsby Shire Council* (2006) 67 NSWLR 256; [2006] NSWLEC 133 (***Telstra***), Preston CJ provides an explanation of how the precautionary principle is triggered, its two conditions precedent, and the concept of a proportionate response. At [128] his Honour states (emphasis added):

The application of the precautionary principle and the concomitant need to take precautionary measures is triggered by the satisfaction of two conditions precedent or thresholds: a ***threat of serious or irreversible environmental damage and scientific uncertainty as to the environmental damage***. ***These conditions or thresholds are cumulative***. *Once both of these conditions or thresholds are satisfied,* ***a precautionary measure may be taken to avert the anticipated threat of environmental damage, but it should be proportionate***.

A threat of serious or irreversible environmental damage

65. In relation to the first condition, Preston CJ states in *Telstra* at [129]:

First, it is not necessary that serious or irreversible environmental damage has actually occurred — it is the threat of such damage that is required. Secondly, the environmental damage threatened must attain the threshold of being serious or irreversible.

66. At [130] his Honour characterises the threats that would satisfy the first condition to include '*direct and indirect threats, secondary and long-term threats and the incremental or cumulative impacts of multiple or repeated actions or decisions. Where threats may interact or be interrelated (for example where action against one threat may exacerbate another threat) they should not be addressed in isolation*'. At [131]:

> *Assessing the seriousness or irreversibility of environmental damage involves consideration of many factors...The factors might include:*
> *(a) the spatial scale of the threat (eg local, regional, statewide, national, international);*
> *(b) the magnitude of possible impacts, on both natural and human systems;*
> *(c) the perceived value of the threatened environment;*
> *(d) the temporal scale of possible impacts, in terms of both the timing and the longevity (or persistence) of the impacts;*
> *(e) the complexity and connectivity of the possible impacts;*
> *(f) the manageability of possible impacts, having regard to the availability of means and the acceptability of means;*
> *(g) the level of public concern, and the rationality of and scientific or other evidentiary basis for the public concern; and*
> *(h) the reversibility of the possible impacts and, if reversible, the time frame for reversing the impacts, and the difficulty and expense of reversing the impacts.*

67. These factors are not exhaustive and other relevant matters may be taken into consideration. Importantly, his Honour highlights at [132]-[134]:

> *[132] The assessment of whether the threats are serious or irreversible will be enhanced by broadening the range of professional expertise consulted and seeking and taking into account the views of relevant stakeholders and rightholders. The former is important because of the inter-disciplinary nature of the questions involved. The latter is important because different judgments, values and cultural perceptions of risk, threat and required action play a role in the assessment process…*
>
> *[133] The assessment involves ascertaining whether scientifically reasonable (that is, based on scientifically plausible reasoning) scenarios or models of possible harm that may result have been formulated…*
>
> *[134] The threat of environmental damage must be adequately sustained by scientific evidence. As was held in* Monsanto Agricoltura Italia v Presidenza del Consiglio dei Ministri, *European Court of Justice, Case C-236/0 (13 March 2003) at [138]:*
>
> > *"not every claim or scientifically unfounded presumption of potential risk to human health or the environment can justify the adoption of national protective measures. Rather, the risk must be adequately substantiated by scientific evidence."*

68. NSW decisions[19] have accepted that the level of 'threat' includes the characterisation made in *Conservation Council of SA Inc v Development*

[19] *BT Goldsmith v Blacktown City Council* [2005] NSWLEC 210[71]; *Telstra* [152]; *Bentley v BGP Properties* [2006] NSWLEC 34 per Preston CJ [68]; *Gray v Minister for Planning* (2006) 152 LGERA 258 per Pain J [116]; *F&D Bonaccorso v City of Canada Bay Council (No 2)* (2007) 158 LGERA 250 per Biscoe J [55].

Assessment Commission and Tuna Boat Owners Assn (No 2) [1999] SAERDC 86, namely that 'threat' can be taken to mean the 'likelihood' or 'probability' of serious or irreversible damage to the environment as a result of the particular development application. The SA Environment, Resources and Development Court provided at [24] (emphasis added):

> *Because of the inherent uncertainty in a scientific opinion, an appellant is unlikely to be able to show that a particular development would be likely to result in serious or irreversible damage to the environment.* ***In reasoning thus, we have taken "threat" to mean "likelihood" or "probability"***.

69. In *Newcastle & Hunter Valley Speleological Society Inc v Upper Hunter Shire Council and Stoneco Pty Limited* [2010] NSWLEC 48, Preston CJ held that scientific likelihood was a higher threshold than a 'mere possibility' at [177] (emphasis added):

> *In the present matter, although there is an absence of site-specific information on biota in the limestone, the presence of biota in caves and groundwater in the near vicinity of the site and the increasing number of studies elsewhere that establish the presence of biota in limestone, make it scientifically likely that some form of biota will be found within the limestone on the site.* ***Without being able to predict the particular species which would be present, it is beyond a mere possibility that biota will be present. This scientific likelihood is sufficient to engage the precautionary principle***.

Scientific uncertainty as to the environmental damage

70. In relation to the second condition, scientific uncertainty as to the environmental damage, requires that there is a lack of full scientific uncertainty as to the '*nature and scope of the threat of environmental damage*'.[20] Similarly to the first condition, Preston CJ stipulates that the degree of scientific uncertainty requires the analysis of many factors and provides a non-exhaustive list of factors that might be considered at [141], including:

> *(a) the sufficiency of the evidence that there might be serious or irreversible environmental harm caused by the development plan, programme or project;*
> *(b) the level of uncertainty, including the kind of uncertainty (such as technical, methodological or epistemological uncertainty); and*
> *(c) the potential to reduce uncertainty having regard to what is possible in principle, economically and within a reasonable time frame.*

71. Preston CJ states that the notion of 'full' scientific uncertainty is somewhat of an unattainable goal (at [143]); rather it should be at least 'considerable' or 'substantial' (at [146]-[147]). His Honour discusses the inverse proportionality between the degree of scientific uncertainty and the degree of potential environmental damage at [146] (emphasis added):

> *Cordonier Segger and Khalfan suggest that the magnitude of environmental damage is usually inversely proportionate to the likelihood of risk in order for precaution to be triggered.* ***That is to say, where the relevant degree or magnitude of potential environmental damage is greater, the degree of certainty about the threat is lower. They suggest that for a formulation of***

[20] *Telstra*, [140].

the precautionary principle which uses the threshold of "serious or irreversible" environmental damage, the correlative degree of certainty about the threat is "highly uncertain of threat"*. This would contrast with a formulation of the precautionary principle which sets a lower degree of potential harm such as "potential adverse effects", where the correlative degree of certainty about the threat would be higher, namely "highly certain of threat": M-C Cordonier Segger and A Khalfan, Sustainable Development Law: Principles, Practices and Prospects, Oxford University Press, 2004 at pp 145–146.*

72. At [148], Preston CJ usefully cites a threshold test of 'reasonable scientific plausibility' as postulated by de Sadeleer, which follows (emphasis added):

"That condition would be fulfilled when empirical scientific data (as opposed to simple hypothesis, speculation, or intuition) make it reasonable to envisage a scenario, even it if does not enjoy unanimous scientific support.

When is there 'reasonable scientific plausibility'? When risk begins to represent a minimum degree of certainty, supported by repeated experience. But a purely theoretical risk may also satisfy this condition, as soon as it becomes scientifically credible*: that is, it arises from a hypothesis formulated with methodological rigour and wins the support of part of the scientific community, albeit a minority.*

*The principle may consequently apply to all post-industrial risks for which a cause-and-effect relationship is not clearly established but where there is a 'reasonable scientific plausibility' that this relationship exists****. This would be particularly appropriate for delayed pollution, which does not become apparent for some time and for which full scientific proof is difficult to assemble****": N de Sadeleer, Environmental Principles: From Political Slogans to Legal Rules, Oxford University Press, 2005 at p 160.*

73. In *Newcastle & Hunter Valley Speleological Society Inc v Upper Hunter Shire Council and Stoneco Pty Limited* [2010] NSWLEC 48, Preston CJ states that the threat of environmental damage was 'scientifically likely' at [178] (emphasis added):

If there is biota present then, at least within the extraction area, the biota will be harmed by quarrying. Such harm would constitute serious and irreversible environmental damage. ***There is uncertainty as to the threat of environmental damage flowing from the uncertainty as to the presence of voids and fissures, with available water, to support biota. However, the threat of environmental damage is scientifically likely****; there is reasonable scientific plausibility that there are voids and fissures, with available water, to support biota, which would be damaged by quarrying …*

74. Once it is determined that the two conditions precedent are satisfied, the precautionary principle is activated, and the evidentiary burden of proof shifts from the objector to the applicant.[21] The activation of the precautionary principle requires the decision-maker to '*assume that the threat of serious or irreversible environmental damage is no longer uncertain but is a reality*'. Moreover, the '*burden of showing that this threat does not in fact exist or is negligible effectively*

[21] *Telstra*, [150].

reverts to the proponent of the economic or other development plan, programme or project'.[22]

75. Preston CJ states at [161] (emphasis added):

> *The type and level of precautionary measures that will be appropriate will depend on the combined effect of the degree of seriousness and irreversibility of the threat and the degree of uncertainty. This involves assessment of risk in its usual formulation, namely the probability of the event occurring and the seriousness of the consequences should it occur.* ***The more significant and the more uncertain the threat, the greater the degree of precaution required*** *...*

76. Moreover, Bates states that *'if precautionary measures cannot acceptably manage the threat of serious or irreversible environmental damage, the appropriate determination* ***may in fact be to prohibit the proposed development or action****'* (emphasis added),[23] or to *'****prohibit specified actions pending further consultation or reference to other expert advice****'* (emphasis added).[24] By way of example:

    a. In *Bulga Milbrodale Progress Association Inc v Minister for Planning and Infrastructure and Warkworth Mining Ltd* (2013) 194 LGERA 347, Preston CJ found that the *'proposed precautionary measures in relation to extension of a coal mine, including compensatory biodiversity offsets, were unlikely to prevent serious and irreversible harm to an endangered ecological community'*.[25]

    b. In *Leatch v Director-General, National Parks and Wildlife Service* (1993) 81 LGERA 270, Stein J applied the precautionary principle to *'refuse a licence to take or kill an endangered frog in the context of a development proposal for a link road'* because the evidence *'left in doubt key questions as to the population, habitat and behavioural characteristics of the giant burrowing frog'*.[26]

The precautionary principle is activated in this case

77. In respect of the Project, the precautionary principle is activated in respect of groundwater impacts because:

    a. there is a threat of serious or irreversible environmental damage (including likely or probable direct and indirect threats, secondary and long-term threats and the incremental or cumulative impacts of multiple or repeated actions or decisions), based on the expert evidence of Dr Hayley and Assoc Prof Currell; and

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[22] *Telstra*, [150].
[23] Gerry Bates, *Environmental Law in Australia* (2019), 10th ed, p. 217, citing *Bulga Milbrodale Progress Association Inc v Minister for Planning and Infrastructure and Warkworth Mining Ltd* [2013] NSWLEC 48.
[24] Gerry Bates, *Environmental Law in Australia* (2019), 10th ed, p. 229, citing *Seafish Tasmania Pelagic Pty Ltd v Burke, Minister for Sustainability, Environment, Water, Population and Communities (No 2)* [2014] FCA 117.
[25] Gerry Bates, *Environmental Law in Australia* (2019), 10th ed, p. 217.
[26] Gerry Bates, *Environmental Law in Australia* (2019), 10th ed, p. 220.

b. there is considerable or substantial scientific uncertainty as to the environmental damage, based on the expert evidence of Assoc Prof Currell and Dr Hayley.

78. In respect of the threat of serious or irreversible environmental damage:

a. Assoc Prof Currell states that the major risks are:[27]

> *1.Groundwater, surface water and land contamination due to leaks and spills of CSG produced water – a saline fluid containing hazardous levels of salt, arsenic and other trace elements. This poses a threat to the quality of groundwater available for potable and irrigation usage and ecosystems in the area.*
>
> *2.Cross-contamination of important shallow aquifers with methane and other hydrocarbons from deep in the Gunnedah Basin. This may result in bore pump failures, secondary impacts to groundwater quality (e.g. contaminant mobilisation) and - in extreme cases - explosion hazard.*
>
> *3.Long term risk of depressurisation and leakage from key water supply aquifers – e.g. the Pilliga Sandstone and Namoi Alluvium - affecting the availability of groundwater for other users in a highly allocated and water-stressed system.*
>
> *4.Risk of land and water contamination with hazardous salt and/or brine produced through treatment of coal seam gas produced water.*

79. In respect of the considerable or substantial scientific uncertainty as to the environmental damage:

a. Assoc Prof Currell states:

> *Based on my analysis of the relevant material, I believe the risks above are considerable, and in general they are likely to have been under-estimated in the EIS and other material produced by the applicant. Despite the above issues being raised by many concerned submitters, very little has been done by the applicant to:*
>
> *a) further understand these risks – e.g., through additional field research programs, collection and analysis of more extensive monitoring data, and modification of assumptions in the groundwater modelling.*
>
> *b) Modify the proposed plan of operations, to allow for mitigation of these potential impacts, and develop a comprehensive suite of baseline data and appropriate groundwater monitoring program.*

b. Dr Hayley states:[28]

> *This review identified aspects of the numerical modelling that*

[27] Currell, Expert Report dated 27 July 2020, p. 2.
[28] Hayley, Expert Report dated 27 July 2020, p. 2.

contradict statements in the EIS and subsequent documentation claiming:

1)The numerical modelling is founded on conservative assumptions.

2)The project has negligible risk of adverse impact to groundwater users. The primary concerns relate to the uncertainty in model predictions, simplifying assumptions in model development, and the lack of observation data to reject alternative models that predict larger magnitude impacts than those reported in the EIS.

80. In his expert report, Dr Hayley noted that the modelling done for the Project has not excluded the possibility that the Project will result in water take equivalent to 8 percent of the long-term average annual extraction limit of the Pilliga Sandstone beneficial use aquifers.[29] NWA notes a recent change to the *Water Sharing Plan for the NSW Great Artesian Basin Groundwater Sources 2020* has come into effect, increasing the long-term average annual extraction limit and thereby modifying the percent of take that could be attributable to the Project. However, Dr Hayley advises that the principles outlined in his written report remain the same. Therefore the predicted take from this over-allocated water source – a water source that has been acknowledged by DPIE to be fully allocated[30] and water-stressed[31] – remains substantial.

81. Moreover, as precautionary measures cannot acceptably manage the threat of serious or irreversible environmental damage through an adaptive management approach (particularly given that approval is being sought for the whole of the Project, and not a first phase of the Project), the appropriate determination is to refuse consent to the Project. These arguments are detailed in the sections that follow.

What is the proportionate response

82. Since the precautionary principle is activated by the Project, proportionate measures must be taken in respect of the threat of serious or irreversible environmental damage. In this case the evidence demonstrates that the only proportionate response is to apply the concept of preventative anticipation, and not adaptive management.

83. What form this precautionary measure may take is a question of proportionality, as Preston CJ states in *Telstra* at [161] (emphasis added):

*The **type and level of precautionary measures** that will be appropriate will depend on the combined effect of the **degree of seriousness and irreversibility of the threat** and the **degree of uncertainty**. This involves assessment of risk in its usual formulation, namely the **probability of the event occurring** and the **seriousness of the consequences** should it occur. **The more significant and the more uncertain the threat, the greater the degree of precaution required** …*

[29] Hayley, Expert Report dated 27 July 2020, p. 9.
[30] Transcript, IPC Public Hearing – Narrabri Gas Project, 20 July 2020, p. 17, at 1.
[31] Currell, Expert Report dated 27 July 2020 states at p. 22: "The Namoi catchment is one of the most water-stressed catchments in Australia, owing to high rates of irrigation usage and more recently – severe drought, and further cumulative impacts must be weighed in this context."

84. A proportionate response may range from the concept of preventative anticipation at one end of the continuum of responses (perhaps leading to refusal of development consent), to the concept of adaptive management at the other end.

85. In *Telstra*, Preston CJ explains the concept of preventative anticipation at [156] (emphasis added):[32]

> *The precautionary principle* ***permits the taking of preventative measures without having to wait until the reality and seriousness of the threats become fully known****… This is the concept of preventative anticipation: T O'Riordan and J Cameron, "The History and Contemporary Significance of the Precautionary Principle" in T O'Riordan and J Cameron (eds),* Interpreting the Precautionary Principle, *Earthscan Publications, 1994, p 12 at p 17; and P Sands,* Principles of International Environmental Law*, 2nd ed, Cambridge University Press, 2003 at p 269.*

86. The passage of O'Riordan and Cameron (1994) cited by Preston CJ in *Telstra* at [156] elucidates the concept of preventative anticipation as one of *'six basic concepts now enshrined in the precautionary principle'*:[33]

> (i) preventative anticipation: *a willingness to take action in advance of scientific proof of evidence of the need for the proposed action on the grounds that further delay will prove ultimately most costly to society and nature, and, in the longer term, selfish and unfair to future generations.*

87. In relation to the concept of adaptive management, in *Telstra* Preston CJ suggests that some margin for error should be retained until all the consequences of a decision to proceed with the project are known, since this will allow for potential errors in risk assessment.[34] It is within this context that Preston CJ introduces the 'adaptive management approach' as 'one means' of retaining that margin of error at [163]-[164]:

> *[163] One means of retaining a margin for error is to implement a step-wise or adaptive management approach, whereby uncertainties are acknowledged and the area affected by the development plan, programme or project is expanded as the extent of uncertainty is reduced.*
>
> *[164] An adaptive management approach might involve the following core elements:*
>
> > *monitoring of impacts of management or decisions based on agreed indicators;*
> >
> > *promoting research, to reduce key uncertainties;*
> >
> > *ensuring periodic evaluation of the outcomes of implementation, drawing of lessons, and review of adjustment, as necessary of the measures or decisions adopted; and*

[32] Cited, for example, in *Barrington – Gloucester – Stroud Preservation Alliance Inc v Minister for Planning and Infrastructure* [2012] NSWLEC 197, [151].
[33] Timothy O'Riordan and James Cameron, *Interpreting the Precautionary Principle* (1994), p.17.
[34] *Telstra,* [162].

establishing an efficient and effective compliance system

88. In *Newcastle & Hunter Valley Speleological Society Inc v Upper Hunter Shire Council* [2010] NSWLEC 48, Preston CJ warned of the difficulties in applying these measures in practice at [184] (emphasis added):

> *Adaptive management is a concept which is frequently invoked but less often implemented in practice.* ***Adaptive management is not a "suck it and see", trial and error approach to management, but it is an iterative approach involving explicit testing of the achievement of defined goals.*** *...*

89. Moreover, in *Boral Cement Pty Ltd v SHCAG Pty Ltd* [2013] NSWLEC 203, Pain J stated at [115] (emphasis added):

> *There is no warrant for reading* [Newcastle & Hunter Valley Speleological Society] *as making the characterisation of a plan as an "adaptive management plan" a necessary precondition to the giving of project approval under s 75J.* ***The ultimate question remains whether the impacts and risks of the project in question are adequately managed by conditions of approval.*** *The characterisation of conditions as imposing an "adaptive management regime" is only a guide to assist in answering that question. Other matters, such as the costs of the precautionary measures and the risk-weighted consequences, may properly be taken into account.*

90. Recent cases have demonstrated a growing discomfort with deferring environmental risks assessments to adaptive management measures post-approval.[35] Moreover, the IPC has itself previously found that an adaptive management approach can be unsuitable and therefore a project should be refused. A recent example is the Bylong Coal Project, where the IPC refused the project on multiple grounds, one of which was the unacceptable groundwater impacts.[36]

91. Similarly, the Planning Assessment Commission (**PAC**) has previously refused projects on the ground that an adaptive management approach is unsuitable. In relation to the Drayton South Coal Project, the PAC refused the project, inter alia, because '*the Project would have air quality and blast noise effects on existing land uses in the vicinity of the Project which cannot be avoided or mitigated and for which adaptive management is unsuitable*'.[37]

92. The significant difficulties in applying adaptive management in practice, as well as specific implications in relation to the Project, will be expanded upon below, drawing on peer-reviewed scientific literature and expert evidence.

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[35] Alison Rose and Revel Pointon, 'Earning a Licence to Mine: Rethinking the Use of Adaptive Management in Light of Recent Mining Land Court Outcomes' (2018) 32 *Australian Environment Review*, p. 221.

[36] IPC, *Statement of Reasons for Decision –Bylong Coal Project (SSD 6367)* (18 September 2019)"https://www.ipcn.nsw.gov.au/resources/pac/media/files/pac/projects/2018/10/bylong-coal-project/determination/bylong-coal-project-ssd-6367--statement-of-reasons-for-decision.pdf (accessed 4 August 2020) at [297], [817].

[37] PAC, *NSW Planning Assessment Commission Determination Report –Drayton South Coal Project (SSD 6875)* (22 February 2017) https://www.ipcn.nsw.gov.au/resources/pac/media/files/pac/projects/2016/09/drayton-south-coal-project/determination/drayton-south-coal-project-report--final.pdf (accessed 4 August 2020) p. 44. See pp. 25-31 for the PAC's detailed discussion of this point.

93. As this submission will later set out, DPIE's proposed conditions of approval, despite purporting to take an 'adaptive management approach', are manifestly inadequate to manage the impacts and risks of the Project. As such, development consent should be refused.

The use of adaptive management has been criticised in the scientific literature

General Concerns about Adaptive Management

94. Lee (2014), in a peer-reviewed study of adaptive management of groundwater impacts of Australian mining projects, writes (emphasis added):[38]

> *Unfortunately, adaptive management often fails to live up to its theoretical promise.* ***There are, presently, few examples of its successful application****. Significant concern has been raised that, in practice, adaptive management is often nothing more than a "****political catch phrase****" or "****comforting gesture****" that loosely promises some answer to future circumstances.*

95. Overwhelmingly, the literature suggests that decision-makers should exercise a high degree of caution when deciding whether an adaptive management approach is appropriate in the circumstances. Several recurring concerns emerge from the scientific and legal literature on adaptive management.

96. Firstly, the literature suggests that there is a strong 'disconnect' between theoretical definitions of adaptive management, and the applications of adaptive management in practice. This has been shown to be particularly the case in relation to groundwater,[39] as these submissions will demonstrate.

97. Adaptive management was originally proposed to enable *'"active" scientific hypothesis testing "in the field", that is, management interventions in ecosystems could be treated as "experiments" from which managers and science can learn and adapt'*.[40] However, in practice, it has increasingly been adopted as a *passive* way of learning and reducing uncertainty. As Williams et al explain, active adaptive management *'actively pursues the reduction of uncertainty through management interventions'*, while passive adaptive management *'focuses on management objectives, with learning an unintended but useful by-product of decision making'*.[41]

98. The increasingly passive approach to reducing scientific uncertainty in pursuit of an adaptive management approach has therefore undermined the original spirit of this technique, such that the objective of such regimes is not to enable the cessation of project activity in the face of fresh evidence demonstrating environmental harm, but rather to manage this environmental harm which is

[38] Jessica Lee, 'Theory to practice: Adaptive management of the groundwater impacts of Australian mining projects' (2014) 31 *Environmental and Planning Law Journal* 251, p. 253.
[39] Jason A Thomann et al, 'Adaptive management in groundwater planning and development: A review of theory and applications' (2020) 586 *Journal of Hydrology* 1, p. 9.
[40] Cameron Holley and Darren Sinclair, 'Collaborative Governance and Adaptive Management: (mis)applications to Groundwater, Salinity and Run-Off'(2011) 14 *Australasian Journal of Natural Resources Law and Policy*, pp. 42-45; CS Holling (ed), *Adaptive Environmental Assessment and Management* (Wiley, 1978).
[41] B.K. Williams, 'Passive and active adaptive management: approaches and an example' (2011) 92 *Journal of Environmental Management*, pp. 1371-1378.

considered an inevitable consequence of the project. A crucial assumption underlying this reasoning is that the project is justified and should go ahead despite these risks. It is submitted that this assumption is erroneous in this case and undermines the original purpose of adaptive management as a precautionary measure adopted via application of the precautionary principle.

99. Secondly, adaptive management regimes have been observed to be plagued with legal obstacles which undermine their effective implementation in practice. One such obstacle is the failure to legally define the content of adaptive management to an adequate degree of precision such that there are clear management objectives and a robust framework for implementation which truly gives form to the spirit of adaptive management.[42] Another is the general lack of binding and legally enforceable obligations on the applicant to adapt and change management practices where strong evidence from monitoring data demonstrates a need for change.[43] In the case of the Project, these problems are exacerbated by the fact that any purportedly binding limits on water take would be based purely on modelling and if impacts are greater than those predicted they are unlikely to be seen for many decades.

100. Thirdly, in practice, adopting an adaptive management approach has been shown to offer only very weak protection for the environment due to the general absence of substantive limits on the environmental impacts of the project. As Lee and Gardner (2014) write (emphasis added):[44]

> *Too often one suspects that the rhetoric of adaptive management has been used **to justify the approval of projects with uncertain environmental impacts on process-based conditions that do not place substantive limits on the impacts of the project**. Rather, approval conditions require proponents to undertake baseline studies and develop models to predict project impacts after approval has been granted.*

101. This is precisely the approach that is being proposed by DPIE for the Project, and the Commission ought not accept DPIE's formulation of 'adaptive management' as an effective means of controlling or limiting the uncertain environmental impacts of the Project.

102. Lee (2014) points out the risk of adaptive management regimes devolving into 'mere process' rather than delivering substantive environmental improvement as intended. This is especially the case where there is an absence of legally binding environmental *objectives* to keep adaptive management on track to deliver its promised outcomes, and legally binding environmental *standards* which provide a minimum environmental outcome that must be achieved.[45]

103. Additionally, the lack of substantive limits on the environmental impacts is generally reflective of the high degree of scientific uncertainty as to the scope and

[42] Jessica Lee, 'Theory to practice: Adaptive management of the groundwater impacts of Australian mining projects' (2014) 31 *Environmental and Planning Law Journal* 251, p. 256.
[43] Jessica Lee, 'Theory to practice: Adaptive management of the groundwater impacts of Australian mining projects' (2014) 31 *Environmental and Planning Law Journal* 251, p. 258.
[44] Jessica Lee and Alex Gardner, 'A Peek Around Kevin's Corner: Adapting Away Substantive Limits?' (2014) 31 *Environmental and Planning Law Journal* 247.
[45] Jessica Lee, 'Theory to practice: Adaptive management of the groundwater impacts of Australian mining projects' (2014) 31 *Environmental and Planning Law Journal* 251, p. 258.

extent of those impacts. Yet Rose and Pointon have argued that adaptive management *'should not be used to defer the resolution of key scientific uncertainties on the basis that management strategies can adapt to adverse impacts as they develop'*.[46] This issue is particularly important in large groundwater systems, where the lag between project activities and the full extent of impact is often considerable.[47]

104. Fourthly, adaptive management has been strongly criticised as being undemocratic and opaque, effectively 'shutting out' meaningful public participation in the planning process by deferring to highly technocratic and inaccessible discussions of the project's purported impacts.

105. Lee (2014) observes that adaptive management can be used as an excuse to defer difficult planning and management decisions and upfront Environmental Impact Assessment, particularly where environmental interests are competing with strong commercial or political interests, as is generally the case in relation to mining projects.[48] Indeed:[49]

> *the trend of deferring impact assessment to post-approval management and reporting [which not only] reduces the opportunity to minimise environmental impacts, [but also] effectively prevents landholder, including traditional owners and the broader public, from participating meaningfully, or at all, in the environment impact assessment (EIA) of projects.*

106. This is a salient point in the present case. The approach taken by DPIE and the applicant with respect to the groundwater assessment for the Project effectively excludes the public from engaging meaningfully in the environmental assessment process. It has been a theme of both the DPIE and the applicant that the strong public concern about risks to groundwater 'cannot be reconciled' with their assessments. However, the failure to produce adequate groundwater assessments, together with the serious and irreversible nature of the risks posed by the Project, renders such criticism nugatory. The proposed conditions requiring modelling and monitoring of impacts, to be implemented *after* mandatory public consultation on the Project, subvert the assessment process. It is of little comfort to affected communities to know that the applicant will be required to do this important work only after approval is granted. As Sally Hunter from People for the Plains said to the IPC during the public hearing:[50]

> *If a bore user has been ignored and no baseline exists, how useful is a condition of consent that says a trigger level predicted from a baseline will be used to identify if that neighbour has been negatively impacted? If the water model has continued to be questioned by DPIE Water and the IESC right up until this very point, how can neighbours rely on it to have an accurate prediction*

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[46] Alison Rose and Revel Pointon, 'Earning a Licence to Mine: Rethinking the Use of Adaptive Management in Light of Recent Mining Land Court Outcomes' (2018) 32 *Australian Environment Review*, p. 220.

[47] For more information on this issue see Rousseau-Gueutin et al, 'Time to reach near-steady state in large aquifers' (2013) *Water Resources Research* 49, pp 6893–6908

[48] Jessica Lee, 'Theory to practice: Adaptive management of the groundwater impacts of Australian mining projects' (2014) 31 *Environmental and Planning Law Journal* 251, p. 257.

[49] Alison Rose and Revel Pointon, 'Earning a Licence to Mine: Rethinking the Use of Adaptive Management in Light of Recent Mining Land Court Outcomes' (2018) 32 *Australian Environment Review*, p. 220.

[50] Transcript, IPC Public Hearing – Narrabri Gas Project, 21 July 2020, p. 10, at 8-17.

of the impacts on them? If the proponent does not own enough water licences to cover its base case predicted take, let alone the worst case scenario, how can conditions that state the proponent must have enough water or adjust the scale of operations to suit available water be relevant? How can the department suggest a condition that stops gas wells from pumping in order to control ground water extraction?

107. From an economic perspective, inadequate upfront impact assessment wastes the resources of the community, the assessing authority, the applicant, and the IPC as they are all forced to respond to applications with limited information, with the community often having to commission its own modelling at its own expense.[51]

108. NWA and its members have engaged numerous experts over several years to provide advice in relation to the Project. The experts have provided unambiguous advice on the failings of the impact assessment and risks and uncertainties associated with the Project. Despite this, the DPIE and applicant have dismissed community concerns citing, amongst other things, *'One of the key reasons for this may be the limited exposure of the community to coal seam gas impacts and its reliance on reports about actual and perceived impacts on other jurisdictions*.'[52]

109. Moreover, despite the formal transparency afforded by procedures such as public hearings, the highly technical nature of adaptive management ensures that there is still a lack of substantive transparency surrounding the full potential impacts of a project:[53]

In practice, adaptive management usually involves small groups of experts regularly reviewing and evaluating technical data over time. The meetings and documents arising out of the process are generally not easily accessible or comprehensible by the public. This lack of transparency is exacerbated where adaptive management is used to circumvent front-end EIA and the content of adaptive management plans is left to be determined by proponents after an action has been approved

110. Furthermore, once impacts have occurred, directly impacted landholders will have considerable difficulty demonstrating that impacts were caused by the project where there is a lack of sufficient baseline assessment prior to its commencement.[54] This is particularly relevant in this case where DPIE has indicated that it does not intend to make raw data available to the community:[55]

...I don't think exposing the public to raw data is necessarily the best way to communicate what the impacts are and how that – so I think that reporting will

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[51] Alison Rose and Revel Pointon, 'Earning a Licence to Mine: Rethinking the Use of Adaptive Management in Light of Recent Mining Land Court Outcomes' (2018) 32 *Australian Environment Review*, pp. 221-2.
[52] Transcript, IPC Public Hearing – Narrabri Gas Project, 20 July 2020, Mr Kitto, p. 10, at 29-31.
[53] Jessica Lee, 'Theory to practice: Adaptive management of the groundwater impacts of Australian mining projects' (2014) 31 *Environmental and Planning Law Journal* 251, p. 257. See also Alison Rose and Revel Pointon, 'Earning a Licence to Mine: Rethinking the Use of Adaptive Management in Light of Recent Mining Land Court Outcomes' (2018) 32 *Australian Environment Review*, pp. 220-2.
[54] Alison Rose and Revel Pointon, 'Earning a Licence to Mine: Rethinking the Use of Adaptive Management in Light of Recent Mining Land Court Outcomes' (2018) 32 *Australian Environment Review*, pp. 221-222.
[55] Transcript, IPC meeting with EPA, DPIE – Water and NRAR – Narrabri Gas Project, 28 July 2020, p. 17, at 8-16.

happen in a simpler way, or a summary of a lot of that data will happen on the Department of Planning's website and other websites where there's a requirement in the conditions – the planning conditions to say that they need to monitor and publicly report on the performance, which is not the raw data, which is sometimes what people talk about when they want access to all the data. So there's an obligation to report and that will clearly not be all the raw data. That will be a summary of the data and analysis and an explanation of what's going on.

111. Fifthly, if courts and assessing authorities increasingly adopt an approach of approving development prior to resolution of verifiable scientific uncertainties by relying on so-called 'adaptive management' conditioning, this runs a real risk of undermining the very purpose of environmental regulations in achieving positive environmental outcomes.[56] Indeed, an overreliance on adaptive management risks depriving the precautionary principle of any meaningful content – as a precautionary measure, adaptive management is often ineffective at best, damaging at worst.

112. These concerns raised by scientific and legal commentators demonstrate that adaptive management suffers from deep theoretical and practical difficulties which have yet to be resolved satisfactorily. This warrants extra caution in applying it to the management of sensitive hydrogeological systems and the ecosystems that depend on them.

Specific Concerns about Adaptive Management and Groundwater

113. Strong concerns have particularly been raised in relation to the application of adaptive management to the management of groundwater impacts from mining projects.

114. From a theoretical standpoint, there are three central concerns.

115. Firstly, the theoretical concepts underpinning the application of adaptive management to groundwater impacts are as yet immature and require further development before they can be confidently applied in the field. As Thomann et al (2020) write:[57]

…there is a clear need for a guiding framework that presents a pragmatic interpretation (and possible extension and/or modification) of AM principles for use in groundwater management… It is also critical that adaptive capacity concepts as they relate to groundwater problems are further developed and assessed prior to the application of AM to avoid the misapplication of the approach to inappropriate contexts.

116. Secondly, adaptive management regimes have increasingly shifted their regulatory focus to impacts of dewatering activities on groundwater dependent ecosystems, rather than on regional groundwater as an essential condition of such ecosystems.[58] Yet the literature suggests that ecosystems can remain stable for

[56] Alison Rose and Revel Pointon, 'Earning a Licence to Mine: Rethinking the Use of Adaptive Management in Light of Recent Mining Land Court Outcomes' (2018) 32 *Australian Environment Review*, pp. 221-222.

[57] Jason A Thomann et al, 'Adaptive management in groundwater planning and development: A review of theory and applications' (2020) 586 *Journal of Hydrology* 1, p. 10.

[58] Jessica Lee, 'Theory to practice: Adaptive management of the groundwater impacts of Australian

extended periods of time, before suddenly experiencing catastrophic collapse.[59] As Lee (2014) asks:[60]

> *if legal regulation and management frameworks address only the impacts of a project upon ecosystems, and not the impacts of the project upon the essential conditions of those ecosystems…what is the risk that, by the time the ecosystems respond to deterioration in those essential conditions, it will be too late?*

117. Thirdly, scientific uncertainty as to how groundwater systems work means that effects on groundwater may only become apparent after a significant time lag, by which point the effects will be irreversible.[61] As Assoc Prof Currell's evidence demonstrates, this renders an adaptive management approach fundamentally incompatible with groundwater management, which this submission will address below.

118. These last two concerns go directly to the heart of the precautionary principle and powerfully militate against applying an adaptive management approach in the context of groundwater management and for this Project.

119. From a practical standpoint, as already discussed, a disconnect between theory and practice of adaptive management has been widely observed in the literature. Thomann et al find this to be the case in their empirical study of applications of adaptive management in groundwater management plans:

> *[Adaptive management] in theoretical descriptions is a highly structured approach, centred on iterative reduction of conceptual uncertainty and integration of new knowledge into future management practices. In contrast, the interpretation of AM that is evident in the reviewed groundwater management plans largely include a relatively simple adaptation of management protocols using [trigger levels] or unstructured/ad-hoc revision of management protocols. This difference in the interpretation of AM principles indicates a disconnect between the literature definitions of AM and practical groundwater applications.*

120. Furthermore, there is a widespread absence of active applications of adaptive management which adhere to its original spirit of scientific experimentation and the testing and ongoing refinement of scientific hypotheses. Instead, out of 11 groundwater management plans reviewed by Thomann et al, none embodied an active adaptive management approach, with all being either passive applications inconsistent with adaptive management principles altogether:[62]

> *Thus, none of the reviewed management plans can be classified as active AM under the conventional definitions. Rather, the case studies evaluated here contained project operations that are designed to produce a system response*

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mining projects' (2014) 31 *Environmental and Planning Law Journal* 251, pp. 260-2.
[59] Jessica Lee, 'Theory to practice: Adaptive management of the groundwater impacts of Australian mining projects' (2014) 31 *Environmental and Planning Law Journal* 251, pp. 260-266.
[60] Jessica Lee, 'Theory to practice: Adaptive management of the groundwater impacts of Australian mining projects' (2014) 31 *Environmental and Planning Law Journal* 251, p. 266.
[61] Jason A Thomann et al, 'Adaptive management in groundwater planning and development: A review of theory and applications' (2020) 586 *Journal of Hydrology* 1, p. 10.
[62] Jason A Thomann et al, 'Adaptive management in groundwater planning and development: A review of theory and applications' (2020) 586 *Journal of Hydrology* 1, p. 9.

that satisfies economic, environmental and/or cultural objectives. Of the reviewed groundwater management plans, those with prescribed and partly prescribed mitigation measures, at best, match the thresholds for passive AM, as defined by Williams (2011b). Management plans where mitigation measures are unprescribed are inconsistent with AM principles described by Fischman and Ruhl (2015).

121. Finally, Lee (2014) and Lee and Gardner (2014) identify several case studies of failures of adaptive management failures in relation to mining projects, which serve as powerful warnings against applying such an approach. These include:

a. Moranbah Gas Project (CSG, QLD);[63]

b. Yandicoogina Junction South East Mine (iron ore, WA)[64;]

c. Kevin's Corner Project (coal, QLD);[65]

d. Pioneer Valley Groundwater Management Area (QLD);[66]

e. Carmichael Coal Mine (QLD).[67]

Based on the expert evidence, it will not be reasonably possible to adopt an adaptive management approach to the Project

122. As identified in Assoc Prof Currell's expert report, the Project poses a serious and irreversible threat to groundwater quality and quantity, including:[68]

a. Groundwater, surface water and land contamination due to leaks and spills of CSG produced water;
b. Cross-contamination of important shallow aquifers with methane and other hydrocarbons;
c. Long term risk of depressurisation and leakage from key water supply aquifers; and
d. Land and water contamination from hazardous salt and/or brine produced through treatment of CSG produced water.

123. Assoc Prof Currell has also provided advice to EDO about how the Project accords with Lee (2014)'s 8 key elements for an effective adaptive management regime.

124. Additionally, while an adaptive management approach involves the acknowledgement of uncertainties and a gradual expansion of the project as the

[63] Jessica Lee, 'Theory to practice: Adaptive management of the groundwater impacts of Australian mining projects' (2014) 31 *Environmental and Planning Law Journal* 251, pp. 271-280.
[64] Jessica Lee, 'Theory to practice: Adaptive management of the groundwater impacts of Australian mining projects' (2014) 31 *Environmental and Planning Law Journal* 251, pp.260-271.
[65] Jessica Lee and Alex Gardner, 'A Peek Around Kevin's Corner: Adapting Away Substantive Limits?' (2014) 31 *Environmental and Planning Law Journal* 247.
[66] Jason A Thomann et al, 'Adaptive management in groundwater planning and development: A review of theory and applications' (2020) 586 *Journal of Hydrology* 1.
[67] Jason A Thomann et al, 'Adaptive management in groundwater planning and development: A review of theory and applications' (2020) 586 *Journal of Hydrology* 1.
[68] Currell, Expert Report dated 27 July 2020, pp. 1-2.

extent of uncertainty is reduced,[69] Dr Hayley's expert report suggests that the uncertainties as to groundwater impacts flowing from the Project have not been sufficiently acknowledged to form the basis of an adaptive management approach. On the contrary, the uncertainty analysis which has been undertaken to date, both by Santos and CSIRO-GISERA, is likely to underestimate the full extent of the uncertainty in groundwater impacts flowing from the Project.[70] This is due to deficiencies in:

a. The hydrogeological conceptual model, which likely underestimates inter-aquifer connectivity;[71]

b. The numerical model, which has been simplified to effectively 'lock in' the interpretation of low inter-aquifer connectivity;[72]

c. The calibration of the model;[73]

d. The consideration of cumulative effects in the model;[74] and

e. The predictive uncertainty analysis presented in the EIS.[75]

These deficiencies have not been meaningfully addressed in the environmental assessment.[76]

125. Thus, Assoc Prof Currell's and Dr Hayley's analyses of the Project, of which key points are outlined below, suggest that it will not be reasonably possible to adopt an adaptive management approach to adequately manage or mitigate these risks. Accordingly, as adaptive management is not appropriate for the Project in its current form, the IPC should adopt a preventative anticipation approach and refuse development consent.

Hayley's expert report

126. Dr Hayley has prepared a number of independent expert reports on the Project, most recently his expert report dated 27 July 2020, as summarised in his presentation to the IPC on 23 July 2020. These reports have raised significant concerns with the modelling underlying the prediction of the Project's impacts and highlight that, contrary to the statements made by the applicant and the DPIE, the assumptions used in this modelling are not conservative.

Hydrogeological conceptual model

[69] *Telstra*, [163].
[70] Hayley, Expert Report dated 27 July 2020.
[71] Hayley, Expert Report dated 27 July 2020, p. 5.
[72] Hayley, Expert Report dated 27 July 2020, pp. 6-7.
[73] Hayley, Expert Report dated 27 July 2020, p. 8.
[74] Hayley, Expert Report dated 27 July 2020, pp. 8-9.
[75] Hayley, Expert Report dated 27 July 2020, at Appendix A, pp. 1-3 (Hayley, Review of Santos NGP EIS dated May 2017).
[76] Hayley, Expert Report dated 27 July 2020, at Appendix B (Hayley, Review of Santos' NGP EIS Response to Submissions dated May 2018).

127. Dr Hayley's concern with the groundwater impact assessment starts with the fundamental basis of modelling, the conceptual hydrogeological model. Dr Hayley explains that:[77]

> *A conceptual hydrogeological model is described as "A descriptive representation of a groundwater system that incorporates an interpretation of the geological and hydrological conditions" (Anderson & Woessner, 1992; Barnett et al., 2012).*

128. In Dr Hayley's opinion it is a necessary pre-cursor to understanding potential impacts that the conceptual model underlying the predictions of impact is an appropriate representation of the geological structures on the site.

129. While Dr Hayley accepts that the applicant's consultants conducted *'a thorough review of the available data to describe the groundwater system'*, the conceptual model subsequently derived is based only on a literature review and point observations from outcrops and boreholes. As a result, Dr Hayley states:[78]

> *Due to the nature of any geological investigation, there remains considerable uncertainty in the local scale thickness, structure, and orientation of layers that could have large impacts on the connection between target coal seams and near surface aquifers that are used for water supply.*
>
> *In particular, the connectivity between target coal seams and overlying aquifers could be very sensitive to:*
> *• local scale variations in thickness or gaps in key low permeability units;*
> *• alternative interpretations on how the Gunnedah-Oxley Basin sub-crops beneath the Namoi Alluvium; and*
> *• the presence of local scale zones of enhanced vertical permeability due to faulting.*

130. As will be seen later, the expert report from Assoc Prof Currell, shows that the risk of currently unmodeled faulting within the Project Area is high, and the impacts associated with this have not been considered in the model and therefore assessed.

131. The consequence of the uncertainty in the conceptual model is that there are alternative interpretations of the hydrogeology at the Project site that are equally plausible to that used by the applicant in the impact assessment.[79]

132. Importantly, out of all the possible alternative interpretations, the most simple interpretation of continuous layers unaltered by faulting was selected. In this situation, Dr Hayley notes that the selected interpretation is the one least likely to demonstrate inter-aquifer connectivity that was chosen as the basis for assessment (emphasis added):[80]

> *The interpretation adopted for the EIS of laterally continuous layers of low permeability with no alteration due to faulting between the target coal seams and water supply aquifers* ***is the interpretation least likely to predict groundwater***

[77] Hayley, Expert Report dated 27 July 2020, p. 5.
[78] Hayley, Expert Report dated 27 July 2020, p. 5.
[79] Hayley, Expert Report dated 27 July 2020, p. 6.
[80] Hayley, Expert Report dated 27 July 2020, p. 6.

impacts of project development. *This is due to the continuous layers forming a barrier to groundwater flow between target coal seams and near surface aquifers.* ***Almost any alternative plausible conceptual model that considers faults and/or heterogeneity in the layers would form a less of a barrier to groundwater flow.***

133. In NWA's submission, the selection of the interpretation least likely to demonstrate inter-aquifer connectivity means that there is a strong possibility that the conceptual hydrogeological model, and the numerical predictive model based on it, significantly underestimate the risks of groundwater impacts, including cross-contamination via the movement of gases from the coal seam to the water use aquifers above.

134. Since the conceptual model fails to give an accurate representation of the full scope and extent of potential risks to groundwater, the IPC is effectively being asked to assess the Project based on incomplete information.

Numerical model

135. In their assessment, the applicant claims that the numerical model is founded on conservative assumptions but Dr Hayley disputes this for three key reasons, namely:

a. uncertainty in model predictions;

b. simplifying assumptions in model development; and

c. the lack of observation data to reject alternative models that predict larger magnitude impacts than those reported in the EIS.[81]

136. Because *'all geologic layers between target coal seams and near surface aquifers were lumped into large zones with uniform properties'* the assumption of low inter-aquifer connectivity has been *'locked in'* to the numerical model (emphasis added):[82]

> *The simplification and model parameter assignment done in the development of the numerical model effectively "lock in" the interpretation of low hydraulic connectivity between target coal seams and near surface aquifers.* ***These aspects of the numerical model place large limitations on all further attempts to consider model predictive uncertainty.***

137. Dr Hayley provided one example of the uncertainty this has on the prediction of impacts during his presentation to the IPC, when he explained:[83]

> *The hydrologic conductivity of a sand and the hydrologic conductivity of clay can be six orders of magnitude different. So when you're picking values for these it's equivalent to picking a number between one and a million.*

138. Despite CSIRO undertaking further work on the groundwater model, the additional assessment was limited by the same constraints on the conceptual

[81] Hayley, Expert Report dated 27 July 2020, p. 2.
[82] Hayley, Expert Report dated 27 July 2020, pp. 6-7.
[83] Transcript, IPC Public Hearing – Narrabri Gas Project, 23 July 2020, p. 10, at 16-18.

model in the EIS, meaning the CSIRO model does not address its shortcomings, as explained in Dr Hayley's report (emphasis added):[84]

> *The adopted conceptual model for both* [the CSIRO study and the study by Santos in its EIS Groundwater Impact Assessment] *is based on the interpretation of laterally continuous confining layers of low vertical permeability with no localized alterations due to faulting. While this interpretation may be the simplest interpretation of available data* ***it is also one that will lead to the lowest predictions of groundwater impact from the project relative to alternatives that consider faulting and heterogeneity****.* ***This fact contradicts statements made in the EIS and other documents that the modelling is founded on conservative assumptions.***

139. While it would have been open to Santos to use alternative modelling methods to provide a much more robust framework for conducting quantitative uncertainty analysis, it has failed to do so.[85]

Model calibration

140. Dr Hayley explains that:[86]

> *Model calibration is a process that occurs after model design and construction, by which parameters are adjusted until model predictions fit historical measurements or observations…*

141. In the case of the Project, the calibration of the predictive model is inadequate, due to a paucity of observation data. As such it provides no information on inter-aquifer connectivity and fails to reduce the uncertainty in predictions from initial prior estimates.[87] This lack of calibration changes the nature of the predictions produced from being an *objective* prediction of impacts to a *subjective* expert opinion:[88]

> *in the absence of a calibration dataset that could inform predictions, or a statistically rigorous predictive uncertainty analysis, the model predictions are a qualitative expression of expert opinion consistent with the physics of groundwater flow rather than a quantification of predicted impacts.*

142. While an uncalibrated model can still be of value, critically, the lack of calibration undermines the degree of confidence that can be placed in its predictions. As expressed in the IESC report:[89]

> *While the groundwater model has some degree of predictive capability in providing an early indication of the general location of impacts, it is not able to reliably indicate the magnitude of impact.*

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[84] Hayley, Expert Report dated 27 July 2020, p. 10.
[85] Hayley, Expert Report dated 27 July 2020, p. 7.
[86] Hayley, Expert Report dated 27 July 2020, p. 7.
[87] Hayley, Expert Report dated 27 July 2020, p.8.
[88] Hayley, Expert Report dated 27 July 2020, p. 3.
[89] Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (IESC), *Advice to decision maker on coal seam gas project: IESC2017-086: Narrabri Gas Project* (8 August 2017). [4]

143. Moreover, it will not be reasonably possible to calibrate the model until *after* the commencement of the Project:[90]

> *…a calibration dataset that would reduce the uncertainty in predictions of groundwater impact would have a pumping stress similar to that of the project development and transient observations of drawdown or pressure changes.*

144. In NWA's submission, given the concerns raised in the expert evidence about the potential for unassessed impacts, time lags in groundwater impacts and the irreversibility of such impacts, to suggest that the model can be calibrated after the Project is approved is unsatisfactory. It would not be an appropriate adaptive management response. By the time the required data has been collected, potentially irreversible changes may already have been made to the groundwater system which may not be observable for many years to come, contravening the precautionary principle.

145. Thus, adopting an adaptive management approach premised on the ongoing calibration of groundwater modelling is inconsistent with the proper application of the precautionary principle and therefore inconsistent with ESD.

Project impacts

146. The groundwater impact assessment relies on modelling work done through the EIS and by CSIRO. However, as stated above the CSIRO modelling used the same conceptual model as the EIS. It also used parameter values that were close to those used in the EIS. On that basis, Dr Hayley makes the observation that *'it is unsurprising that the median predictions from this study are largely consistent with predictions from the EIS.'* Dr Hayley goes on to state '*However, the range in predicted impacts to water use aquifers is large, and predictions at the higher end of the range show impact from the Project.* '[91]

147. Uncertainty analysis to test these predicted impacts was limited and Dr Hayley observes:[92]

> *Even with this limited evaluation of uncertainty, the predictions show a large range of impacts. Simulations that included higher vertical hydraulic conductivity and lower storage parameters predicted maximum drawdown in Great Artesian Basin Aquifers used for water supply that was an order of magnitude higher (5.7 m vs. < 0.5 m) than predicted by the parameters used in the rest of the Groundwater Impact Assessment.*

148. Noting the recent change to the *Water Sharing Plan for the NSW Great Artesian Basin Groundwater Sources 2020* discussed above, Dr Hayley describes the impacts that were predicted as follows (emphasis added):[93]

> *Predictions of changes in flux to the Great Artesian Basin Pilliga sandstone show a maximum change of 2299 ML/yr at the 95th percentile. This prediction is approximately* ***8 % of the Long-Term Annual Extraction Limit from the***

[90] Hayley, Expert Report dated 27 July 2020, p. 7.
[91] Hayley, Expert Report dated 27 July 2020, p. 9.
[92] Hayley, Expert Report dated 27 July 2020, p. 8.
[93] Hayley, Expert Report dated 27 July 2020, p. 9.

Pilliga Sandstone *of 29.68 GL/yr. Predictions of changes in flux to the Namoi Alluvium the 95th percentile predictions show a maximum change in flux of 30 ML/yr…*

149. It is important to note that these impacts are predicted *before* issues such as faulting have been incorporated in the model, *before* the model has been calibrated with appropriate on-ground data, and *without* a robust uncertainty analysis.

150. Dr Hayley's advice concludes with the view that:[94]

The hypothesis proposed by Santos that the project development will not have an impact on groundwater users in the region is shown to be consistent with all available observation data and is therefore a valid one. However, the uncertainty analysis conducted for the EIS to assess alternative hypotheses was very limited in scope. The uncertainty analysis did show that predictions of impact are highly sensitive to relatively small variations in parameter values, suggesting a wide range of possible impacts…
The adopted conceptual model for both studies is based on the interpretation of laterally continuous confining layers of low vertical permeability with no localized alterations due to faulting. While this interpretation may be the simplest interpretation of available data it is also one that will lead to the lowest predictions of groundwater impact from the project relative to alternatives that consider faulting and heterogeneity. This fact contradicts statements made in the EIS and other documents that the modelling is founded on conservative assumptions…
Based on this analysis, an alternative hypothesis that the project ***will*** *have an adverse impact on groundwater users cannot be rejected as inconsistent with any observation data and is therefore also valid. This fact contradicts statements made in the EIS and other documents that the risk of adverse impacts to local groundwater users from project development is negligible.*

Currell's expert report

151. Assoc Prof Currell has prepared a number of independent expert reports on the Project, again most recently with a written expert report dated 27 July 2020, and a presentation to the IPC on 23 July 2020. As noted above, Assoc Prof Currell's expert report identified the following key issues in relation to the Project:[95]

a. Groundwater, surface water and land contamination due to leaks and spills of CSG produced water;

b. Cross-contamination of important shallow aquifers with methane and other hydrocarbons;

c. Long term risk of depressurisation and leakage from key water supply aquifers; and

d. Land and water contamination from hazardous salt and/or brine produced through treatment of CSG produced water (this issue is discussed further in relation to Project salt waste management).

[94] Hayley, Expert Report dated 27 July 2020, p. 10.
[95] Currell, Expert Report dated 27 July 2020, pp. 1-2.

152. Assoc Prof Currell set the context for his advice in speaking to the IPC:[96]

> *Based on my review of this material 10 over – over a number of years, I believe that the decision regarding the Narrabri Gas Project is of major consequence for groundwater and the users and ecosystems dependent on it in this region, and there are significant future implications for an aquifer system which is of great value. I think the context is absolutely critical in this case, so this is a region with unusually high yielding aquifers containing unusually high-quality groundwater, and there are existing stresses on the system from irrigation usage, which has been high over many years, along with recent climate, which put this groundwater system under significant stress already.*

Groundwater, surface water and land contamination due to leaks and spills of CSG produced water

153. DPIE and the Water Expert Panel (**WEP**) continue to maintain their view that risk of contamination from spills and leaks of CSG produced water *'imposes a fairly low likelihood*'.[97] In the meeting with the IPC on 28 July 2020, Prof Fell from WEP indicated that this view was based, amongst other things on the following:

> *They've been successful in three years in not having any in this Queensland operations, and the likelihood of doing major damage is very small. And, in fact, the impact of one spill that was had by Eastern Gas some years back, was only – knockout maybe an acre or two of growth, which they successfully retrieved. There was no impact on the lower aquifers below.*

154. The reference to Prof Fell's experience in Queensland is in direct contrast to the published peer-reviewed literature on this issue. As Assoc Prof Currell describes in his expert report:[98]

> *Extensive reviews and data compilations across a range of settings (e.g., Jackson et al., 2014; US EPA, 2016; Patterson et al., 2017) show that where they are carefully monitored and reported, spills and leaks of wastewaters are a common, if not inevitable, part of unconventional oil and gas production:*
>
> > *"We assessed spill data from 2005 to 2014 at 31,481 UOG (unconventional oil and gas) wells in Colorado, New Mexico, North Dakota, and Pennsylvania. We found 2−16% of wells reported a spill each year." (Patterson et al., 2017).*
>
> *While Patterson et al.'s review and others from the U.S. predominantly examine wells subjected to hydraulic fracturing (which is not proposed in the Narrabri project), their review and other relevant case studies of unconventional gas in the U.S. (e.g. Lauer et al., 2016), make clear that the majority of spills and leaks are not related to the hydraulic fracturing process and occur by mechanisms that apply to all gas wells, e.g., leakage from tanks, ponds, flowlines/pipelines and connection points for these. Produced water volumes in coal seam gas – including in the Narrabri area -*

[96] Transcript, IPC Public Hearing – Narrabri Gas Project, 23 July 2020, p. 15, at 10-18.
[97] Transcript, IPC meeting with WEP – Narrabri Gas Project, 28 July 2020, p. 7, at 26.
[98] Currell, Expert Report dated 27 July 2020, p. 3.

are typically much greater than hydraulically fractured shale gas in the US (Kondash et al., 2018; Underschultz et al., 2018), and in this regard the potential for, and volume of, spills and leaks is heightened relative to shale gas (although risks at the well head associated with hydraulic fracturing are reduced – e.g. Fig. 1). It is unrealistic to expect the Narrabri gas project to be different.

155. The risk of spills and leaks from the Project is a key concern for community members and a recurring theme during the IPC hearing. Janet Thompson shared her concerns:[99]

The dead zones that gas mines have already abandoned in other locations would be replicated, where toxic sludge from produced water, full of toxins and heavy metals, is left in plastic lined ponds until heavy rain spills it and washes it into soil and waterways. Nothing grows where they've been.

156. Sam Bragg, a local landholder said:[100]

When – not if – there is another toxic spill such as the 20 times the acceptable dose of uranium that has killed a vast ..... of forest and polluted ground water that can't be rehabilitated, our properties, bores, soil, forests will become worthless and uninhabitable by us, our children, their descendants, all the wildlife we value and cherish.

157. And is it clear from the lived experience in Narrabri that these concerns are not unfounded. Numerous spills and leaks have been recorded in the area with a NSW Environment Protection Authority (**EPA**) investigation report into pollution of two groundwater aquifers (shallow and deep) as a result of leaking ponds at the Bibblewindi Water Treatment Facility finding that pollution had occurred in groundwater to depths of 33m.[101]

158. The IPC also heard from the community, supported by evidence from Mr Paull,[102] that the areas of the Pilliga previously affected by spills and leaks have not recovered, despite extensive rehabilitation efforts. Colin Hamilton, a Narromine food producer and farmer, told the IPC:[103]

I have been to and seen the numerous spill sites at the Santos coal seam gas pond in the Pilliga a few years ago. I witnessed the total wipe out of all living plants and animals in that part of the forest due to whatever the toxic mix is that this industry 10 uses or causes as part of their operation. This company, after several attempts and many millions of dollars, has failed repeatedly to rehabilitate these dead zones due to the long-lasting toxic nature of this business.

159. Anne Marett said:[104]

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[99] Transcript, IPC Public Hearing – Narrabri Gas Project, 22 July 2020, p. 27, at 1-4.
[100] Transcript, IPC Public Hearing – Narrabri Gas Project, 22 July 2020, p. 43, at 19-23.
[101] EPA, *Investigation Report.* Available at: http://d3n8a8pro7vhmx.cloudfront.net/lockthegate/pages/1160/attachments/original/1399238109/Santos_Bibblewindi_Investigation_Report_-_Final_-_To_be_released.PDF?1399238109.
[102] Paull, Expert Report dated 9 August 2020, p. 13
[103] Transcript, IPC Public Hearing – Narrabri Gas Project, 22 July 2020, p. 59, at 8-13.
[104] Transcript, IPC Public Hearing – Narrabri Gas Project, 24 July 2020, p.17, at 19-34.

In 2018 I made a visit to the Pilliga area with a group from the east coast… we moved to the site of the 2011 wastewater spill. This is a kill zone, an area contaminated by toxic spill. An accident, apparently. Two attempts to rehabilitate the site have failed. There, trees stood bare and stark or lay on the ground. This was destruction of a very permanent kind, and this was just one spill. There have been over 20 already.

160. Assoc Prof Currell describes why this potential impact is of particular concern for the Project:[105]

> *In the Narrabri project area, there are three factors which heighten the significance and potential adverse consequences of produced water spills and leaks:*
> *1. The quality of groundwater in shallow aquifers is unusually high, and groundwater quality (and availability) is of great importance to water users.*
> *2. The project area is within a recharge zone for a key Great Artesian Basin (GAB) aquifer (Pilliga Sandstone). As such, contamination incidents have wider significance than if they were to take place where recharge is limited and/or where the aquifer(s) are not extensively utilised.*
> *3. The quality of produced water from the coal seams that will be extracted, transported, stored, and treated throughout the project area is particularly poor, containing unusually high concentrations of salts and trace elements. For reference, average reported total dissolved solids content of Gunnedah Basin CSG produced water is more than five times the average from Surat Basin CSG operations (in Queensland), where DPIE conducted a field trip and consultations to assist in forming views about the project.*

161. Even a spill rate at the low end of the published literature would, in Assoc Prof Currell's opinion *'have significant potential to compromise the quality of recharging groundwater and contaminate land in the area'*.[106]

162. Even if the proposed management plan and conditions may reduce the likelihood of spills and incidents, the potential consequences are heightened by the stark difference in quality between the shallow groundwater, which is especially high quality, and the CSG produced water, which is particularly poor quality.[107]

163. Additionally, there is a lack of thorough study of recharge zones in the Great Artesian Basin (emphasis added):[108]

> *Given the significance of this issue to assessment of future groundwater quality risks, as well as the groundwater modelling… it is hard to understand why a thorough study of recharge, as well as flow paths and inter-aquifer connectivity, has not been conducted in the project area. This would have provided important information to understand the significance and consequences of potential contamination effects and more robust assessment of groundwater quality risk.* ***Such work is also required for the development of a robust numerical model for predicting impacts on groundwater quantity… as well as appropriate management and mitigation measures****. Conducting such work after approval means it is not possible to gain a* ***sound understanding*** *of potential risk level and*

[105] Currell, Expert Report dated 27 July 2020, pp. 3-4.
[106] Currell, Expert Report dated 27 July 2020, p. 4.
[107] Currell, Expert Report dated 27 July 2020, p. 5.
[108] Currell, Expert Report dated 27 July 2020, p. 7.

feasibility of impact mitigation.

164. Moreover, the groundwater monitoring network is unsatisfactory in Assoc Prof Currell's view: [109]

> *The current monitoring network has been noted by the IESC and WEP to have significant gaps, which at present would not be adequate for the purpose.*

Cross-contamination of important shallow aquifers with methane and other hydrocarbons

165. The failure of DPIE and WEP to require the applicant to incorporate recent peer-reviewed research[110] suggesting enhanced connectivity between deep and shallow geological structures in the Project area in their modelling, means that DPIE and WEP assessments of the risk of the migration of gas (methane and other hydrocarbons) and water between geological structures and aquifers is based on 'incomplete information'.[111] To proceed with the Project on this basis would be 'highly risky'.[112]

166. As Assoc Prof Currell writes (emphasis added):[113]

> *This is a key issue with major implications for predictions of water quality (and quantity) risks of the Narrabri Gas Project.* ***Leaving this unresolved at the time of an approval decision would mean current assessments of risk are based on an incomplete conceptual geological model and data sets****. As such, decision-makers and the public are being asked to make judgements about the project's merits and risks* ***without critical information incorporated into a robust assessment of the full potential impacts****.*

167. In their meeting with the IPC, members of WEP dismissed the importance of this research by suggesting the model used was 'fit-for-purpose', it is unreasonable to expect that the impacts of drilling all 850 wells would be known upfront, and that if aquifers were connected as suggested by Iverarch et al (2017 and 2020), there would be more evidence of it in the groundwater data, suggesting:

> *– if the aquifers were connected through these structural features and these faults and so on, over – over the passage of long time, you'd expect equalisation or – or – of the salt concentration. So that's one bit of evidence that suggests things are probably not very well connected at the present. The other bit of evidence is that – the different pressure gradients in the different aquifers.*

168. Evidence from Assoc Prof Currell demonstrates how this approach fails to adequately consider the risk posed by faults. In relation to methane, Assoc Prof Currell has advised NWA that:

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[109] Currell, Expert Report dated 27 July 2020, p. 8.
[110] Charlotte P. Iverach et al, 'Constraining source attribution of methane in an alluvial aquifer with multiple recharge pathways' (2020) 703 *Science of the Total Environment*.

[111] Currell, Expert Report dated 27 July 2020, p. 14.
[112] Currell, Expert Report dated 27 July 2020, p. 14.
[113] Currell, Expert Report dated 27 July 2020, p. 14.

The key finding from Iverach's work is the establishment of a pathway for migration of gas from deep in the basin to the shallow aquifers, contrary to the conceptual model adopted by Santos. The working hypothesis they develop (consistent with their data) is that the pathway for methane migration is preferential – e.g. via faults or other geological structures, and hence more rapid than would otherwise be expected if the aquitards were fully competent throughout the region (as is the assumption in Santos' modelling). Again, it is the potential for transport, via such pathways to increase in both rate and volume during CSG production that is of potential concern. The CSG extraction will depressurise coal seams and liberate a huge quantity of gas from them (most of which will flow to the gas wells, but some of which will not). If there are pathways for that gas to migrate upwards, as indicated in Iverach's paper, then this may occur rapidly and in significant quantities. We don't know this yet, but the research shows that there is a pathway and mechanism that is worthy of further detailed investigation.

169. Assoc Prof Currell notes that the information relied on by Iverarch et al (2017 and 2020) was not uniquely derived for that research and has been equally available to the applicant. This has led Assoc Prof Currell to form the view:[114]

Given the significant amount of seismic data available, as well as studies of the geological structure of the region (e.g. Tadros et al., 1993; Gurba and Weber, 2001) the fact that such information was not extensively documented and discussed in the project EIS, or incorporated into the conceptual and numerical modelling (at the very least, in the form of an alternative hydrogeological conceptualisation) is concerning.

170. Further, Assoc Prof Currell has advised that:[115]

Depressurising coal seams in the vicinity of geological structures that provide existing or potential pathways for gas transport would enhance the potential for further transport of hydrocarbon gases (predominantly methane) via these pathways (Fig. 5; Walker and Mallants, 2014). The wells sampled in Iverach et al.'s research are mostly to the north of the proposed gas development area (due to limited availability of suitable monitoring wells further to the south); however, areas where vertical transport of methane to shallow aquifers was identified are close to the northern boundary of the project area, and there is extensive evidence of geological structures – including faults - within the areas of proposed gas well development (Fig. 3). As such, there is direct relevance to the question of potential gas contamination of bores…

Based on the current available evidence, these risks are considerable in the Narrabri context.

171. Community members also expressed concern about the ability for the Project to enhance methane transport pathways, both through faults and through failings and weaknesses associated with drilling and case of wells. The IPC heard from

[114] Currell, Expert Report dated 27 July 2020, p. 14.
[115] Currell, Expert Report dated 27 July 2020, pp. 14-15.

Malcolm Donaldson, whose farm is to the east of the Project area and utilises water from the Gunnedah Oxley Basin:[116]

I am concerned that DPIE had a figure 6 on the gas well configurations, which showed Santos labelling one of their gas bores as between 300 and 800 metres deep. And I look at our bore, which is 307 metres deep, and we sort of – you get quite concerned. If the Gunnedah-Oxley Basin is depleted by Santos dewatering the deeper bores, we can expect that we will have a drop in our water levels and our bores. And as soon as we get a drop in water levels, I would expect this bore to start producing much more methane than it already does and turn our stock water supply into a gas well, if you like. So it would also mean that our bore – our bore was also identified in the original Santos EIS, but we haven't been – we have been ignored and overlooked by the latest DPIE and WEP analysis, as far as I can see. They seem to be pretty comfortable with the computer modelling and not active enough to actually go out into the real world.

172. Carol Bennett told the IPC:[117]

Many speakers have mentioned that wells fail with resultant methane emissions. According to Dr Anthony Ingraffea, the distinguished professor of engineering at Cornell University, industry records show that 6.5 per cent of well casings fail initially, 60 per cent fail over 20 years, but all fail over time.

173. Assoc Prof Currell provided the IPC with further information on this issue:[118]

Davies et al. conducted a thorough review of available oil and gas well integrity data worldwide, incorporating hundreds of thousands of wells. Their analysis shows a wide range of rates of well barrier and/or integrity failure, ranging between 1.9% to 75% of the wells in a project/region (Fig. 6). Important factors include the age of wells, their depth, geology, construction materials, surrounding geochemical environment, and regulatory requirements around drilling, monitoring, and decommissioning. Again, based on these data it is optimistic to believe the Narrabri gas project will be different to other oil and gas projects, and not encounter some percentage of wells suffering barrier or integrity failures.

174. Once drilling and gas extraction have begun, the irreversible impacts of such activities on inter-aquifer connectivity render an adaptive management approach wholly unfeasible (emphasis added):[119]

Based on the current available evidence, these risks [of the migration of gaseous hydrocarbons into aquifers] are considerable in the Narrabri context. By the time drilling and gas extraction have commenced, enhanced connectivity related to geological structures - such as increased upward leakage of gas in response to decreasing pressures within the coal seams - ***will not be able to be feasibly reversed.*** *While cross contamination with gases due to well integrity issues (see below) can in some cases be remediated through well repair works,* ***stopping the migration of gas along geological structures is not practical. This means an 'adaptive' approach (post-approval), as is inherent in the recommended conditions of consent, leaves open a***

[116] Transcript, IPC Public Hearing – Narrabri Gas Project, 24 July 2020, p. 13, at 2-15.
[117] Transcript, IPC Public Hearing – Narrabri Gas Project, 25 July 2020, p. 34, at 42-45.
[118] Currell, Expert Report dated 27 July 2020, p. 16
[119] Currell, Expert Report dated 27 July 2020, p. 15.

significant risk of major adverse outcomes which it may not be practical to mitigate.

175. Finally, despite the views of WEP and DPIE that well integrity issues can be 'managed' via adherence to the CSG Well Integrity Code, widespread international experience of breakdown in well integrity suggests that it would be 'optimistic' to believe the Project would be different.[120]

Long term risk of depressurisation and leakage from key water supply aquifers

176. In their review, the Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (**IESC**) identified:[121]

The key risks of the project include impacts to landholder bores and GDEs utilising groundwater from the Namoi Alluvium, Pilliga Sandstone and the alluvium associated with Bohena Creek. These long-term risks are due to potential groundwater depressurisation propagating from target coal seams. While the groundwater model has some degree of predictive capability in providing an early indication of the general location of impacts, it is not able to reliably indicate the magnitude of impact.

177. Depressurisation and leakage was another key concern of the community. Sarah Ciesiolka, People for the Plains, told the IPC:[122]

It is clear that groundwater depressurisation and drawdown in aquifers together with contamination is a real risk and does not respect property boundaries. The risks associated with the CSG industry are so significant that they are considered uninsurable… Water is without question the most precious asset we have. It is key to everything we do and our groundwater should not be put at risk for any reason. Afterall, it's this groundwater that saw our community through the worst drought in more than a hundred years.

178. Doug Storer, Warren Pipeline Action Group, said:[123]

People want change. People want sustainability. People want certainty. And people have a right to water and good health, both physical and mental wellbeing… People don't want our sustaining groundwater tampered with. And people don't want groundwater and Artesian Basin water depressurised

179. David Wallis, Concerned Residents against Pipelines, said:[124]

… agriculture pays and carries the scars for these projects forever... Our water source must be protected before the event and not after.

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[120] Currell, Expert Report dated 27 July 2020, p. 16.
[121] Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (IESC), *Advice to decision maker on coal seam gas project: IESC2017-086: Narrabri Gas Project* (8 August 2017).

[122] Transcript, IPC Public Hearing – Narrabri Gas Project, 21 July 2020, p. 16, at 41-44.
[123] Transcript, IPC Public Hearing – Narrabri Gas Project, 20 July 2020, p. 62, at 13-21.
[124] Transcript, IPC Public Hearing – Narrabri Gas Project, 20 July 2020, p. 78, at 45-46.

180. In order to properly assess and monitor the impacts of management or decisions on groundwater quality and quantity, the groundwater modelling must be robust. However, in the case of the Project, this is far from the case. As Assoc Prof Currell writes in his expert report (emphasis added):[125]

> *Proper groundwater modelling must first incorporate careful development of correct geological conceptual modelling, supported by extensive field data and evidence (which are currently deficient in key areas). Without the proper use of field investigations to develop a robust hydrogeological conceptualisation, any numerical modelling is likely to produce inaccurate and potentially misleading predictions.* ***This is crucial in the context of DPIE's proposed conditions, which will rely on the groundwater model to estimate indirect water usage from the project, and thus determine the volume groundwater licenses required by the applicant.***

181. In DPIE's current analysis of the impacts of the Project, the detail on depressurisation of key water supply aquifers is missing key data which must be considered upfront during Project assessment, rather than delayed and deferred to post-approval processes. As Assoc Prof Currell writes, collecting this data after approval or commencement of the Project would mean (emphasis added):[126]

> ***Analysis of the full possible range of impacts on groundwater quantity, based on a rigorous hydrogeological conceptualisation (including alternative hypotheses), is incomplete*** *– affecting the validity of modelling predictions used to assess groundwater impacts in each Water Sharing Plan zone, and appropriate water licensing.*
>
> ***Unexpected impacts – e.g. greater than predicted propagation of drawdown or leakage in areas of gas well development – may occur****. Once such impacts begin to manifest,* ***it may be practically impossible to reverse them (as re-injection of water into the coal seams will not be feasible).***

182. Assoc Prof Currell notes *'The evidence of inter-aquifer connectivity documented in Iverach et al., (2017 & 2020) indicate considerable likelihood that the modelling has under-estimated leakage rates*'[127] bringing into question DPIE's view that the current groundwater model is 'fit-for-purpose'.

183. Assoc Prof Currell goes on to say:[128]

> *This is critically important, as the determination of appropriate water allocation volumes – which the applicant will need to secure under the recommended consent conditions (see below) - is entirely dependent on the modelling (i.e., the fluxes of water from the shallow aquifers can't be directly measured and will be estimated using the model).*

184. Another area of concern, both in terms of groundwater and climate change impacts, relations to the proposal to extract gas from the Hoskissons coal seam. Assoc Prof Currell:[129]

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[125] Currell, Expert Report dated 27 July 2020, pp. 2-3.
[126] Currell, Expert Report dated 27 July 2020, p. 21.
[127] Currell, Expert Report dated 27 July 2020, p. 20.
[128] Currell, Expert Report dated 27 July 2020, p. 20.
[129] Currell, Expert Report dated 27 July 2020, p. 24.

Extraction of a small proportion of the Narrabri project's total gas from the relatively shallow (~300 m depth) Hoskissons coal seam is proposed under the project plan. This coal seam is significantly closer to the GAB (and other shallow aquifers) than the deeper Maules Creek seams that will be predominantly targeted. This means that inter-aquifer leakage and drawdown related to water and gas extraction from this seam is likely to be greater than extraction from the deeper Maules Creek seams.

185. Thus, an adaptive management approach would be wholly unsuited to mitigating these risks, particularly given the significant time-lags involved:[130]

An 'adaptive management' regime is not well suited to the context, given the significant scale, depths and hydraulic inertia within the geological basins, which mean significant time-lags will characterise the response of the hydrogeological system to gas development (as is clear from the timings predicted for peak impacts to manifest in the current modelling). These lags will also make the timely identification of impact, and linking to specific processes difficult (or impossible), and will mean remedial action(s) taken to address impacts may require lengthy periods of time to take effect (e.g. Bredehoeft and Durbin, 2009), and may ultimately be ineffective. Pitfalls of an adaptive management approach in regional groundwater systems related to such timelags are discussed in Thomann et al., (2020).

186. Furthermore, the applicant has failed to develop appropriate monitoring and mitigation mechanisms as recommended by the IESC[131] to assess the impacts of the Project on Groundwater Dependent Ecosystems (**GDEs**). Conducting this work after any Project approval will mean that *'unexpected effects on groundwater and GDEs will not be able to be adequately detected or characterised*'[132] – again, the decision makers, and the public, are being asked to form an opinion about the merits and risks of the Project on incomplete information.

187. The risks of long-term water loss, significant hydraulic inertia and time-lags pose serious questions of inter-generational equity for the IPC. DPIE appears willing to dismiss the risks of unmitigated water take on communities in the future but Assoc Prof Currell explained this remains a real risk:[133]

Another point that's really important to – to take home here is that the large groundwater systems are characterised by significant hydraulic inertia, so they respond, over a long time period, to changes that have been made at a given point in time.

This means you can actually lock in future impacts, for example, by dewatering a certain amount, that you can't see the immediate or full consequence of those impacts and can't feasibly go in and remediate or, you know, fix impacts that are beyond what you expected…

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[130] Currell, Expert Report dated 27 July 2020, p. 21.
[131] Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (IESC), *Advice to decision maker on coal seam gas project: IESC2017-086: Narrabri Gas Project* (8 August 2017).
[132] Currell, Expert Report dated 27 July 2020, p. 24.
[133] Transcript, IPC Public Hearing – Narrabri Gas Project, 23 July 2020, p. 18, at 2-10.

188. As stated by Jane Judd, Friends of the Pilliga:[134]

According to Santos, many of the impacts to water and the Great Artesian Basin may take 200 years before they become apparent. What right have we to do this to the future generations?

Analysis of Project according to Lee (2014)'s 8 key elements for an effective adaptive management regime

189. A close examination of the adaptive management regime proposed for this Project reveals that it is far from satisfactory, it is not concordant with established best practice, and it should not be applied to the Project in its current form.

190. Lee (2014) sets out 8 key elements for an adaptive management regime to be effective.[135] Assoc Prof Currell has advised EDO that the Project is deficient against each of the key elements, as set out below:

Key element (Lee (2014))	**Currell's advice**
'1. Define the management problem: *The starting point for any application of adaptive management is to carefully analyse the ecosystem, establish the baseline conditions and define the management problem'*	Baseline conditions are currently not currently adequately established in the Project area (with respect to groundwater and its associated ecosystem and water use values). As Peter Serov and the IESC explained, there has been minimal characterisation of groundwater dependent ecosystems, and Santos do not propose to conduct further baseline monitoring of these. There is also no detailed baseline data presented showing current methane concentrations in groundwater from different aquifers and areas in the region (to use as a baseline to assess potential methane contamination of bores), or characterisation of the gas isotopic compositions for baselining purposes. Groundwater flow rates (including between key aquifer units) are not well understood, as recharge rates and hydraulic conductivity values are not properly constrained with adequate field data - i.e. we do not really know how much inter-aquifer flow occurs under baseline conditions.
'2. Set clear management objectives: *Setting clear and specific objectives from*	The objectives of the groundwater monitoring and management program are

[134] Transcript, IPC Public Hearing – Narrabri Gas Project, 21 July 2020, p. 39, at 22-24.
[135] Jessica Lee, 'Theory to practice: Adaptive management of the groundwater impacts of Australian mining projects' (2014) 31 *Environmental and Planning Law Journal* 251, pp. 254-4.

the beginning is critical. Objectives play an important role in evaluating progress and directing the adjustments to be made to management actions. To be effective, objectives should be set in consultation with stakeholders and be fully integrated into the adaptive management plan and legal instruments putting it in place. Where broad policy goals apply to the management area, they must be translated into site-specific objectives. Critically, objectives should be substantive and measurable so that progress towards them can be easily shown.'	not clearly explained – although it is implied the objectives are not to cause drawdown beyond the NSW aquifer interference policy, and not to contaminate groundwater. Have groundwater users in the area been involved in the setting of management objectives in this case? Have they been asked about the importance of groundwater to them, and what would be an 'acceptable' level of impact (in terms of both quality and quantity)? How has this been incorporated into the setting of management objectives?
'3. Identify uncertainties and hypothesise: *A key part of adaptive management is formulating competing hypotheses about identified uncertainties in the ecosystem structure and the causes of the management problem. Numerical models should be built to simulate the ecosystem being managed and used to test the competing hypotheses.'*	What are the competing hypotheses that have been explored and tested through modelling? For example, based on the peer-reviewed research studies of Iverach et al, there are clearly alternative geological conceptualisations that need to be explored via modelling. In the current modelling, aquitard layers are assumed to be continuous and homogeneous. Testing an alternative scenario where faulting and/or volcanic intrusions provide pathways for water and/or gas movement in parts of the study area (consistent with field evidence), is a key hypothesis that needs exploring (this was also recommended by the IESC). Testing a wider range of potential hydraulic parameters within the model (beyond the sensitivity analysis) until these parameters are better established with field data is also warranted. Then we would have a better idea of full potential magnitude of impacts, against which to carefully monitor.
'4. Identify, select and implement management actions: *A rich set of alternative management actions should be generated based on the range of hypotheses. The alternatives should be evaluated against the probability of each hypothesis being correct, the management objectives and the model-predicted ecosystem responses to each alternative. A choice must then be made about which management action/s should be implemented. There is no set method for selection; some managers use formal optimisation methods and*	What alternative management scenarios have been proposed and/or tested at this stage? – e.g. restricting areas of gas well development (both laterally and with depth) and/or the number of gas wells? Confining all gas development to a particular depth in the system? There has been some minor assessment of alternatives in the form of modelling high, low and base-case water extractions, but this is by no means a comprehensive suite of management alternatives.

others use informal commonsense approaches. Once a choice has been made the action should be implemented until measurable changes occur in the system.'	
*'*5. Monitor ecosystem response: *It is critically important that effective indicators of ecosystem response to management actions are selected and monitored. It is this data that will show progress towards objectives, trigger changes in management and facilitate learning. A monitoring program, designating clear procedures, should be put in place to collect that data.'*	Monitoring program is yet to be developed. DPIE propose that this will happen during 'phase 1' after approval but before gas well development. It has yet to be demonstrated that there is a monitoring plan that will capture the groundwater and related ecosystem conditions such that a set of clear objectives for protecting these (in consultation with relevant stakeholders) in accordance with the steps above. Santos has argued (in its supplementary RTS) that they do not need to monitor GDE health in the area. What are the critical thresholds (e.g. groundwater levels, methane contents, GDE health indicators) that will be assessed to determine if objectives (set according to 2) are being met?
*'*6. Evaluate: *Systematic evaluation and transparent reporting of findings is an integral part of the adaptive management process.40 Monitoring data should be compared with baseline data and model-predicted outcomes to evaluate progress towards objectives and produce evidence for the most correct hypothesis. By comparing actual responses with expected and desired outcomes, managers are able to learn about the ecosystem and the effectiveness of their management actions.'*	Is this formalised within the proposed conditions of consent? How frequently will indicators of groundwater (and GDE health) be compared to model predictions and the management objectives? What will be done if/when unexpected trends in the groundwater characteristics at the site are observed? Based on current level of model uncertainty – see IESC advice - this is basically inevitable.
*'*7. Adjust: *Adjusting management actions in response to what is learned is at the heart of adaptive management. Where an action is not having the desired or predicted outcome it may be altered or replaced. Successful adaptive management requires a clearly defined system for making adjustments. The system should designate when changes should be made through the use of set trigger thresholds, the corresponding management responses if those triggers are exceeded, as well as who is responsible for making the required changes. Importantly, there must also be*	As per (4) above – what is the specific set of management actions that will be taken in response to certain levels of change/impact detected in the monitoring program (e.g. reduction in number of gas wells or permissible volumes of water extraction? Ceasing gas extraction until full extent of impacts can be determined and linked to causal mechanism, and an effective mitigation strategy implemented?) How is this defined in the conditions of consent?

sufficient flexibility in the management plan and wider legal framework for changes to be made.'	
'8. Reiterate: *Adaptive management requires that the above elements are repeated in an ongoing cycle. As the cycle continues, management evolves in response to both learning and changes in the ecosystem.'*	Where is this cycle – i.e., setting of clear management objectives, defining baseline condition and indicators of system health, monitoring key indicators against predictions, definition (and where applicable, implementation) of alternative management actions, and updating of each step as new data becomes available - formalised within the proposed conditions of consent?

191. This presents a number of problems for the IPC that were summarised by Assoc Prof Currell in his presentation:[136]

> *A good practice in hydrogeology is to first do rigorous conceptual model development based on good available field data, not do this backwards, the other way round, and without proper field investigations our numerical model is getting quite unreliable. Secondly, the decision-makers and the public are not currently presented with a proper account of the full risks and impacts of this project, and some of them may have been significantly understated. And, thirdly, the adaptive management approach that's embedded in the conditions is really risky. Ground water systems often have time lagged responses, and secondly, in terms of contamination impacts, things are really difficult to remediate once you actually contaminate an aquifers. It's a lot easier to go one way and contaminate, than it is to clean up once you've got a problem spreading through that subsurface.*

192. Assoc Prof Currell also provides the following analysis:

> *The analysis above still does not deal with the issue of time-lags - which is in my opinion probably the biggest problem with the idea of using Adaptive Management for this type of project. In a large groundwater system like this one, it is going to be practically impossible to adjust project operations to achieve a defined management objective within a reasonable timeframe (as per the above cycle). For example, it may take decades before changing the rates of water/gas extraction from the coal seams at a given time (e.g. in response to monitoring data showing a larger than predicted impact), results in the desired management outcome (e.g. limiting or reducing the rates of leakage or drawdown to pre-defined objectives).*
>
> *It is quite plausible that all of the gas (and water) extraction could be done and dusted within 25 years, before the peak or full impacts on shallow aquifers actually manifests (the current modelling already suggests this). At this point, it is quite plausible that significantly greater leakage or drawdown may occur (as the analysis of the model's uncertainties by the IESC, CSIRO and Kevin Hayley makes clear). In this case, how is the proponent going to 'adaptively manage' impacts, beyond the life of the project? They can't feasibly replace the water extracted with the gas back into the coal seams.*

[136] Transcript, IPC Public Hearing – Narrabri Gas Project, 23 July 2020, p. 23, at 25-35.

193. Ms Andrea Broughton in her presentation to the IPC expressed it thus:[137]

> *This (oversimplifying the modelling of the aquitard) could mean Santos may be using more than 100 times more water than they will be licenced for, but we wouldn't see this for decades. We know that the performance of these aquitards will have a significant effect on drawdown in the Great Artesian Basin. I do not believe the numerical model is sufficiently realistic to make predictions for the Narrabri Gas Project site.*

194. Thus, not only are the proposed adaptive management conditions for the Project manifestly inadequate, but adaptive management is inappropriate for the Project. Accordingly, the proper application of the precautionary principle to the Project suggests that is inappropriate to adopt an adaptive management approach. Rather, the appropriate precautionary measure is to refuse consent to the Project outright (particularly as the whole of the Project is before the IPC for determination), in line with the concept of preventative anticipation.

Conclusion

195. The precautionary principle is enlivened by the Project's groundwater impacts because:

a. there is a threat of serious or irreversible environmental damage (including likely or probable direct and indirect threats, secondary and long-term threats and the incremental or cumulative impacts of multiple or repeated actions or decisions), based on the expert evidence of Assoc Prof Currell and Dr Hayley; and
b. there is considerable or substantial scientific uncertainty as to the environmental damage, based on the expert evidence of Assoc Prof Currell and Dr Hayley.

196. This is contrary to the evidence provided by the applicant and DPIE, who have denied that the precautionary principle is activated. For example, David Kitto told the IPC at the public hearing that '*none of our assessment has identified any potential significant or irreversible harm that would result from the project. And, in our [DPIEs view], the project does not trigger the precautionary principle*'.[138]

197. On any reasonable view of the expert evidence, the IPC would prefer the interpretation of the evidence of Assoc Prof Currell and Dr Hayley over the evidence of the applicant and DPIE and find that the precautionary principle has been enlivened.

198. Dr Hayley's review of the numerical groundwater modelling conducted for the EIS reports that the methods used likely underestimate the uncertainty in groundwater impacts due to the Project. This means that a hypothesis that the Project *will* have an adverse impact on groundwater is also valid and fits the observation data.

[137] Transcript, IPC Public Hearing – Narrabri Gas Project, 23 July 2020, p. 79, at 1-8.
[138] Transcript, IPC Public Hearing – Narrabri Gas Project, 20 July 2020, p. 25.

199. Assoc Prof Currell reports that the potential risk of produced water leaks and spills above a high-quality GAB aquifer, cross contamination of groundwater with hydrocarbons, and inter-aquifer leakage and drawdown of groundwater from important shallow aquifers have not been adequately addressed by the modelling and/or data in the applicant's or in DPIE's review. The result is that the full realistic range of potential impacts from the Project has not been presented at this assessment stage.

200. As the precautionary principle is activated, the IPC must apply a proportionate response to the risks and uncertainties inherent in the Project. Applying the proportionality analysis in *Telstra* to the Project, the IPC would reasonably conclude that an adaptive management approach to the Project should be rejected and a greater degree of precaution be applied. The IPC would reasonably conclude that the only precautionary measure which would be proportionate to the threat of serious or irreversible environmental damage and considerable or substantial scientific uncertainty as to the environmental damage is refusal of development consent for the Project, in line with the concept of preventative anticipation.

B. ECOLOGICAL/BIODIVERSITY IMPACTS

201. NWA commissioned 3 independent expert reports in relation to ecological impacts from:

a. Mr David Milledge – Faunal ecology expert – expert report 9 August 2020;

b. Mr David Paull – Terrestrial ecology expert – expert report 9 August 2020; and

c. Dr Peter Serov – Aquatic ecology and Groundwater Dependent Ecosystems expert– expert report dated 8 August 2020.

202. These expert reports identified that uncertainty about the location of gas infrastructure as well as the scale of direct and indirect impacts has made a transparent assessment of the biodiversity impacts of this Project impossible. Nonetheless, from the information that has been provided, and in consideration of the ecological importance of the area, it is clear that there will be serious threats to locally, regionally and nationally important biodiversity.

203. The Pilliga Forests constitute an important refuge area for wildlife, containing high conservation-value relatively pristine patches, which are part of a National Biodiversity Hotspot. There are several endemic species and ecological processes facing high levels of ongoing threat. The irreplaceability of the local biodiversity is of the highest order.

204. The evidence presented to the IPC has demonstrated that the installation and operation of the 850 gas wells will result in the following detrimental impacts:

a. increased fragmentation of a landscape already under severe environmental stress, and increased disturbance from an increase in vehicle movements, dust, noise and lighting associated with gas mining operations;

b. significant risks to aquatic ecosystems and groundwater dependent ecosystems, including stygofauna which are likely to be new to science and

endemic to the Pilliga;

c. direct impacts on terrestrial ecosystems and species, the scale of which remains inadequately assessed and improperly quantified but is likely to be higher than predicted, particularly when considering cumulative impacts resulting from the exacerbation of perturbations already operating in the Project area due to climate change and forestry operations; and
d. insufficient and inappropriate mitigation of impacts through the use of biodiversity offsets.

205. In light of the Project's adverse ecological and biodiversity impacts, approval of the Project would be contrary to the public interest and the principles of ESD, including the precautionary principle, the conservation of biological diversity, and the principles of intergenerational equity and intragenerational equity.

Increased fragmentation

206. The Project will result in significant fragmentation of a major patch of the largest remaining stand of the Pilliga Forests. Mr David Milledge advises that:[139]

The 0.5 million hectares of the Pilliga Scrub comprise the largest, relatively unfragmented stand of temperate, semi-arid forest and woodland in eastern Australia (NICE and CUCCLG 2012, Lunney et al. 2017). It constitutes a major refuge for the biodiversity of these ecosystems, particularly their threatened vertebrate species, as an island in a sea of agricultural development.

207. This makes the Pilliga Forests, a large proportion of which is included in the Project area, a stronghold, particularly for threatened vertebrate species. Importantly, it is the Pilliga's landscape-scale ecological integrity that supports viable populations and increases the opportunities for species to adapt to the impacts of climate change. This is particularly true for species with large home ranges, complex social ecologies, and dependence on the particular attributes of old-growth forest and woodland, such as large tree hollows.

208. Threatened species dependent on woodland and forests in the Project area include:[140]

a. Pale-headed Snake *Hoplocephalus bitorquatus;*

b. Barking Owl *Ninox connivens*;

c. Eastern Pygmy-possum *Cercartetus nanus*;

d. Black-striped Wallaby *Macropus dorsalis*;

e. South-eastern Long-eared Bat *Nyctophilus corbeni*; and

f. Pilliga Mouse *Pseudomys pilligaensis*.

[139] Milledge, Expert Report dated 9 August 2020, [6].
[140] Milledge, Expert Report dated 9 August 2020, [10].

209. Fragmentation will result from the Project as a consequence of the extensive network of tracks and pipe easements that must occur for the Project to proceed. The DPIE suggests that the Field Development Protocol will be used to minimise impacts on ecosystems and species but this protocol cannot mitigate against the fragmentation and associated species impacts that will occur. Rather than the impact of clearing being limited to the 1,000ha of impact that the DPIE has stated is *'1,000 hectares of clearing, which should never be – should never happen'*[141] the impact of the Project throughout the Pilliga Forest Project area is likely to be extensive. As expressed by Jane Judd from Friends of the Pilliga:[142]

Each road, pipeline, WellCAD vent changes the ecosystem. Wide gas pipeline corridors and gathering lines already radiate out from Bibblewindi and Leewood. Add to that the corridor for the inland rail and the clearing of the fence for the Rewilding Project and it's death by a thousand cuts. The integrity of the forest is challenged. Massive fragmentation occurs.

210. The consequences of this fragmentation can be severe. Mr Paull advises:[143]

Tracks and pipe easements vary in width, though even gaps in vegetation of a few metres is wide enough to inhibit the essential behavioural patterns of many species of small vertebrates and invertebrates. The fragmenting effects of tracks and roads on wildlife is well studied internationally, as Wilbert et al (2008) point out that there are "… hundreds of scientific papers covered in the literature reviews … illustrate the preponderance of evidence that routes ranging from narrow dirt tracks to paved roads can and do have adverse affects on wildlife. In fact, habitat fragmentation from roads and other human infrastructure has been identified as one of the greatest threats to biological diversity worldwide."

211. Fragmentation also exposes species to other risks through mechanisms commonly known as edge effects, most notably in this case, increased levels of feral animal predation, a known key threatening process. Mr Paull expressed the view that:[144]

The impact of increased predation in the forest following high levels of internal fragmentation cannot be offset or mitigated in any meaningful way. The result being that these small species (including the Pilliga Mouse, Eastern Pygmy Possum and Black-striped Wallaby are likely to undergo increased risk of local extinction.

212. The DPIE has suggested that the IPC can be confident that impacts such as this are appropriately dealt with by the proposed offset strategy. This view is in direct contrast to Mr Milledge who says:[145]

Impacts on populations of key threatened vertebrate species as well as on a number of other threatened vertebrates with core populations in the Pilliga are likely to be severe and irreversible. This is because they are unlikely to be alleviated by proposed mitigation measures or compensated for by the use of offsets.

[141] Transcript, IPC Public Hearing – Narrabri Gas Project, 1 August 2020, p. 89, at 10.
[142] Transcript, IPC Public Hearing – Narrabri Gas Project, 21 July 2020, p. 38, at 37-41.
[143] Paull, Expert Report dated 9 August 2020, p. 12.
[144] Paull, Expert Report dated 9 August 2020, p. 16.
[145] Milledge, Expert Report dated 9 August 2020, [45].

213. These impacts arise as the application of the *NSW Major Projects Offset Policy* (**Offset Policy**) to this Project fails to protect species in two important ways. The first is that the true impacts of this fragmentation occurs as indirect impacts, rather than the direct clearing impacts primarily accounted for in the Offset Policy. As Mr Paull notes:[146]

In the Project Description for the EIS, Santos however presents an 'indicative layout' of the Narrabri field (Figure 2). This figure also suggests the extent of new access roads will be a significant proportion of the total clearing within the forest itself…

214. And:[147]

> *Indirect impacts can be much more significant impacts on wildlife in diffuse development layouts such as gas fields than in projects with a low edge to area ratio. These have been poorly considered in the EIS.*

215. While the EIS did give some consideration to indirect impacts, in Mr Paull's view the approach taken by Santos gives *'a poor assessment of the potential extent of a range and extent of impacts which may arise from gas development'* and was inconsistent with the requirements of the Framework for Biodiversity Assessment.[148] Indirect impacts also include light pollution, noise pollution, edge effects on vegetation, increased levels of weed invasion, increased vehicle collisions, increased risk of bushfire and water and soil contamination. Further, several threatened fauna species will be disproportionately impacted by these indirect impacts.[149]

216. Secondly, the Offsets Policy is likely to result in a change from a large, continuous area of habitat to patches of habitat spatially distant from the main Pilliga block - patches which have also already suffered the impacts of fragmentation. These smaller patches are also likely to be lacking viable populations of the impacted species. In Mr Milledge's opinion:[150]

Such land is also likely to have already suffered the effects of fragmentation and, in accordance with the principles of island biogeography (MacArthur and Wilson 1967, Terborgh 1974, Diamond 1975), may have already lost many of the specialised threatened species that are supposedly being compensated for by offsetting.

Even if potential offsets containing species such as the Barking Owl, Black-striped Wallaby, South-eastern Long-eared Bat and Pilliga Mouse are currently available in the region, these are likely to be significantly smaller in area than the main Pilliga block and can be expected to lose these specialised species in future as climate change perturbations begin operating at an increased frequency.

217. It is clear from the responses provided by DPIE on 1 August 2020 that the replacement of a large contiguous habitat with small patches is not merely a risk, but a likely outcome. Mr Kitto stated:[151]

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[146] Paull, Expert Report dated 9 August 2020, p. 6.
[147] Paull, Expert Report dated 9 August 2020, p. 10.
[148] Paull, Expert Report dated 9 August 2020, p. 11.
[149] Paull, Expert Report dated 9 August 2020, p. 3.
[150] Milledge, Expert Report dated 9 August 2020, [35-36].
[151] Transcript, IPC Public Hearing – Narrabri Gas Project, 1 August 2020, p. 89, at 32-36.

...It may well be that, you know, the offsets are distributed over many, many properties and a number of farmers may make money, and that's how the government policy is supposed to work, and it would be focusing on existing biodiversity values rather than taking productive land out and carrying out measures to make it, you know, conservation land

218. Mr Milledge concluded his evidence at the public hearing by offering the following powerful analogy for this approach:[152]

Perhaps, just in finishing I could invoke the analogy of the science writer, David Quammen, in his book Song of the Dodo, where you take a fine Persian carpet, you look at its integrity, you see the connections of the weaving, and then take a knife and you cut it into, say, 20 small pieces, and from this fine Persian carpet you - you still have the same area, but do you have 20 fine throw rugs from this carpet. No, what you have are 20 useless pieces of carpet, that are all unravelling at the edges, and I think this mirrors the issues we're facing with biodiversity conservation, particularly in Western New South Wales today, and I might finish there.

Groundwater Dependent Ecosystems

219. The impact on Groundwater Dependent Ecosystems (**GDEs**) and populations of stygofauna in the Project have been severely underestimated and are likely to include impacts on endemic stygofauna species.

220. In response to a question to WEP from the IPC, the IPC heard Prof Cook's view that there is likely to be very little stygofauna in the region. This view was largely based on an assumption that water has been moved around extensively in the area and endemic stygofauna are unlikely to remain.[153] But it must be noted that this view appears to be based purely on an assumption rather than evidence, as the EIS failed to undertake an appropriate assessment of stygofauna and groundwater dependent ecosystems.

221. In his expert report to the IPC Dr Peter Serov, an expert in this field, told the IPC that the EIS contained an inappropriate and insufficient sampling of stygofauna within and downstream of the Project and over a sufficient period. This problem was exacerbated by:

a. Over-simplification of the definition of GDE by relying on Eamus and Froend's classification from 2006, which Dr Serov describes as:[154]

> *an outdated and overly simplified classification that gives a false representation of the number of GDE types present allowing for the misidentification and under representation of the number and diversity of GDE's within a defined area*…[and] *for important, sensitive ecosystem types to be ignored and therefore not included in the assessment*

b. Misinterpretation of groundwater cues, significantly understating ecological values;

[152] Transcript, IPC Public Hearing – Narrabri Gas Project, 23 July 2020, p. 34, at 15-25.
[153] Transcript, IPC meeting with Water Expert Panel – Narrabri Gas Project, 28 July 2020, pp. 21-22.
[154] Serov, Expert Report dated 8 August 2020, p. 8.

c. Use of inappropriate methodologies to assess aquatic ecosystem conditions. These include the use of rapid assessment technique AUSRIVAS, which cannot detect 'sensitive or short-range endemic species', as well as the reliance on satellite imagery to assess the presence and therefore dependence on groundwater in the absence of sampling in the field;

d. Absence of an appropriate interpretation of the aquatic ecology in relation to water-dependent flora and fauna, with the omission from discussion of:

   i. Macroinvertebrate fauna – which can be '*strong indicators of water permanence and possible groundwater dependence*';[155]
   ii. Important sensitive species such as freshwater mussels and other organisms – with a significant study having previously identified '*a surprisingly rich and relatively intact aquatic native molluscan fauna'*;[156]
   iii. mischaracterisation of stygofauna as soil fauna;

e. Failure to conduct longer-term monitoring data collection to adequately support an inference of groundwater dependency;

f. Inadequate sampling of stygofauna –including a very limited sample size, issues with stygofauna sampling site selection, use of ineffective sampling techniques, and the crucial omission of the rich stygofauna community at Maules Creek. On this point, Dr Serov concludes:[157]

> *Therefore, it would appear that the sample sites chosen were non representative of the major aquifers, very limited in aerial coverage and number of sites and used inappropriate methods to sample the baseflow hyporheic environment of the main streams i.e. Bohena Creek.*

g. Oversimplification of the varied drawdown levels across the landscape, based on the incorrect assumption that drawdown will be uniform across the site and therefore impacts on GDEs will also be uniform;

h. Use of threatened species and threatened community lists to assess GDEs – which are completely inadequate and misleading since such lists often disregard GDEs:[158]

> *Most (~99%) of the fauna associated with many GDE types but particularly subterranean GDEs have never been described. The few species that have been listed are from caves and these are very few in number. In addition, most subterranean fauna typically have small ranges and are highly endemic and most areas have not been sampled previously. Therefore, the fact that there is currently no listing of threatened species in an area that has very limited surveys conducted does not mean there are no potential threatened species. In contrast, the fact that there have been so few surveys indicate that*

[155] Serov, Expert Report dated 8 August 2020, p. 12.
[156] Serov, Expert Report dated 8 August 2020, p. 12.
[157] Serov, Expert Report dated 8 August 2020, p. 12.
[158] Serov, Expert Report dated 8 August 2020, p. 9.

any fauna found there in the future will most likely new [sic] *to science, be of high conservation value and as the threat from CSG increases, would therefore likely to be added to the threatened species lists.*

222. In direct contrast to the EIS and the assumptions of the WEP, Dr Serov, who has conducted numerous studies in stygofauna in the area, identified the presence of stygofauna at the majority of the bores appropriately tested:[159]

significant stygofauna community exists within the shallow alluvial aquifers and the deeper sandstone aquifers across the Pilliga and adjacent aquifers and have been recorded on multiple occasions.

223. Further, the EIS suffers from a failure to recognise the Pilliga's high ecological value and inclusion in the Lowland Darling aquatic Endangered Ecological Community (**EEC**) under the *Fisheries Management Act 1994* (NSW), or that the Pilliga contains significant recharge zones for the Great Artesian Basin groundwater source. As a consequence, all GDEs within the Pilliga should be considered of High Ecological Value.[160]

224. Dr Serov further notes that the Pilliga streams are uniquely undisturbed compared to the nearby Namoi River and wetlands to the west of the Project site:[161]

Bohena Creek had higher biodiversity than the Namoi River and Narrabri Creek, and contained 11 taxa not found in the Namoi River sites. As the Namoi is a regulated system and highly impacted, the undisturbed Pilliga streams should be considered as a refuge area for aquatic macroinvertebrates

225. The evidence of Dr Serov demonstrates that GDEs in the Project area form a unique ecosystem of high ecological value, despite Santos' suggestion to the contrary:[162]

The sand-based stream ecosystems present in this area are a unique ecosystem type. While generally having a lower biodiversity than other regions, they are unique in their geomorphology and faunal associations; are part of an EEC; have water level sensitive fauna and locally restricted fauna; have fauna that occur at the edge of their ranges; have a higher biodiversity in some groups than the rest of the region; and have habitats that are regional refuges, and therefore of high value.

226. This concern is elaborated on by Mr Paull who found, in relation to the Santos assessment:[163]

This is a failure of 'due diligence' as many water features in the Namoi Alluvium Water Sharing Plan have not been assessed. Santos' consultants also misrepresented the biodiversity values of these ecosystems - for example, erroneously described the Bohena Creek system as being in a poor condition. The assessment undertaken by independent groundwater specialist (submission by Dr Serov, Stygoecologia) has

[159] Serov, Expert Report dated 8 August 2020, p. 4.
[160] Serov, Expert Report dated 8 August 2020, p. 3.
[161] Serov, Expert Report dated 8 August 2020, p. 14.
[162] Serov, Expert Report dated 8 August 2020, p. 9.
[163] Paull, Expert Report dated 9 August 2020, p. 9.

shown in fact the aquatic ecosystems in the Project Area have a 'high condition', with a high aquatic biodiversity with endemic species of stygofauna.

Had the Bohena Creek alluvial system (including above and underground water features) been assessed properly, it would have matched all the necessary criteria for being a 'high priority' and therefore 'sensitive'.

227. Furthermore, according to Dr Serov, the assessments of impacts on GDEs that were undertaken omitted the full suite of potential impacts on GDEs including:

a. Contamination of surface water and aquifers by methane, wastewater and the mixing of water between naturally disconnected aquifers with different water chemistries including oxygen and salt levels and ionic composition, and

b. Drawdown, particularly on sensitive ecosystems, such as the streams, and wetland sensitive organisms such as freshwater molluscs (mussels), crustaceans and some aquatic insect groups and the GDE terrestrial flora community. Any discussion of the speed, timing or frequency of drawdown in alluvial and Pilliga Sands aquifers is conspicuously absent. Yet according to Dr Serov:[164]

> *[t]his is a significant factor that needs to be considered as the rate of drawdown is a critical factor for terrestrial vegetation communities dependent on groundwater as well as the water level sensitive surface aquatic fauna and the stygofauna present in thin water bearing zones...*
>
> And there is
>
> *a complete lack of understanding of which terrestrial vegetation is considered to be groundwater dependent. The EIS does not relate the dependency of the surrounding terrestrial GDE vegetation or other vegetation e.g. rooting depths of known groundwater dependencies of terrestrial species such as. Red Gum and Rough-barked Apple (known as phreatophytes with specific rooting depths) to actual groundwater depths."*

228. In his presentation to the IPC, Dr Serov summarised these issues as follows (emphasis added):[165]

…the risk of impact** from water quality changes, water level changes, **is regarded as high** as any change in water quality parameters outside the natural range can adversely impact subterranean systems. Any changes in the water level across the region will impact the terrestrial systems and the surface water ecosystems, which are very shallow. **The most important concept to consider here is that, once these ecosystems are lost, there's no rehabilitation or recolonisation, as they can't come from anywhere else, and this is particularly in the subterranean ecosystems. Once they are gone, they're gone forever. And the impacts posed by Santos are likely to have severe and irreparable damage.

[164] Serov, Expert Report dated 8 August 2020, p. 4.
[165] Transcript, IPC Public Hearing – Narrabri Gas Project, 23 July 2020, p. 43, at 21-30.

229. Evidence discussed elsewhere in these submissions, shows that the applicant's assumptions regarding the risk of impacts such as water source contamination and groundwater drawdown are insufficiently supported by the scientific evidence.

230. As noted previously, in *Newcastle & Hunter Valley Speleological Society Inc v Upper Hunter Shire Council and Stoneco Pty Limited* (2010) 210 LGERA 126, Preston CJ considered the application of the precautionary principle in the context of an objector appeal under (former) s 98(1) of the *Environmental Planning and Assessment Act 1979* (NSW) against the approval of a limestone quarry. An issue that arose was whether the limestone on the development site was likely to contain caves and other karst features and cave-dwelling fauna. His Honour in that case stated (at [177]-[179]) (emphasis added):

In the present matter, although there is an absence of site-specific information on biota in the limestone, the presence of biota in caves and groundwater in the near vicinity of the site and the increasing number of studies elsewhere that establish the presence of biota in limestone, make it scientifically likely that some form of biota will be found within the limestone on the site. ***Without being able to predict the particular species which would be present, it is beyond a mere possibility that biota will be present. This scientific likelihood is sufficient to engage the precautionary principle.***

…

The precautionary principle is therefore activated. The Court should assume that there will be a serious or irreversible threat of environmental damage and take this into account, notwithstanding there is a degree of scientific uncertainty about whether the threat really exists: Telstra Corporation Ltd v Hornsby Shire Council *at [150], [152]. Lack of full scientific uncertainly is not to be used as a reason to postpone taking measures to prevent environmental damage.*

231. Applying the principles in that case to the Project, and based on the evidence of Dr Serov and Mr Paull, *it is scientifically likely, beyond a mere possibility*, that the Project site contains significant and unique stygofauna communities and other GDEs that will be seriously and irreversibly harmed by the Project. The precautionary principle is activated in this regard.

Direct impacts on species and communities

232. The independent experts commissioned by NWA have identified that there are significant deficiencies in the impact assessment that mean that the impact of the Project is likely to be larger than predicted by the EIS. These include:

a. The survey effort undertaken for the environmental assessment for some key threatened species, namely the Koala, Pilliga Mouse, Eastern Pygmy-possum and the Five-clawed Worm-skink was insufficient and this has inhibited a proper assessment of impacts;

b. The scale of the direct impact of the Project through vegetation removal is not certain. Based on experience from other CSG fields, including those belonging to the applicant, figures provided by Santos for the Project are likely to be under-estimates. Further, the Field Development Protocol does

not exclude impacts on any sensitive ecosystems or EECs and allows an upper limit to clearing, rather than avoidance; and

c. Cumulative impacts considered by Santos only included those previously undertaken for gas infrastructure. As such, it has completely omitted to consider the 'historic impact' of previous forestry operations in the Project area, or ongoing mining operations such as the Narrabri Underground Mine.

233. Mr Milledge and Mr Paull identify a number of species that, in combination with cumulative effects, will have a heightened risk of localised extinction as a result of the Project, including the Black-striped Wallaby, the Pilliga Mouse, Eastern Pygmy-possum, and the Five-clawed Worm-skink.[166] As a consequence, the Project is likely to have irreversible impacts on biodiversity of state, national, and even international significance.

Survey effort

234. According to the independent experts, there is an obvious absence of credible and robust baseline data on key threatened species to inform the setting of avoidance, mitigation, and management objectives.[167] As Mr Milledge writes, the measures proposed by Santos have been fundamentally compromised by:[168]

inadequate field survey work that… failed to obtain sufficient records of key threatened species to inform an adequate assessment of potential impacts on these species and provide the basis for the design of satisfactory mitigation measures.

235. Similarly, Mr Paull writes (emphasis added):[169]

The EIS suffered from what appeared to be a lack of survey success for a number of key threatened species that occur in the Project Area. EcoLogical, the consultants which carried out Santos' ecological field work, surveyed according to recommended minimum requirements ***yet significantly under-reported*** *several threatened species which occur in the Project Area. In addition, references regarding habitat preferences on key species were not adequately canvassed in the scientific literature. The combination of these issues has resulted in poor habitat and impact assessments in the Narrabri Gas Project EIS, which have persisted in the Assessment Report and recommended Conditions of Consent and have* ***inhibited a more accurate assessment of their impact and offset requirements.***

236. In his presentation to the IPC, Mr Milledge provided an example of these failings:[170]

[166] Milledge, Expert Report dated 9 August 2020, [35-39] and Paull, Expert Report dated 9 August 2020, pp. 14-16 and pp. 21-23.
[167] Milledge, Expert Report dated 9 August 2020, [37] and Paull Expert Report dated 9 August 2020, pp. 20-23.
[168] Milledge, Expert Report dated 9 August 2020, [25].
[169] Paull, Expert Report dated 9 August 2020, p. 20.
[170] Transcript, IPC Public Hearing – Narrabri Gas Project, 23 July 2020, pp. 31, at 42-45 and p. 32, at 1-2.

…just for example in the four years that Santos conducted surveys in the Pilliga they were only able to find five individuals of two of the key species, the south-eastern long-eared bat and the Pilliga Mouse. Five individuals in four years, whereas the rapid assessment survey that we conducted in 2011 we recorded 21 individuals of the south-eastern long-eared bat and 25 individuals of the Pilliga Mouse, and this was in only a 10-day period.

237. This failure to adequately identify species and their habitats has significant consequences. As articulated by Ms Eleanor Lawless from The Wilderness Society during the public hearing:[171]

The future of the Pilliga Mouse is threatened by this project, due to the increased fragmentation from access tracks and dispersed clearance, potentially creating unfavourable micro-climates, open space, and traffic disturbances. The loss of habitat is significant. It might be a small brown mouse, but it is our small brown mouse, and we cannot fail it.

238. The considerable limitations of the surveys conducted by EcoLogical thus create unacceptably high levels of scientific uncertainty as to the true extent and risk of serious or irreversible harm to biodiversity eventuating if the Project is approved.

Scale of impact is uncertain

239. It is clear that Santos has failed to appropriately apply the offset hierarchy of 'avoid, minimise, offset'. Instead of making any meaningful attempt to address the first step in this hierarchy – to avoid adverse impacts on biodiversity – avoidance has been left to management plans and a Field Development Protocol. As Mr Paull writes:[172]

...the modelled approach with 'upper disturbance limits' as proposed by Santos is at variance with the concept of avoidance...

240. These issues are demonstrated by Santos' proposal to clear three threatened ecological communities, two of which are Commonwealth listed, rather than site Project infrastructure to avoid them. Mr Paull notes that of these, one could easily have been avoided, while for another, the proposed area to be cleared has increased during the assessment process.[173]

241. Furthermore, as Mr Milledge notes, there are frequent qualifications on the extent of protection afforded to threatened species. Statements abound in the DPIE Assessment Report referring to the protection of threatened species to the greatest extent 'possible', or 'where practicable', with measures being dispensed with where they are not 'feasible or reasonable'.[174] These qualifications greatly weaken the protections purportedly afforded by the proposed measures:[175]

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[171] Transcript, IPC Public Hearing – Narrabri Gas Project, 24 July 2020, p. 35, at 5-10.
[172] Paull, Expert Report dated 9 August 2020, p. 8.
[173] Paull, Expert Report dated 9 August 2020, p. 9.
[174] Milledge, Expert Report dated 9 August 2020, [30]; DPIE, *Narrabri Gas Project (SSD 6367) Assessment Report* (June 2020); Santos, *Narrabri Gas Project Environmental Impact Statement* (2017) 'Executive Summary'.
[175] Milledge, Expert Report dated 9 August 2020, [30].

engendering little confidence in the process and suggesting that protection of these values cannot be guaranteed even if they are identified.

242. In Mr Milledge's opinion, the complete reliance on micro-siting surveys under the Field Development Protocol to identify threatened vertebrate values is misguided and the evidence suggests that '*this approach is unlikely to be effective as assessments will be limited in time and in relation to season*'.[176]

243. The environmental management concept of avoidance is consonant with the legal concept of preventative anticipation, which Preston CJ in *Telstra* held to be inherent to the precautionary principle. Thus, the rationale underlying both environmental policy and the law justifies a higher degree of precaution in relation to biodiversity impacts, and this is especially the case in relation to this Project.

Cumulative impacts

244. In relation to cumulative impact Mr Milledge explains:[177]

Although the Pilliga forests and woodlands currently possess a high level of faunal habitat integrity and support significant populations of threatened vertebrates, they have been subjected to past and on-going environmental stresses that have already had detrimental effects on biodiversity (Lunney et al. 2017, Milledge 2004, 2017, Niche Environment and Heritage 2004, Parnaby et al. 2010a, b). This has included the apparent extinctions of a number of bird and mammal species including the Malleefowl Leipoa ocellata, Squatter Pigeon Geophaps scripta, Western Quoll Dasyurus geoffroii, Western Barred Bandicoot Perameles bougainville, Bilby Macrotis lagotis and Brush-tailed Rock-wallaby Petrogale penicillata (NICE and CUCCLG 2012) and appears to be a continuing process, as illustrated by the decline of the Koala Phascolarctos cinereus (Lunney et al. 2017).

Recent past perturbations such as drought, extreme temperatures and wildfires have resulted in a severe decline in the Pilliga Koala population that 20 years ago was considered to be the most important west of the Dividing Range in NSW (Lunney et al. 2017). This population has now been described as "completely unviable" or functionally extinct (NSW Legislative Council 2020) and forewarns the potential losses of other threatened vertebrate populations, particularly with the increase in frequency and intensity of these perturbations predicted for the Pilliga under climate change scenarios (Lunney et al. 2017, OEH 2014).

245. Community members also expressed their concern about the impacts of current and future climate change on wildlife, including koalas. Margaret Louse told the IPC:[178]

> *As a board member of Friends of Koala Incorporated, I know that the largest koala population west of the Great Dividing Range will be seriously jeopardised if gas fields here are established. After last year's devastating bushfires, millions of people from all over the world sent donations to ensure*

[176] Milledge, Expert Report dated 9 August 2020, [29].
[177] Milledge, Expert Report dated 9 August 2020, [17-18].
[178] Transcript, IPC Public Hearing – Narrabri Gas Project, 1 August 2020, p. 11, at 12-17.

that koalas could get the care they needed but here at home, we're considering building 850 gas wells in the midst of some of their last habitat. Clearly, we can do better.

246. Further:[179]

The report argues that the NSW Government's 2005 strategic land use planning outcomes for the Pilliga struck a balance between competing land uses, but fails to recognise that the reserves created for biodiversity and/or cultural heritage conservation did not adequately protect the most important areas for conservation. The status of some reserves also allows activities other than conservation management that are detrimental to biodiversity conservation. Significantly, the zoning has enabled resource extraction to occur in areas of high biodiversity value such as the Pilliga Outwash Subregion of the Interim Biogeographic Regionalism of Australia (Australia's Bioregions (IBRA), Department of Agriculture, Water and the Environment website, accessed July 2020).

247. This failure to adequately account for cumulative impacts, which are required to be considered as part of the application of the precautionary principle,[180] is likely to result in the impacts of the Project being significantly underestimated. Without a proper understanding of the true impacts of the Project, it is impossible to set meaningful, substantive limits on the environmental impacts of the Project, a precondition for the use of adaptive management.

Biodiversity offsets

248. Despite the reliance on proposed biodiversity offsets to mitigate against biodiversity impacts, no feasibility analysis has been undertaken to verify that the offset arrangements can indeed be effectively implemented based on the existing vegetation available. As noted by Mr Paull (emphasis added):[181]

The DPIE has made it a requirement that Santos retire 70% of their credits prior to construction in the form of land-based offsets. The DPIE claims in its Assessment Report that Santos has demonstrated that there is more than enough land in the region that could be used to retire these credits. But ***no feasibility analysis has been undertaken to provide some surety on the availability of lands for agreements or their suitability to meet the specific requirements of the credits required.***

249. Proper application of the Offset Policy requires crucial verification from ground-truthing and field-based sampling. The applicant's failure to do so creates an unacceptably high degree of scientific uncertainty as to whether the required vegetation is actually available. One illustrative example is in relation to Santos' proposal to offset its clearing of up to 45 ha of Brigalow woodland (emphasis added):[182]

Santos is proposing to clear up to 45 ha of Brigalow woodland and 'derived

[179] Milledge, Expert Report dated 9 August 2020, [21].
[180] *Telstra*, [130].
[181] Paull, Expert Report dated 9 August 2020, p. 18.
[182] Paull, Expert Report dated 9 August 2020, p. 18-19.

grassland' requiring an offset in the order of some 350-400 ha if current guidelines on offset ratios are to be accepted...

Judging by current status of this community, it is apparent that this quantity of Brigalow would be very difficult to find, and certainly does not exist in in the form of large remnants, the Brigalow Park reserves being the largest in NSW. Other patches may exist in Queensland, outside the NSW Offset Policy guidelines.

250. Furthermore, the offset scheme proposed fails to mandate a 'like-for-like' approach in selecting offsets, and has no provision for auditing to gauge the effectiveness of the offsets in achieving intended outcomes.[183] As Mr Milledge writes (emphasis added):[184]

In the case of the Narrabri Gas Project Area, the ***potential for unavoidable impacts on threatened vertebrates being offset by a number of small, isolated patches of habitat spatially distant from the main Pilliga block and lacking populations of the impacted species appears a likely outcome.*** *Although Santos claims that more than the total area of land necessary to meet offsetting requirements exists in the region (DPIE 2020), no details have been provided as to how this would allow for the retirement of credits for relevant "species credit species" or cater for habitat loss of the numerous ecosystem credit species...*

Consequently, together with the uncertainties associated with effectively compensating for impacts on ecosystem credit species (as described above) the majority of threatened vertebrates with important populations in the Narrabri Gas Project Area are ***unlikely to have their habitat losses compensated for by offsetting.***

251. One example is the proposal to offset impacts to the *'endangered, isolated and significant endemic population'*[185] of the Black-striped Wallaby *Macropus dorsalis*. Given that 90% or more of the population's known distribution is within the Project area, biodiversity offsets are simply not feasible to reduce impacts on this species.[186]

252. Furthermore, in relation to the entire group of declining woodland bird species designated as ecosystem credit species,[187] most of which have core populations in the Pilliga, the Project is likely to have *'serious and irreversible impacts leading to localised extinctions'*.[188] The biodiversity offsets similarly offer extremely weak protection for hollow-dependent species, koalas, or small sensitive animals.[189]

253. In his evidence to the IPC, Mr Milledge went so far as to say:[190]

offsetting, which is the other arm of mitigating the impacts on threatened species

[183] Milledge, Expert Report dated 9 August 2020, [33].
[184] Milledge, Expert Report dated 9 August 2020, [35, 37].
[185] Paull, Expert Report dated 9 August 2020, p. 15.
[186] Paull, Expert Report dated 9 August 2020, p. 14.
[187] DPIE, *Narrabri Gas Project (SSD 6367) Assessment Report* (June 2020), Table 13, p. 93.
[188] Milledge, Expert Report dated 9 August 2020, [39].
[189] Milledge, Expert Report dated 9 August 2020, [40]; Paull, Expert Report dated 9 August 2020, pp. 17-20.
[190] Transcript, IPC Public Hearing – Narrabri Gas Project, 23 July 2020, p. 33, at 6-13.

here, I say is a fundamentally flawed process, particularly with species which are designated ecosystem credit species under this system, and it assumes that the occurrence of particular threatened species can be predicted on the basis of plant community types, which are essentially just based on floristics, and you can't - you simply can't predict the occurrence of threatened species which are essentially rare, specialised species, patchily distributed, on the basis of plant floristics

254. As noted previously, the biodiversity offsets also fail to take into account the impact of indirect impacts, particularly on the small and medium-sized vertebrates are currently most at risk in the forest:[191]

Increased fragmentation, indirect impacts and disruption to essential behavioural patterns will disproportionately affect small and medium sized vertebrates, those species most currently at risk in the forest. The offsets for indirect impacts were not addressed in the Assessment Report or in the recommended Conditions of Consent. It is therefore undeniable that indirect impacts have not been taken into account adequately in the offset arrangements and it is likely that these impacts also have not been, and arguably cannot be, offset.

255. Finally, the offset system does not require the applicant to identify on-ground offsets but rather allows them to pay money to the Biodiversity Conservation Trust, who are further able to diverge from delivering like-for-like offsets. As Mr Milledge explains:[192]

Offsetting under Government policy also does not mandate a "like-for-like" approach in selecting an offset, including a requirement for an offset to be located in the same landscape system. Significantly, it does not require evidence that an offset contains the species being impacted. If a suitable offset cannot be obtained, the policy allows the impact to be "offset" by the payment of money into the Biodiversity Conservation Fund (DPIE 2020), a mechanism that also does not require "like-for-like" compensation with the expenditure of these funds.

256. As such the proposed measures fail to provide any degree of certainty that impacts on biodiversity values will be effectively mitigated.

Conclusion

257. The independent experts commissioned by NWA collectively have several decades of local research experience, are considered specialists in the species found in the Pilliga, and have been responsible for the identification of unique species and ecosystems in this region.[193] This experience contrasts with the applicant's assessment, which has been demonstrated to be inadequate and failing to understand local environmental cues. In this regard, the IPC should prefer the evidence of Mr Milledge, Dr Serov and Mr Paull in relation to the likely impacts of the Project on Pilliga Forests, woodlands, GDEs and species.

[191] Paull, Expert Report 9 dated August 2020, pp. 17-18.
[192] Milledge, Expert Report dated 9 August 2020, [33].
[193] Transcript, IPC Public Hearing – Narrabri Gas Project, 23 July 2020, p. 30, at 31-45, p. 35, at 15-22, and p. 39, at 24-41.

258. As summarised by Mr Milledge:[194]

The lack of any certainty that the landscape-scale refuge function and important key threatened vertebrate populations of the Narrabri Gas Project Area will be maintained under the DPIE's recommended consent conditions for the Project militates strongly against its approval. Loss of these values is likely to have a significant adverse impact on the Pilliga's unique and irreplaceable biodiversity.

259. Further, the real possibility of the localised extinctions of key threatened species invokes the ESD principles of intergenerational equity and intragenerational equity and the conservation of biological diversity to which the IPC is required to have regard. Moreover, the precautionary principle is enlivened because of the high degree of risk of serious or irreversible environmental damage to terrestrial and groundwater dependent ecosystems, coupled with the high degree of scientific uncertainty.

260. Accordingly, a higher degree of precaution must be adopted in this case, justifying a refusal of the Project (in line with the concept of preventative anticipation), rather than conditional approval or adopting an adaptive management approach.[195]

C. CLIMATE CHANGE IMPACTS

261. NWA's case on this issue is that approval of the Project at the current time is not in the public interest and contrary to the principles of ESD, in particular the principles of social equity for present and future generations, the conservation of biological diversity, and the polluter pays principle, because the GHG emissions (Scope 1, 2 & 3) from the proposed development would adversely impact on the environment, including the environment of NSW, and hinder measures to limit dangerous anthropogenic climate change.

262. On this issue, substantial weight should be attached to the seminal decision, and reasons, of Preston CJ in *Gloucester Resources Ltd v Minister for Planning* (2019) 234 LGERA 257. It is apparent from those reasons that, in that case, climate change was a decisive factor in the refusal of development consent to the proposed Rocky . As his Honour stated at [697]:

> *The project will be a material source of GHG emissions and contribute to climate change. Approval of the project will not assist in achieving the rapid and deep reductions in GHG emissions that are needed now in order to balance emissions by sources with removals by sinks of GHGs in the second half of the century and achieve the generally agreed goal of limiting the increase in global average temperature to well below 2°C above pre-industrial levels.*

263. These reasons equally apply to the assessment of the current Project.

264. In particular, Preston CJ sets out an approach for the assessment of the environmental impacts of a fossil fuel development in "absolute" or "relative" terms:[196]

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[194] Milledge, Expert Report dated 9 August 2020, [44].
[195] See *Telstra*, [161].
[196] *Gloucester Resources Ltd v Minister for Planning* (2019) 234 LGERA 257, [553]-[555].

[553] I consider the better approach is to evaluate the merits of the particular fossil fuel development that is the subject of the development application to be determined. Should this fossil fuel development be approved or refused? Answering this question involves consideration of the GHG emissions of the development and their likely contribution to climate change and its consequences, as well as the other impacts of the development. The consideration can be in absolute terms or relative terms.

[554] In absolute terms, a particular fossil fuel development may itself be a sufficiently large source of GHG emissions that refusal of the development could be seen to make a meaningful contribution to remaining within the carbon budget and achieving the long term temperature goal. In short, refusing larger fossil fuel developments prevents greater increases in GHG emissions than refusing smaller fossil fuel developments.

[555] In relative terms, similar size fossil fuel developments, with similar GHG emissions, may have different environmental, social and economic impacts. Other things being equal, it would be rational to refuse fossil fuel developments with greater environmental, social and economic impacts than fossil fuel developments with lesser environmental, social and economic impacts. To do so not only achieves the goal of not increasing GHG emissions by source, but also achieves the collateral benefit of preventing those greater environmental, social and economic impacts.

265. If *Gloucester Resources Ltd v Minister for Planning* (2019) 234 LGERA 257 is considered to be a form of persuasive guidance (and NWA submits it should be considered highly persuasive and directly applicable),[197] NWA submits that it can reasonably be considered that the environmental impacts of the Project are sufficiently adverse in **both absolute and relative terms**.

266. In absolute terms, the Project's aggregate greenhouse gas emissions are substantial (see evidence of Prof Sackett and Mr Forcey).[198] On this basis, NWA submits that the environmental impacts arising from the greenhouse gas emissions that are an inevitable consequence of the Project warrant rejection in absolute terms.

267. In relative terms, NWA has commissioned extensive independent expert advice that has identified extensive and adverse environmental impacts. On this basis, the Project also warrants rejection in relative terms.

268. Ultimately, it is the wrong time (and wrong place) for the Project at [699]:

In short, an open cut coal mine in this part of the Gloucester valley would be in the wrong place at the wrong time. Wrong place because an open cut coal mine in this scenic and cultural landscape, proximate to many people's homes and farms, will cause significant planning, amenity, visual and social impacts. Wrong time because the GHG emissions of the coal mine and its coal product will increase global total concentrations of GHGs at a time when what is now urgently needed, in order to meet generally agreed climate

[197] Linda Pearson, 'Policy, principles and guidance: Tribunal rule-making' (2012) 23 Public Law Review 16, pp. 32.
[198] *Gloucester Resources Ltd v Minister for Planning* (2019) 234 LGERA 257, [556].

targets, is a rapid and deep decrease in GHG emissions. These dire consequences should be avoided. The Project should be refused.

269. The effects of carbon in the atmosphere arising from the activities at the site, and the burning of the gas extracted from the development, are inconsistent with a carbon budget and internationally agreed policy intentions to keep global temperature increases to well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 degrees Celsius above pre-industrial levels, and would have a cumulative effect on climate change effects in the long term. In light of that substantial environmental harm, and the critical importance of combatting climate change now, the Project should be refused.

270. There are multiple statutory pathways under the EP&A Act by which the IPC must have regard to the impacts of the Project on climate change, and which permit the IPC to refuse the development on this ground. These are:

a. s 4.15(1)(a), which requires the IPC to take into consideration the provisions of the *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* (**Mining SEPP**), which requires the decision maker to have regard to the downstream impacts of the Project (cl 14(2));

b. s 4.15(1)(b), which requires the IPC to take into consideration the likely impacts of the proposed development, including environmental impacts (which includes the impacts of GHG emissions on climate change); and

c. s 4.15(1)(e), which requires the IPC to take into consideration the public interest, including the principles of ESD.

271. As set out above, section 4.15 of the EP&A Act makes any applicable EPI a mandatory relevant consideration. The activities the subject of the Project meet the definition of 'mining, petroleum production or extractive industry' in clause 3 of Mining SEPP. Consequently, the Mining SEPP applies to the determination of the Project.

272. Clause 14 of the Mining SEPP relevantly provides:

> ***14 Natural resource management and environmental management***
> *(1) Before granting consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider whether or not the consent should be issued subject to conditions aimed at ensuring that the development is undertaken in an environmentally responsible manner, including conditions to ensure the following:*
>
> > *…*
> >
> > *(c) that greenhouse gas emissions are minimised to the greatest extent practicable.*
>
> *(2) Without limiting subclause (1), in determining a development application for development for the purposes of mining, petroleum production or*

extractive industry, the consent authority must consider an assessment of the greenhouse gas emissions (including downstream emissions) of the development, and must do so having regard to any applicable State or national policies, programs or guidelines concerning greenhouse gas emissions.

…

273. Accordingly, clause 14(2) of the Mining SEPP makes all GHG emissions (including downstream) of the Project a mandatory relevant consideration to be taken into account by the IPC when determining the Project. The downstream emissions from the Project will result in direct emissions for Australia and NSW, because it is a condition of any approval for the Project that the gas from the Project will be sold and delivered (and therefore combusted) within NSW. All Scope 3 emissions should therefore be presumed to be Scope 1 emissions for Australia and NSW.[199]

274. Approval of the Project would breach the obligation of intergenerational and intragenerational equity in that the development of this Project would have an adverse impact on climate change, in particular a carbon budget and internationally agreed policy intentions to keep global temperatures to well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius above pre-industrial levels.

275. Approving the Project will worsen the impacts of climate change, thus contributing to the burden that will be borne by future generations in living with, and addressing, the consequences of climate change.

Professor Sackett's evidence

276. NWA adduces expert evidence from Professor Penny Sackett, Honorary Professor at the Climate Change Centre, Australian National University, and the former Chief Scientist for Australia from 2008-2011. Considerable weight should be given by the IPC to the views expressed in her report.

277. In her report dated 9 August 2020, Professor Sackett summarises the science of anthropogenic climate change (at [4]-[20]). The report explains that the rate of climate change is primarily driven by carbon dioxide (**CO_2**) emissions, with about 85-90% of CO_2 emissions arising from fossil fuel (coal, oil, gas) combustion.[200] Relevantly CO_2 emissions from gas are growing faster than from coal or oil.[201] The report documents the current serious impacts of climate change[202] and notes that many of the impacts are being felt in NSW to an even larger degree than the national average.[203]

278. She advises that *'the production, delivery and combustion of fossil fuels are also associated with the release of methane'*.[204] As set out below, that is a particularly relevant issue in the context of the extraction of coal seam gas.

[199] Sackett, Expert Report dated 9 August 2020, [74].
[200] Sackett, Expert Report dated 9 August 2020, [17].
[201] Sackett, Expert Report dated 9 August 2020, [18].
[202] Sackett, Expert Report dated 9 August 2020, [21-24].
[203] Sackett, Expert Report dated 9 August 2020, [24].
[204] Sackett, Expert Report dated 9 August 2020, [19].

279. In order to address the issue of dangerous climate change, Australia, along 196 other Parties, is a signatory to the Paris Agreement, which entered into force on 4 November 2016. The Paris Agreement aims to strengthen the global response to the threat of climate change, in the context of sustainable development and efforts to eradicate poverty, including by, *inter alia*:

> *Holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change.*

280. Individual signatory nations have made separate Nationally Determined Contributions (**NDC**) to meet the Paris goals. At present, it is estimated that the current NDCs, if achieved, would result in global warming between 2.9°C and 3.4°C by 2100 relative to pre-industrial levels, and continuing thereafter. That is, current commitments are not sufficient to hold warming to 2°C, let alone well below 2°C. As a nation, Australia's NDC is to reduce its emissions by 26% to 28% (on 2005 levels) by 2030. That is insufficient. If every country followed Australia's level of action, the world would be on a trajectory to reach a 3- 4°C temperature rise by 2100 and would thus face extremely damaging levels of climate change impacts. Australia is not on track to meet its NDC target for 2030.

281. New South Wales has set an objective of reducing its GHG emissions by 35% on 2005 levels by 2030, and to reach net zero emissions by 2050. Whilst that objective is consistent with the Paris Agreement, reaching net zero emissions by 2050 requires rapid reduction in emissions beginning now. Approval of the Project is inconsistent with that objective, as the evidence demonstrates.

282. In Professor Sackett's opinion, the carbon budget approach, as adopted by the Intergovernmental Panel on Climate Change (**IPCC**), is a conceptually simple and scientifically sound method to determine the cumulative amount of carbon that can be emitted into the atmosphere to stay within the temperature goals of the Paris Agreement. This is explained in section V of Professor Sackett's report. The analysis shows that most of the 2°C budget is already spent and that, without immediate dramatic action, humanities remaining 2°C carbon budget may be consumed in about 4 to 25 years, that is, sometime between about 2023 and 2024. If GHGs (especially CO2 and CH4) can be reduced quickly and continuously, this budget could last longer. Unfortunately both CO2 and CH for emissions are going in the opposite direction, they are rising, year on year. In order to reach carbon neutrality by 2050 (a commitment all Australian states and territories have made) on a steady, linear path, world emissions need to peak in 2020, and then decrease by 3.3% of the 2009 level every year, year on year until 2050. It is important to note that this carbon budget is for 2°C of warming. The Paris agreement is to limit global temperature rise this century *well below* 2°C above preindustrial levels and to pursue efforts to limit the rise to 1.5°C. In order to keep warming well below 2°C with a 66% probability, the carbon budgets are smaller and timescales to reach net zero emissions shorter.

283. Jennifer Granger put it simply:[205]

> *Climate change is occurring. The science is there. Humankind, through projects such as this, is contributing to it. Extreme weather events, ones thought to occur rarely, are now happening annually. It's imperative that we act now to keep to the Paris Agreement and not exceed the 1.5 degrees full stop.*

284. Professor Sackett demonstrates that approval of the Project would make the Australian and NSW emissions targets considerably more difficult to meet. The Project would shorten the timespan before Australia and NSW exceed notional 2°C carbon budgets. If the Project were to proceed, it would cause (directly and indirectly) the release of over 120 Mt CO2 into the atmosphere over its 25 year life. This is at least 11% of the remaining NSW 2°C carbon budget (including downstream emissions, which will be emitted in NSW or other parts of Australia if the applicant's promise to commit gas from the Project to domestic use is kept).[206]

285. All GHG emissions arising directly or indirectly from an activity lead to global warming and climate change (including within NSW), regardless of where they are emitted. Thus, from an environmental perspective, all omissions, including Scope 3 or 'downstream' emissions released when gases combusted bites and use it, must be included. The IPC accepted this argument in the Bylong Coal Project determination,[207] agreeing with Preston CJ in *Gloucester Resources Ltd v Minister for Planning* (2019) 234 LGERA 257 at [525] that:

> *Nevertheless, the exploitation and burning of a new fossil fuel reserve, which will increase GHG emissions, cannot assist in achieving the rapid and deep reductions in GHG emissions that are necessary in order to achieve "a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century" (Article 4(1) of the Paris Agreement) or the long term temperature goal of limiting the increase in global average temperature to between 1.5°C and 2°C above pre-industrial levels (Article 2 of the Paris Agreement).*

286. The argument should equally be accepted in this case.

287. Residents in the area of the proposal are already living with these climate change impacts. A neighbour of the proposed Project, Scott McCalman, told the IPC:[208]

> *I've been involved in innovative agriculture production for over 35 years. Commissioners, I cannot overstate the devastating impacts that climate change is now having on the Australian continent, particularly in the last 20 years. As I implement more innovative risk management strategies in*

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[205] Transcript, IPC Public Hearing – Narrabri Gas Project, 25 July 2020, pp. 21-22.
[206] Sackett, Expert Report dated 9 August 2020, [84].
[207] IPC, *Statement of Reasons for Decision – Bylong Coal Project (SSD 6367)* (18 September 2019) https://www.ipcn.nsw.gov.au/resources/pac/media/files/pac/projects/2018/10/bylong-coal-project/determination/bylong-coal-project-ssd-6367--statement-of-reasons-for-decision.pdf (accessed 4 August 2020) [690].
[208] Transcript, IPC Public Hearing – Narrabri Gas Project, 22 July 2020, p. 45, at 17-34.

my business the climate hurdles only increase; vastly increased temperatures, huge daily transpiration and evaporation, increase in frequency and duration of drought, diminished and highly variable rainfall, plant stress, dieback, erosion, wild fires, monetary loss and impacts to native flora and fauna.

We do not have the luxury of high altitudes on this continent. We do not have highly elevated snow peak mountain ranges and other buffering landscape features to combat elevating temperatures. Rural Australia does not have the buffering of a sea breeze. We are seeking some sobering figures – we are seeing some sobering figures from 24 hour weather station data loggers comparing to long historical records. I farm on the Liverpool Plains and we are now operating at summer temperatures 330 per cent above our long-term average. Long standing – the average daily temperatures in summer above 35 degrees the long standing is 20 days we are now operating. In the last decade this has risen to over 65 days.

288. Prof Sackett gives reasons why approval of the Project is inconsistent with the Paris Agreement. The IPC also heard from Professor Steffen who gave evidence that, under any reasonable set of assumptions regarding probabilities of actually meeting the carbon budget and the sensitivity of the climate system to the level of GHGs in the atmosphere, fossil fuel combustion must be phased out quickly, and most of the world's existing fossil fuel reserves – coal, oil and gas – must be left in the ground, unburned, if the Paris Agreement temperature targets are to be met. It therefore follows that no new fossil fuel development, including the Project, can be permitted because its approval would be inconsistent with the carbon budget approach towards climate stabilisation and the Paris Agreement climate target.

289. Prof Sackett supports this argument, maintaining that the exploitation of gas is not a transition or bridge to a zero-emissions future. She explains in her evidence:

95. Even putting the unreported methane concern to one side, a recent economic analysis **based on only a 50% chance of achieving 2°C** (equivalent to flipping a coin) concluded that **half of all gas reserves must remain unused from 2010 to 2050 in order to meet a target of 2°C** (McGlade and Ekins, 2015),[108] specifically including reserves held by OEDC countries in the Pacific, of which Australia is the major player.

96. Underscoring this point is the SEI report (SEI et al., 2019)[109] that analyses the gap between different nations' expectations for the production of fossil fuels and the Paris warming targets that the same nations support. The analysis shows that **governments are planning to produce about 50% more fossil fuels by 2030 than would be consistent with a 2°C pathway and 120% more than would be consistent with a 1.5°C pathway. This means that plans *already on the table* must be shelved to hold warming to Paris limits.**

97. **The disconnect between the intention to produce more fossil fuels and the commitment to reduce emissions has been called the "Production Gap."** Australia is a major contributor to this gap[110] between global intended fossil fuel production and the Paris agreed warming target range, as shown in Figure 8 below, taken from the SEI report[111].

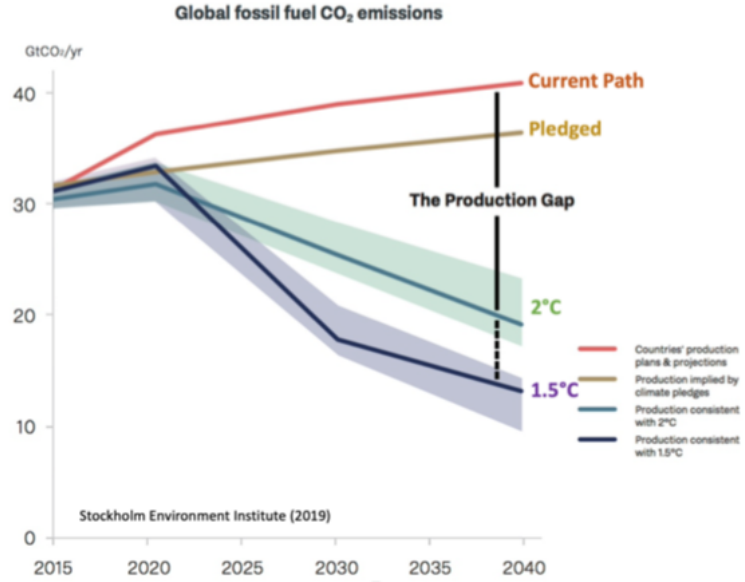


Figure 8: Possible trajectories of global CO_2 emissions from 2015 to 2040 in units of $GtCO_2$ emitted in each year. In red is the current trajectory, whilst the gold line indicates what would be achieved if all Paris Agreement pledges were met. Lavender and turquoise trajectories reflect world fossil fuel production consistent with a 66% chance of holding warming to 1.5°C and 2.0°C, respectively. Shaded regions indicate uncertainty ranges for the 1.5°C and 2.0°C trajectories.

290. Prof Sackett continues by concluding on this issue:

> *Trajectories for gas may decline slower than oil or coal to achieve the overall trajectories shown in Figure 8, but gas must still decline around 2020 (under a 1.5°C pathway) or around 2030 (under a 2°C pathway).*
>
> *Redressing this fossil fuel production gap cannot be met by adding fossil fuel development, even that which may have already planned. Instead, new fossil fuel development and expansion must cease, and ageing facilities brought to rapid close. For the reasons discussed in this section, in my view, approving the Narrabri Gas Project is inconsistent with the Paris Agreement.*

291. In this regard, climate science is supported by current energy trends. In their submission to the IPC, the Institute for Energy Economics and Financial

Analysis highlight that "Gas is no longer serving a role as a transition fuel either domestically or globally. The clear established global trend is towards more renewable power in electricity systems, and less gas."[209]

292. A further reason given by Professor Sackett for rejecting gas as a transitional fuel to a carbon neutral future concerns the high global warming potential of methane which is associated with new gas development. This issue is addressed more fully in the evidence of Mr Forcey below and is supported by findings of the Global Energy Monitor in its report entitled 'Gas Bubble' dated July 2020:

LNG'S GREENHOUSE GAS EMISSIONS

Fossil gas has been touted as a "clean" fuel, one that can serve as a "bridge fuel" allowing the world to shut down coal-fired power plants, as a stopgap measure until renewable energy becomes cheaper. This "bridge fuel" argument has been based primarily on the fact that, compared with using coal, burning gas releases about half as much carbon dioxide, the main greenhouse gas. Thus there has been a push for expanding the natural gas system worldwide, with a rapid expansion of the LNG system a crucial part of this (IEA 2019).

However, the fossil gas system suffers from a major problem: leakage. Fossil gas is mainly methane, a greenhouse gas that is much more powerful than CO_2. Methane leaks from many parts of the fossil gas system, from extraction wells, compressors, and pipelines.

Methane leakage is a problem worldwide, with major sources of methane emissions in many gas-producing countries (ESA 2020). Most of the studies to date of methane leakage have focused on the U.S., where recent studies have found much more gas leaking from the system than estimated by the US Environmental Production Agency (Alvarez 2018).

Average leakage rates for the U.S. for different parts of the fossil gas system are:

- 1.9% leakage rate for production areas (Alvarez 2018)
- 0.3% leakage rate for pipelines in the US (Alvarez 2018)
- 0.5% leakage rate for additional transmission pipeline travel for LNG exports (Pace Global 2015)
- 1.3–2.7% leakage rates for several large cities: Los Angeles, Boston, New York, Philadelphia, Baltimore, and Washington, DC (McKain et al 2015, Plant et al 2019, Wennberg et al 2012)

The most comprehensive study to date of the U.S. fossil gas system estimated the overall leakage to be 2.3% (Alvarez 2018). At that rate, emissions from methane leakage are about the same as the emissions from burning the natural gas in power plants or for heat, when evaluated over a 20-year period—thus doubling the warming from simply burning the gas (Alvarez 2018).

Some areas have shown higher leakage. A recent satellite study that found the Permian basin in Texas and New Mexico—the most intensive area for fracking in the U.S. now—is leaking 3.7% of the fossil gas produced (Zhang 2020). Gas from the Permian is increasingly viewed as a major source to be exported as LNG, with large pipelines recently built, under construction, and proposed to connect to LNG terminals on the coast of the Gulf of Mexico.

Given the leakage rates in the US fossil gas system, using fossil gas for electricity can at best achieve only minor reductions in warming compared with using coal, while locking in long-term fossil infrastructure that will slow the transition to combinations of renewables and battery storage. Exact comparisons are difficult due to the apples-and-oranges nature of the global warming profiles of methane versus carbon dioxide. Depending on the assumptions about methane leakage rates, the relative efficiencies of the coal-fired and gas-fired power plants being compared, and the period over which warming is being measured, the global warming impact of building a new gas plant instead of a new coal plant, assuming the gas plant is supplied by LNG, can range from 29% lower to 16% higher (GEM analysis; see technical discussion here.) Overall, due to the consequences of further locking in fossil combustion rather than transitioning to renewable power, switching from coal to gas does not appear to offer a useful strategy to achieve rapid cuts in greenhouse gas emissions to achieve carbon neutrality.

Shipping fossil gas as LNG significantly increases the greenhouse gas footprint. Cooling gas to the very low temperatures needed to to turn it into a liquid (LNG) requires huge energy inputs to run compressors. In an LNG export terminal, typically 10–20% of the incoming gas is burned to power the liquefaction process (Lowell 2013). LNG tankers traveling long distances—such as from Texas to Japan, the largest LNG importer—add more emissions from the fuel they burn. Overall, using fossil gas as LNG adds around 25% more CO_2 emissions, on top of those from burning the gas for electricity or heat (Pavlenko et al 2020).

Fossil gas is also increasingly used for transportation—in cars, trucks, and ships—as a replacement for liquid fossil fuels traditionally used in transportation (gasoline and diesel for road transport; heavy fuel oil and marine gas oil for ships). But given the methane leakage rates in the US fossil gas system, switching from liquids to gas actually increases the overall emissions from these vehicles (Pavlenko 2020, Alvarez 2012).

Factoring in the large methane leakage found in recent studies could further tip the balance away from fossil gas.

[209] IEEFA (2020) *The Narrabri Gas Project - Submission to Independent Planning Commission: The State of NSW Should Not Sponsor a Loss-Making, Wealth Destroying Industry*, IEEFA, August 2020.

293. Prof Sackett's and Prof Steffen's evidence is based on a body of scientific evidence that confirms the immediately and significant threat posed to the environment, including the environment of NSW, and communities from climate change. A selection of the relevant evidence is provided to the IPC as a bundle of relevant documents, listed in Appendix 1 to these submissions.

294. The applicant's argument that the Project contributes insignificantly to global GHG emissions, and thus has a minimal impact on climate change, should be dismissed immediately. Arguing that a single proposal or event is immaterial because it is a tiny percentage in terms of its impact fails to acknowledge cumulative and incremental impacts: see Preston CJ in *Gloucester Resources Ltd v Minister for Planning* (2019) 234 LGERA 257 at [514]-[524]. In the Bylong Coal Project determination, the IPC also accepted that the cumulative environmental impact of the Project needed to be considered when weighing the acceptability of GHG emissions associated with the mine.[210] Once again, the IPC accepted the finding of Preston CJ in *Gloucester Resources Ltd v Minister for Planning* (2019) 234 LGERA 257 when his Honour said:

> *it would be rational to refuse fossil fuel developments with greater environmental, social and economic impacts than fossil fuel developments with lesser environmental, social and economic impacts. To do so not only achieves the goal of not increasing GHG emissions by source, but also achieves the collateral benefit of preventing those greater environmental, social and economic impacts.*

295. The applicant has not adduced evidence to demonstrate that, if the Project is not approved, NSW will need to secure an alternative source of gas and that the production of this gas in other territories may lead to poorer environmental outcomes (for example, if the gas is imported into the Port Kembla LNG Terminal). The IPC agreed with Preston CJ that an unacceptable development does not become acceptable simply because an alternative development that may cause unacceptable impacts might be pursued in other territories:[211]

> *If a development will cause an environmental impact that is found to be unacceptable, the environmental impact does not become acceptable because a hypothetical and uncertain alternative development might also cause the same unacceptable environmental impact. The environmental impact remains unacceptable regardless of where it is caused. The potential for a hypothetical but uncertain alternative development to cause the same unacceptable environmental impact is not a reason to approve a definite development that will certainly cause the unacceptable environmental impacts. In this case, the potential that if the Project were not to be approved and therefore not cause the unacceptable GHG emissions and climate change impacts, some other coal mine would do so, is not a reason for approving the Project and its unacceptable GHG emissions and climate change impacts: see Kane Bennett, "Australian climate change litigation: Assessing the impact of carbon emissions" (2016) 33 EPLJ 538 at 546-548; Justine Bell-*

[210] IPC, *Statement of Reasons for Decision – Bylong Coal Project (SSD 6367)* (18 September 2019) https://www.ipcn.nsw.gov.au/resources/pac/media/files/pac/projects/2018/10/bylong-coal-project/determination/bylong-coal-project-ssd-6367--statement-of-reasons-for-decision.pdf (accessed 4 August 2020) at [692]-[695].
[211] *Gloucester Resources Ltd v Minister for Planning* (2019) 234 LGERA 257, [545].

James and Sean Ryan, "Climate change litigation in Queensland: A case study in incrementalism" (2016) 33 EPLJ 515 at 535

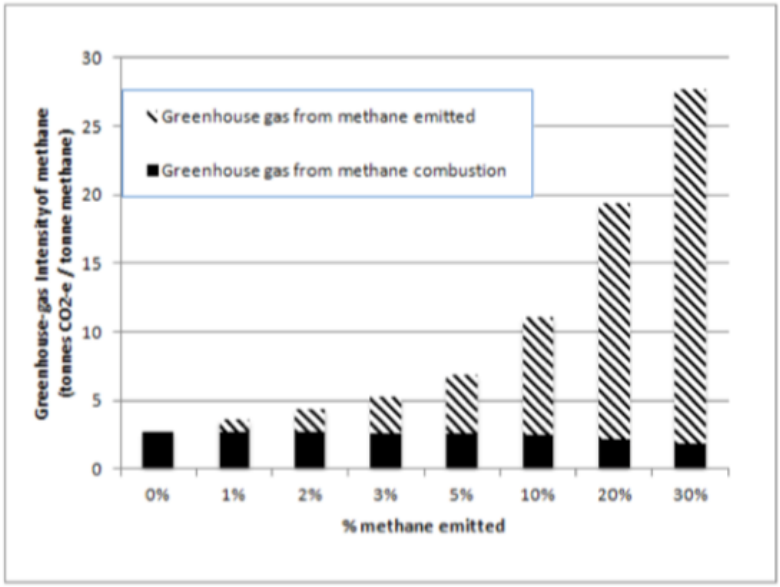
Mr Tim Forcey's evidence

296. Mr Forcey is an independent energy advisor with 30 years' experience in energy companies, including in coal seam gas operations, and with the Australian Energy Market Operator (AEMO) as gas planning principal.

297. Satellite data from the USA, and other evidence from coal seam gas operations in QLD, shows that the release of methane is a particular by-product of coal seam gas wells. His evidence is that methane is a GHG which is 86 times more powerful than carbon dioxide (on a per tonne basis) (in other words, it is 86 times more effective than carbon dioxide in trapping heat) and he explains the importance of limiting methane, in particular, unburnt methane into the atmosphere as follows:

The importance of focusing on methane emissions

8. The following chart illustrates why we must focus on methane emissions. Fossil gas negatively impacts our climate through the burning of methane and the conversion of methane to carbon dioxide, a greenhouse gas. But because methane itself is a powerful greenhouse gas far more damaging than carbon dioxide, if only a few percent of the original methane is released before it even gets burnt, this is very bad for our climate.



Greenhouse gas impact of releasing methane vs burning methane (3)

9. The chart shows how if only 1% of the methane is released, the impact is large even when compared to burning the other 99%. Releasing 3% of the methane will have the same climate impact as burning the other 97%, doubling the emissions impact.

298. Even without considering these facts, Assoc Prof Bryce Kelly from the University of NSW identified that:[212]

The Narrabri Gas Project option 1 will produce approximately one million tonnes of CO2 equivalent per year. As a single entity this will make the Narrabri Gas Project the 54th largest scope 1 emitter of greenhouse gases in Australia. The project 2 option will produce approximately 620,000 tonnes of CO2 equivalent per year, making it the 63rd largest scope 1 emitter of greenhouse gases in Australia.

299. For these reasons, the approval of the Project at the current time is contrary to the principles of intergenerational equity and intragenerational equity because of the cumulative impact of GHG emissions from the Project, which is inconsistent with the carbon budget approach towards climate stabilisation and the Paris Agreement climate target. The Project's contribution to cumulative climate change impacts mean that its approval would be inequitable for current and future generations, including in relation to impacts on groundwater.

300. As Nicole Hunter from the Coonabarabran Swimming Club said to the IPC:[213]

as stated very conservatively by Santos and the department of planning, infrastructure and environment summary I quote:

> The extraction of 1.5 gigalitres of saline water each year is predicted to result in the annual leakage of a maximum of 60 megalitres of water a year from the shallower aquifers, our aquifers, in about 200 to 250 years.

That's the future generation's aquifers, which is a low volume of water compared with the 165 gigalitres of water currently being extracted from its aquifers by other water users each year. Sixty megalitres of water lost to leakage could mean everything in 200 years with our changing climate. This is intergenerational inequality in its highest form. I'm outraged by the statement and attitude.

301. Moreover, approval of the Project would jeopardise the conservation of biological diversity and the polluter pays principle.

302. Because the Project will contribute to cumulative anthropogenic GHG emissions that are currently projected to exceed the carbon budget, any conditions to be attached to the Project that do not require it to be carbon neutral will be insufficient to address its cumulative GHG impacts.

303. Accordingly, approval of the Project at the current time would be irrational, not in the public interest, and contrary to the principles of ESD. Development consent should be refused.

D. BUSHFIRE IMPACTS

[212] Transcript, IPC Public Hearing – Narrabri Gas Project 25 July 2020, p. 48, at 29-34.
[213] Transcript, IPC Public Hearing – Narrabri Gas Project 1 August 2020, p. 73, at 13-25

304. The IPC heard that a significant risk to the Project and the surrounding communities and wildlife is the increased fire risk that comes as a consequence of climate change. The Project poses direct and indirect bushfire risks, both as a contributor to catastrophic climate change (which in NSW and Australia includes specifically longer, more severe bushfire seasons), and as an ignition source.

305. In making its determination, the IPC is required to take into account the likely impacts of the development (including environmental on both the natural and built environments, and social and economic impacts in the locality),[214] any submissions made in accordance with the EP&A Act or the regulations,[215] and the public interest (which includes the principles of ESD).[216] The principles of ESD include the principles of intergenerational equity and intragenerational equity and the conservation of biological diversity.

306. On 23 July 2020 the IPC heard from Mr Greg Mullins AO AFSM, a former commissioner of Fire and Rescue New South Wales. Mr Mullins is an eminent Australian emergency services leader and is a deputy group captain in the Rural Fire Service, the former head of the peak council for fire and emergency services in Australia and New Zealand, and the founder of Emergency Leaders for Climate Action, which is a coalition of 33 former fire and emergency service chiefs covering every fire service in Australia, every State and Territory, including former Directors-General of Emergency Management Australia. In light of Mr Mullins' unparalleled experience in this area, the IPC would give considerable weight to his opinion.

307. Mr Mullins provided the IPC with advice about bushfire risk: how it is being driven by climate change caused by the burning of coal, oil and gas; and about the additional threat of bushfires in the sensitive Pilliga that the Project will introduce; and contended that the Project is 'far too risky'[217] to proceed because of its effect on local and global risks to life, property and the environment.

308. Mr Mullins is clear that the effects of climate change on bushfire impacts are already being felt:[218]

> *Worsening extremes were graphically demonstrated in California in 2017 when around 10,000 homes were destroyed; the following year, 2018, when around 20,000 structures were destroyed and about 100 people lost their lives; then, of course, in Australia, Black Summer 2019/20, where around 4000 structures were destroyed, not including thousands of buildings and outbuildings.*
>
> *Fires are burning in countries now where they were formally rare or non-existent, such as England and Greenland. Australian bushfire seasons have lengthened significantly ..... higher temperatures and a trend of decreasing rainfall has increased flammability and availability of fuels and that in turn increases fire intensity and rates of spread. In most parts of Australia, the annual accumulated forest fire danger index is increasing. The number of*

[214] EP&A Act, s 4.15(1)(b).
[215] EP&A Act, s 4.15(d).
[216] EP&A Act, s 4.15(e).
[217] Transcript, IPC Public Hearing – Narrabri Gas Project, 23 July 2020, p. 74, at 13.
[218] Transcript, IPC Public Hearing – Narrabri Gas Project, 23 July 2020, p. 74, at 20-41 and p. 75, at 14-23.

very high, severe, extreme and catastrophic fire danger days are increasing. In many parts of Australia, bushfire ignitions as a result of lightening from dry thunderstorms are increasing, particularly in Tasmania and it was a big feature of this last fire season also in Queensland, New South Wales, Victoria, South Australia.

The frequency of pyroconvective events and fire-generated storms are increasing hugely. Between 1978 and 2001, only two known events, two possibles; about 45 in this last fire season and 15 others under investigation. Now, these storms drive extreme fire behaviour and kill people, including firefighters, as they did this season...

2019 was the hottest, driest year ever recorded in Australia. The New South Wales bushfires destroyed more than 11 times more homes than ever lost before in this state, the previous worst losses being 222 homes in 2013. Nearly twice as many people lost their lives in New South Wales compared to the previous highest number in 1968/69, where 14 people lost their lives.

5.4 million hectares of New South Wales was burnt and up to 21 per cent of eastern Eastern Broadleaf Forest and up to 18 million hectares Australia-wide. About 417 people lost their lives due to the effects of bushfire smoke.

309. Fire risk is particularly relevant to the Project because:[219]

The Pilliga is unusual, because the nature of vegetation means that it can burn explosively with very rapid rates of spread under very high, severe and catastrophic fire danger conditions. But when conditions moderate, for example, at night, because when we do most of our backburning, because of the relatively ground - low ground-fuel loads, it can be really difficult to ignite backburns.

So that means that firefighting in the Pilliga is very resource intensive. The use of expensive plant and equipment, including bulldozers, graders and firefighting aircraft is necessary. Because the region is sparsely populated, firefighting resources are relatively scarce. And the strong reliance on volunteers from the RFS, many of whom have pointed out that they strongly oppose this proposal, and may be unwilling to place themselves at risk fighting fires caused by or threatening mining operations. Shallow gas line infrastructure, including plastic pipelines can be prone to damage from heavy earthmoving equipment used in fire line construction or even hinder or prevent construction of strategic advantage lines during a fire.

310. David Watt, a Deputy Captain of the Wynella Rural Fire Brigade, which is responsible for the area east of the Project through to Boggabri and beyond, talked to the IPC about concerns about the additional ignition points that will occur as a consequence of the Project and the risk to their own lives and the lives of others in their community:[220]

For those living and farming on the eastern side of the Pilliga, fire is an inherent risk. We are constantly aware of it and do our best to manage

[219] Transcript, IPC Public Hearing – Narrabri Gas Project, 23 July 2020, p. 75, at 43-46 and p. 76, at 1-12.
[220] Transcript, IPC Public Hearing – Narrabri Gas Project, 22 July 2020, p. 29, at 11-16.

against it. But the predominant wind direction is from the northwest, and fires that start deep in the Pilliga, generally from lighting strikes, can be on our doorsteps within hours. Some of our neighbours simply will not leave their properties during the summer, such is the risk and losses that fire poses to them and their businesses…

311. The proponent itself acknowledges that the Project will increase the risk of fire in the area, suggesting that it will be increased to once in 70 years. While there has been some acknowledgement that the Project will increase the risk of fire in the area, both Mr Mullins and local fire fighters were skeptical of this assessment with Mr Mullins saying that the estimate of increased risk *'appears to have no basis whatsoever. Maybe a dart - thrown at a dartboard. I don't know'*.[221]

312. One reason for this is that the assessment of increased risk fails to take into account climate change. Expert advice obtained by NWA found that incorporating climate change into risk projections suggests a 150% increase in the probability of a loss of containment of a fire under IPCC's Representative Concentration Pathway 8.5, which is the current global emissions trajectory.

313. It is unclear whether DPIE adequately assessed this risk. Despite acknowledging that it is a bushfire prone area, and that climate change will exacerbate this risk, statements to the IPC by DPIE suggest that at least one source of potential ignition was not considered in the assessment:[222]

So in our view, and it has always been the assumption that those flares would not be installed on site and, you know, that there wouldn't be any fire risks associated with those flares.

314. This assumption has been made despite a failure to include any such requirement in the recommended Conditions of Consent.

315. In speaking to the IPC, DPIE's focussed on the risk to the Project from fire or the requirement for the Project staff to protect infrastructure, rather than the broader risk to surrounding communities, the high conservation values forests or the local wildlife and the role of management plans in minimising risk.[223]

316. But Jan O'Leary from the Blue Mountains Union Council made it clear that the proposed responses from the DPIE do not alleviate the risks to workers:[224]

The issue of workplace safety is the big one for us too. The project is largely situated in the fire-prone Pilliga Forest. There is now little dispute that we can expect hotter, drier summers and a greater likelihood of fires and even more intense ones. Yet Santos will be allowed to flare in a forest even on catastrophic fire days. Peter Bookhouse is a local firefighter who has been engaged in bush fire planning and prediction. He argues that debris could be blown through the flare and ignite. Then within two hours fire could race through the gas fields. He said fires in the area can be so fast and furious that there might not be time to evacuate workers. Yet Santos rates the bush

[221] Transcript, IPC Public Hearing – Narrabri Gas Project, 23 July 2020, p. 42, at 19-20.
[222] Transcript, IPC Public Hearing – Narrabri Gas Project, 1 August 2020, p. 75, at 25-27.
[223] Transcript, IPC Public Hearing – Narrabri Gas Project, 1 August 2020, p. 74, at 6-14.
[224] Transcript, IPC Public Hearing – Narrabri Gas Project, 22 July 2020, p. 62, at 39-46 and p. 63, at 1-2.

fire risk as moderate. Given what we've seen in the last fire season, this rating is either out of date or never was correct in the first place.

317. Practising veterinarian, Bronwen Evans, highlighted how this was also an unacceptable risk, to local wildlife and ecological communities:[225]

After the devastation of the recent fire season, it means we do not have any native habitats to lose. The areas left that survived need to be protected as the oasis they are. They need to be protected. The future will clearly have increasing frequency of extreme weather events. All major projects from now forward need urgently to be increasing our capability to cope with this and not further decreasing our resilience.

318. In Mr Mullins' view, the only way to eliminate the increased risk from flaring would be to remove all fuels (i.e. the forest) upwind for 'massive distances'. While Mr Mullins acknowledges that it could be done, it would come at massive environmental cost and *'I just can't see how any of that can be justified'*.[226]

319. In summary, the risk from bushfire is higher than predicted in the assessment and likely to be exacerbated by climate change during the life of the Project. As Mr Timothy McGuire said to the IPC on the closing day of public hearings:[227]

Just yesterday, at the conclusion of the 2020 National Bushfire and Climate Summit, Greg Mullins says the former New South Wales Fire and Emergency Services Commission said the simple truth is you can't fight fires unless you fight climate change. What sort of lunacy and double-speak is it to accept the science of climate change, as our New South Wales Government professes, but then to allow develop [sic] *of fossil fuel projects to make a dire situation even worse?*

320. Accordingly, a proper consideration of the increased bushfire risk vis-a-vis the principles of intergenerational equity and intragenerational equity and the conservation of biological diversity militates against approval of the Project.

E. SOCIAL IMPACTS

321. In NWA's submission, the Project will generate adverse social impacts on the community of Narrabri. Those adverse social impacts will not be offset by the Project's social and economic benefits, which the applicant has overstated.

322. The expert evidence of Dr Alison Ziller and the objector evidence given in oral and written form by lay objectors demonstrates that the Project will have a significant social impact on residents and the community of Narrabri, contrary to the public interest, the principle of intergenerational equity, and the precautionary principle.

No social licence

[225] Transcript, IPC Public Hearing – Narrabri Gas Project, 22 July 2020, p. 69, at 7-11.
[226] Transcript, IPC Public Hearing – Narrabri Gas Project, 23 July 2020, p. 77, at 33-37.
[227] Transcript, IPC Public Hearing – Narrabri Gas Project, 1 August 2020, p. 48, at 8-14.

323. A common theme during presentations to the IPC public hearing was the lack of social licence that Santos holds for the Project.

324. Dr Ziller notes that there is substantial evidence of opposition to the Project among residents of the Narrabri LGA and the wider region. 23,000 submissions were made, with 98% of submissions opposing the Project.[228] The GISERA Social Baseline Assessment found that *'three broad groups of attitudes towards CSG development in the shire could be identified from the data: those opposed (30.5% of residents who 'reject'), lukewarm (41.7% of residents who would 'tolerate' or be 'ok with it'), and those very supportive (27.8% of residents who 'approve' or 'embrace' CSG development)*[229]. Further, a *'North West Alliance (NWA) survey of 839 residents of Narrabri town found 52% opposed, 28% in favour but 20% chose to abstain or said they didn't know'*.[230] Dr Ziller states:

The number of submissions in opposition, the proportion of submissions which are in opposition, and the development of organisations and alliances which are leading a sustained level of response all indicate that opposition to CSG extraction is likely to be long lasting. [231]

325. Dr Georgina Woods, Lock the Gate Alliance, told the IPC:[232]

This project is the most controversial in the history of the Environmental Planning and Assessment Act. Of the almost 23,000 submissions to the Environmental Impact Statement, 98 per cent were objections including a majority of submissions from the local area. In addition, I have with me here today 5000 signatures on a petition against the project which we will submit to the Commission.

326. Several lay objectors spoke about the lack of a social licence for the Project. For example, Russell Chiffey stated:[233]

Now the Santos proposal fails on many fronts...it has no social licence, as has been demonstrated by almost universal opposition by the local and broader community.

327. Cr Kodi Brady, Warrumbungle Shire Council & President of Yarn, Support, Connect, told the IPC:[234]

We all know what consent means and what lack of consent is. The many polls, gatherings, meetings and our community overwhelmingly says no to CSG. If this project is approved our community will experience the feeling of being violated, our wishes ignored, our lives and living places and livelihoods dismissed as worthless.

328. Dr Johanna Kijas said:[235]

The concept of social licence has three key elements; legitimacy, credibility and trust. The department asserts that this is a relatively small project and they have

[228] Ziller, Expert Report dated 4 August 2020, p. 14.
[229] Ziller, Expert Report dated 4 August 2020, p. 14, citing GISERA, *Social Baseline Assessment: Narrabri Project – Final Report* (February 2018).
[230] Ziller, Expert Report dated 4 August 2020, p. 15.
[231] Ziller, Expert Report dated 4 August 2020, p. 16.
[232] Transcript, IPC Public Hearing – Narrabri Gas Project, 20 July 2020, p. 51.
[233] Transcript, IPC Public Hearing – Narrabri Gas Project, 1 August 2020, p. 5.
[234] Transcript, IPC Public Hearing – Narrabri Gas Project, 21 July 2020, p. 6.
[235] Transcript, IPC Public Hearing – Narrabri Gas Project, 1 August 2020, p. 10.

acknowledged, of course, that there has been significant community concern about the project.

329. As Dr Kijas noted, opposition to the Project comes from the local community and a broad spectrum of the wider NSW community:[236]

The opposition to the Narrabri Gas Project from local and broader New South Wales community comes not from a generalised green activist minority but from local members of local communities across central and northern parts of the State who have had direct local experience of the industry. The community members that I interviewed learnt about the industry usually from an open minded standpoint, often from the standpoint of disinterest in the beginning, and in some cases, as one of my interviews from my region of the Northern Rivers, certainly an initial thinking that the industry might bring much needed jobs to our region.

330. The substantial community opposition to the Project was noted by Sean O'Shannessy, who stated to IPC:[237]

You've heard from traditional owners, local farmers, fireys, mums and dads, grandparents and relatively young people. Hundreds of citizens of New South Wales have spoken here against the Santos proposal. For everyone who has spoken, thousands stand behind them. If you choose to ignore them, they're not just going to lie down and play dead.

331. Recognising the absence of a social licence for the Project, the IPC must consider the balance between social benefits and costs in the context of the public interest and ESD. Dr Ziller provides the following summary of likely social costs and benefits of the Project:[238]

[236] Transcript, IPC Public Hearing – Narrabri Gas Project, 1 August 2020, p. 10.
[237] Transcript, IPC Public Hearing – Narrabri Gas Project, 1 August 2020, p. 8.
[238] Ziller, Expert Report dated 4 August 2020, p. 52.

Likely local social benefits	Likely local social costs and risks
Approximately 130 construction jobs or 10% of anticipated construction jobs	Inconsistent management of risks and hazards by a large number of sub-contractors affecting quality of life
Small number (20-40 see Table 7) of on-going operational jobs	Risks arising from operation of financial conflicts of interest
Opportunities for skills training for Aboriginal residents	The limited social benefits are ineffectively managed
Slight increase in job diversity, if at all	Decline in key public health indicators
Minor increase in local procurement in the short term	Decreased housing availability and affordability
Possible gradual increase in population	Masculinisation of the town
Compensation payments to land holders for the duration of the project	Interruption to farming practices due to construction / loss of agricultural land to well pads and infrastructure
CGBF grants of no more than $500 000 per event or activity	No strategy or mechanism for improvements in social infrastructure for the town
21% ($3m) of VPA funds for community initiatives or local infrastructure	Continuing social conflict and polarisation
	Lack of distributional equity
	Poor prognosis for inter-generational equity
	Increased traffic and related incidents

Questionable social benefits

332. Dr Ziller states that the economic benefits of the construction jobs associated with the Project *'will largely accrue to people living in other parts or NSW or Australia (viz. 90% of workers)'* and that the *'economic benefit to the town arising from construction jobs will last at most for four years (till construction is completed) and largely accrue to the operators of hostels for the non-resident workers (**NRW**)(which will accommodate and cater for the 90%)*'.[239] Moreover:[240]

most of the on-going operational jobs generated by this project would be held by people not living in the Narrabri LGA or within a one-hour drive of the project, but living elsewhere. This again means that the economic benefit to the town will be limited and will derive mainly to the operators of the NRW hostels.

333. Dr Ziller notes that there is a risk that flow-on social effects on local businesses and residents of the competition for skilled local residents may not be socially beneficial, citing Ogge (2015, p. 17):[241]

When regional towns become service centres for the gas industry, existing businesses often lose their skilled staff, have to compete with inflated gas industry wages and face higher costs for rent and services. Workers work long shifts in self-contained camps and have little opportunity to spend money locally, and companies often bypass local suppliers

[239] Ziller, Expert Report dated 4 August 2020, p. 20.
[240] Ziller, Expert Report dated 4 August 2020, p. 21.
[241] Ziller, Expert Report dated 4 August 2020, p. 22.

334. This issue was raised with DPIE during the public hearing who expressed the view that:[242]

I mean, in many ways, our view is that it would create opportunities for employment within the area, but, you know, if the local area can't fill those – all those jobs, then they would be filled from outside the region…

…

whilst there would be some local jobs and so forth of various sorts, that there would also be a significant proportion of the construction workforce and the operational workforce that would have very different skills and qualifications, etcetera, than what would be required for, you know, agricultural work.

335. Concern about the overstating of the jobs benefits that the Project will bring was captured by Ms Sally Hunter from People for the Plains who, during the public hearing said:[243]

I hear the hollow cry of jobs from an industry that employs less than Bunnings. Narrabri locals who want to work in the gas industry are left to squabble over 40 jobs predicted for them over the 25 year life span of the project.

336. Dr Ziller also finds:

a. 'There is not enough information about employment and training opportunities for Aboriginal residents to give credibility to the one-line assurance in the documents';[244]

b. 'Only a small impact on local job diversity from the gas project is likely';[245]

c. 'At most, some local businesses may provide more supplies of some items to CIVEO for three to four years, but this will be a short-lived increase in trade. The increased demand will not even last for the duration of the project's life';[246]

d. A '[p]otential gradual increase in the resident population' is 'both speculative and temporary';[247]

e. 'There is no analysis of the relationship between the compensation fee and costs experienced by landowners who agree to permit wells on their land. It is also not clear what the situation would be if a significant proportion of landowners refused';[248]

[242] Transcript, IPC Public Hearing – Narrabri Gas Project, 1 August 2020, p. 99, at 36-46.
[243] Transcript, IPC Public Hearing – Narrabri Gas Project, 21 July 2020, p. 10, at 31-34.
[244] Ziller, Expert Report dated 4 August 2020, p. 25.
[245] Ziller, Expert Report dated 4 August 2020, p. 25.
[246] Ziller, Expert Report dated 4 August 2020, p. 27.
[247] Ziller, Expert Report dated 4 August 2020, p. 27.
[248] Ziller, Expert Report dated 4 August 2020, p. 28.

f. The Community Gas Benefits Fund is not established to 'ensure that the amount of tax relief rebounds to the benefit of the local (host) community' in that:[249]

'• there is a cap on the amounts that can be disbursed to any one project;
• the Fund may not be used for long-term social infrastructure provision except in exceptional circumstances;
• administration of the Fund is not required to consider or redress distributional inequity; and
• the capacity of local community groups to influence the recommendations of the local CGBF Committee or the decisions of the Panel is effectively nil';

g. 'While a VPA provides Narrabri Shire Council with greater certainty about funds to be received for the benefit of local residents, only 21% of these funds are earmarked for social purposes. This is likely to be insufficient for many social infrastructure purposes'.[250]

Adverse social impacts

337. In relation to likely adverse impacts, Dr Ziller finds:[251]

a. *'The sheer number of areas of risk and hazard is an indication of the potential reach of adverse impacts of this project. The suggestion that these can be managed via a raft of 22 plans is not convincing given the financial and other conflicts of interest present';*

b. *'The precautionary principle has been addressed with a series of assurances and proposed strategies. With regard to social impacts, the assurances and strategies are weak and limited and there is no independent agency available to provide stringent monitoring of their implementation or efficacy. The precautionary principle does not appear to have been met';*

c. *'The paucity of social benefits, the likely increase in rents and prices, the fact that most jobs will go to non-residents and the continuing local opposition to the project are likely to have an adverse effect on key public health indicators. The effects on the health of NRWs has not been considered';*

d. *'There will be a decrease in housing availability and affordability';*

e. *'Particularly during the construction period, the town is likely to experience adverse social impacts due to the influx of large numbers of relatively well-paid male workers';*

f. *'The SIA has not addressed the distributional inequity of the project, that is, the expectation that most of the social and economic benefits accrue to people outside the region while most of the social costs will accrue locally';*

g. *'The long-term adverse effects of the project are also likely disproportionately to affect the local area';*

[249] Ziller, Expert Report dated 4 August 2020, p. 33.
[250] Ziller, Expert Report dated 4 August 2020, p. 34.
[251] Ziller, Expert Report dated 4 August 2020, p. 51.

h. *'Social conflict and polarisation arising from this project is likely to persist'.*

338. Dr Kathleen Wild, a general practitioner in Newcastle and a lecturer at the University of Newcastle, expanded on the health effects that will impact on the people of NSW through climate change and to which the Project will contribute:[252]

I know you've had multiple presentations over the past week regarding the impact that climate change has on human health. The increased heat is going to have a direct effect on people's kidney health, blood pressures, or causing mortality from cardiac deaths as a result of natural disasters, which are going to increase in severity and frequency which lead to, not just the direct sequelae such as the lung disease from dust from the bushfires, but it also disrupts people's regular healthcare as well.

We have a projected increase in infectious diseases worldwide, as well as the mental health toll that these changes on our natural environment have on us…

339. The impacts on local business were noted by Maria Rickert, owner of Pilliga Pottery and Barkala Farmstay:[253]

The Narrabri Gas Project threatens that very air we breathe, the water we drink, the land we farm, and the food we produce. It threatens to drive people away from our community, and its long-term impact, it will be lasting on our community and on tourism. The infrastructure that will litter the so far undisturbed forest will forever change the landscape of this region. …

…

I have spoken to hundreds of tourists, who were deeply impressed by the beauty and diversity of this region. These people are the greatest advocates for this region and under no circumstances do they want to see their newly discovered Pilliga sacrificed to ..... for gas exploration. Let us not allow this project, that has so many negative implications to our environment, proceed; but instead, promote and invest in the pure beauty of regional Australia in order to flourish. This is an irreplaceable beauty that exists nowhere else on earth.

340. Sarah Ciesiolka, a fifth-generation farmer living and farming less than 6 kilometres to the north and downstream of the phase 1 of the Project, said:[254]

I can assure you there is widespread local community rejection of the Narrabri Gas Project and that Santos will face sustained ongoing opposition if this project is approved. Our farm sits above the lower Namoi Alluvium and straddles both sides of Bundock Creek which flows directly from the project area. We have the misfortune of being one of the closest large scale irrigators to the proposed project. We rely entirely on underground water from the lower Namoi Alluvium to irrigate our crops and for drinking water and everyday household use. We have no other reliable source of water. Water is without question the most precious asset we have. It is key to everything we do and our groundwater should not be put at risk for any reason.

[252] Transcript, IPC Public Hearing – Narrabri Gas Project, 25 July 2020, p. 10, at 37-45..
[253] Transcript, IPC Public Hearing – Narrabri Gas Project, 21 July 2020, p. 91.
[254] Transcript, IPC Public Hearing – Narrabri Gas Project, 21 July 2020, pp. 17-18.

Afterall, it's this groundwater that saw our community through the worst drought in more than a hundred years.

…

… We face an uncertain future where our water resources could be contaminated or depleted and we cannot insure against it. This project hanging over our heads for more than a decade now has ultimately meant less investment, less jobs in the region and frankly, the future looks grim for our family farming operation if this project is approved.

341. David Chadwick, Great Artesian Basin Protection Group, said:[255]

Our little business employs 25 full-time people plus casuals and contractors. We have a turnover of $85 million. The critical part of our business is we supply 100,000 servings of beef per day, 365 days of the year.

We are just one business on the Great Artesian Basin. If we don't have water or the water is poisonous, we don't have a business. If we don't have a business, there are no jobs, and certainly there's no food. And if that's expounded on to include the supermarkets and the trucks and the abattoirs, it's a frightening proposal. I've had a long history of cancer, but I still am able to maintain a life policy. But I cannot get any cover over the CSG activities on my land. That's frightening, when the biggest risk-takers in the world won't insure you. We're the largest exporting nation on the planet, yet we've got the dearest energy prices.

342. Further, Doug Storer, Warren Pipeline Action Group, told the IPC:[256]

What do we risk? We risk primary production. We risk wool, land, mutton, beef, wheat, barley, chickpeas, canola, even cotton. The list goes on and on. And that production supports stock agents, fertiliser and chemical suppliers, fuel merchants, pubs, butchers, supermarkets, accountants, financial agents, contractors, freight companies. The list goes on and on again. And all of this primary and secondary production supports our local community.

343. The intergenerational inequity of the Project was pointed out by Helen Carrigan, Moree Plains Gas Pipeline Group, who told the IPC:[257]

Apart from financial losses for the company and its shareholders, whereas, our agricultural lands, precious water, farming, families and communities will make personal sacrifices and will suffer for generations to come if you recommend this project to be approved.

344. Judy Summers, Knitting Nannas Against Gas (Lismore), noted:[258]

The future generations of the Narrabri region have the right to inherit a healthy, balanced and sustainable environment.

[255] Transcript, IPC Public Hearing – Narrabri Gas Project, 20 July 2020, p. 64.
[256] Transcript, IPC Public Hearing – Narrabri Gas Project, 20 July 2020, p. 62.
[257] Transcript, IPC Public Hearing – Narrabri Gas Project, 21 July 2020, p. 25.
[258] Transcript, IPC Public Hearing – Narrabri Gas Project, 21 July 2020, p. 30.

345. But it was not just the Narrabri communities who have expressed concern about the social impacts of the Project. In his presentation to the IPC, Cr Stephen Lawrence, Deputy Mayor of Dubbo Council said:[259]

Our community relies to a significant extent on the economic and human activity in the region where the project is planned… Any threat to agriculture and human communities in the Pilliga Region and its surrounding towns is a threat to the Dubbo Region.

346. Similarly, Cr Kodi Brady, Warrumbungle Shire Council & President of Yarn, Support, Connect, said:[260]

I want to speak for the Coonabarabran area as a whole to point out the damage CSG mining will do to the mental, emotional and social welfare of our community. CSG mining is dirty. It leaks methane. It involves moving toxic substances into open air pools. It will poison the waters of the Great Artesian Basin guaranteed. How much, who knows? When this will happen, who knows? It will pollute our gorgeous night sky, the first Dark Sky Park in Australia, with needless light.

347. Dr Melissa Haswell has provided information to the IPC on the rapid growth in research examining the negative health outcomes that have been linked to life near gas mining operations. These include asthma exacerbations and hospitalisations; sinus conditions and migraines; skin rashes, fatigue and headaches; hospitalisations for heart, nerve, respiratory, immune system diseases and some cancers; traffic injuries and fatalities; sexually transmitted infections; and stress, anxiety and depression.

348. Dr Haswell notes that evidence of impacts is particularly strong for negative birth outcomes through reduced average birth weight; small for gestational age births and low birth weight babies; higher frequency of extreme pre-term deliveries and spontaneous abortions; congenital heart defects; and antenatal depression and anxiety.

349. The public health impacts of anthropogenic climate change were noted by Dr Bob Vickers, Doctors for the Environment Australia:[261]

… the health risks of climate change are the most important issue facing the medical profession currently. This project would exacerbate all health effects of climate change by contributing increasing greenhouse gases at a time when the international community and majority of Australians are causing for a rapid decarbonisation of not just out energy and electricity sectors, but our entire society. The direct and indirect health effects of these types of projects are measurable and seriously concerning.

350. Rosemary Vass, Coonabarabran Residents Against CSG, told the IPC:[262]

It has no social licence to proceed. We should be discussing the joys of our children and grandchildren, not fighting for their future, threatened by climate impacts exacerbated by projects like this which will cause intergenerational inequity and an

[259] Transcript, IPC Public Hearing – Narrabri Gas Project, 20 July 2020, p. 49, at 13-17.
[260] Transcript, IPC Public Hearing – Narrabri Gas Project, 21 July 2020, p. 5, at 22-28.
[261] Transcript, IPC Public Hearing – Narrabri Gas Project, 20 July 2020, p. 75.
[262] Transcript, IPC Public Hearing – Narrabri Gas Project, 21 July 2020, p. 48.

unliveable planet. This project poses multiple risks that remain unresolved.

351. Moreover, Margaret Fleck, CWA Tambar Springs Branch, said:[263]

We live the rising temperatures. Farmers have to work fewer hours out of doors because of the increased risk of heat stroke. We live the increased severity and frequency of droughts, having just come through the worst drought in living memory. The fear and expectation of another is always with us.

The views of Aboriginal communities

352. Dr Ziller notes that amongst Aboriginal communities it appears that *'only the Narrabri Aboriginal Land Council was consulted about social impact issues'*,[264] and that this occurred five years ago when the Social Impact Assessment (SIA) was conducted. Dr Ziller notes that the *'Dharriwaa Elders Group, the Gomeroi Traditional Custodians and a representative of Yarn, Support, Connect (Coonabarabran) oppose the project in their written and verbal submissions to the IPC*'.[265]

353. Wendy Spencer, Dharriwaa Elders Group, told the IPC:[266]

If the Great Artesian Basin, the Namoi River and the Namoi alluvial basins are polluted by this activity, the IPC and the New South Wales Government will be responsible for knowingly contributing to our community's already overburdened chronic disease. They will be responsible for denying our community water to drink, water to grow our food, rivers that provide our communities food and well-being. What gives anyone the right to think they can do that?

354. Cathy Craigie, Gomeroi Traditional Custodians, stated:[267]

My objections to Santos coming into the Pilliga-Narrabri area is derived from my Gamilaroi heritage. To allow Santos to drill or to do anything in this area would be a desecration to an important Gamilaroi area. Fracking or mining for gas uses millions of litres of water, and in this case Santos will be penetrating deeply into the Great Artesian Basin. In our culture, water is protected by lore, l-o-r-e. It's in our songs, our dances, our stories and our art. To allow any sort of interference in the area identified for Santos will certainly desecrate an important Gamilaroi area, and this will again highlight the disrespect Australian governments have for First Nation beliefs and cultures.

Mitigation and management

355. Recognising the potential for negative social impacts from the Project, the applicant has proposed purported mitigation and management measures in relation to social impacts.

356. Dr Ziller notes that *'mitigation of adverse social impacts should meet certain criteria, namely, the action to be taken should be tangible…deliverable…and*

[263] Transcript, IPC Public Hearing – Narrabri Gas Project, 21 July 2020, p. 67.
[264] Ziller, Expert Report dated 4 August 2020, p. 17.
[265] Ziller, Expert Report dated 4 August 2020, p. 18.
[266] Transcript, IPC Public Hearing – Narrabri Gas Project, 20 July 2020, p. 58.
[267] Transcript, IPC Public Hearing – Narrabri Gas Project, 20 July 2020, p. 60.

durably effective'. Furthermore, 'good intentions' and 'aspirations', 'suggestions' as to what others might do, and 'short-term' initiatives do not fulfil these criteria.[268]

357. Dr Ziller assesses the applicant's proposed mitigation of adverse impacts as follows:[269]

Table 12: Proposed mitigations assessed against three criteria

Issue	Description of mitigating action	Criteria		
		Tangible	Deliverable	Durably effective
Impacts on landholder	Agreed principles of land access	√	√	
	Payment of reasonable financial costs for legal advice	√	√	
	Compensation payments	√	√	
	Farm management plan	Contents unknown		
	Mitigation measures and management strategies outlined in chapters on agriculture, noise and vibration, air quality, landscape and visual impact, traffic and transport	Contents unknown		
	Working with Landholders Fact Sheet	√	√	
	On-going engagement with landholders	√	√	
	Training, up-skilling, apprentice and traineeship programs	√	√	
	Source workers from wider regional area and the State	√	√	
Impact on community values	Santos project workforce management plan	√	√	
	Santos Code of Conduct	√	√	
Impact on recreational activities	200 metre no-go zone around Yarrie Lake	√	√	
Impact on social infrastructure	Santos will engage with service providers and monitor changes in demand for health emergency services		√	
	Santos will invest in community infrastructure through the Gas Community Benefits Fund			
Impact on housing and accommodation	Monitor change in demand on housing and accommodation arising from the project		√	
	Implement a flexible approach to accommodation management		√	
Traffic safety	Traffic management plan	√	√	

Source: Table 25 in T1 pp 80-86

358. Dr Ziller finds that:[270]

... for the most part, the proponent could deliver the proposed action(s), but they do not meet the criterion of durable efficacy. For example, it is not clear whether the proponent will meet on-going or continuing legal costs of land holders. The proponent can deliver community engagement, but it is not clear whether the community will agree that the engagement is adequate and there is no indication as to how adequacy will be achieved.

359. Mr David Quince, Mullaley Gas & Pipeline Accord, told the IPC:[271]

The claim in the department's assessment report that any adverse social impacts of the Narrabri Gas Project can be mitigated to a large extent can only be a belief expressed by people who don't know, understand or live in the region.

[268] Ziller, Expert Report dated 4 August 2020, p. 52.
[269] Ziller, Expert Report dated 4 August 2020, p. 53.
[270] Ziller, Expert Report dated 4 August 2020, p. 53.
[271] Transcript, IPC Public Hearing – Narrabri Gas Project, 21 July 2020, p. 22.

The Social Impacts Management Plan (SIMP)

360. A key concern for Dr Ziller is the acknowledgement in relation to the proposed Social impacts Management Plan (**SIMP**) *'that the negative social impacts of the project still require identification… whereas these should have been identified before determination not at some unspecified date afterwards.'*[272]

361. Dr Ziller finds the following deficiencies with the proposed SIMP and CSRM's review of the applicant's SIA (**CSRM 2**):

a. CSRM 2 *'in effect sanctions the postponement of a large number of issues on the unjustified assumption that everything can be sorted out through adaptive management'*;[273]

b. CSRM 2:[274]

does not take account of the fact that the SIMP is to be managed and, therefore, paid for by the proponent. The proponent is not a social planning or community development agency. Merely to prepare strategies to address the above list of issues will require expenditure, presumably on consultants. The proponent will have an interest in how much money is spent. At the same time, every dollar spent on consultants is money not spent on community initiatives. The review does not consider this aspect of reliance on a SIMP, nor the possible use of GCBF monies to pay for it.

c. DPIE's recommended conditions:[275]

The draft conditions say that the role of the SIMP is to identify opportunities and to monitor effectiveness (items d, e and f), but there is no mention of the possibility that some social costs may not be avoidable or able to be mitigated, nor how adaptive management measures will be paid for, particularly if these are expensive. The Council, the community consultative committee and representatives of the local community are given an advisory role, but the decision making role about what actions to take rests with Santos, not the local community. As noted, Santos will have financial interests in that decision. There is no deadline for preparation of the SIMP. There are no penalties for non-compliance or weak and inadequate actions under the SIMP.

362. Dr Ziller concludes that this approach *'fails the people of Narrabri whose social wellbeing deserves due and proper consideration'* because DPIE appears to:[276]

sanction postponement of identification of adverse social impacts, postponement of identification, costing and implementation of suitable programs or actions to address these, and [place] identification of the issues and selection of suitable responses in the hands of the proponent without a timeline or a penalty for poor or inadequate compliance.

[272] Ziller, Expert Report dated 4 August 2020, p. 57.
[273] Ziller, Expert Report dated 4 August 2020, p. 56.
[274] Ziller, Expert Report dated 4 August 2020, p. 56.
[275] Ziller, Expert Report dated 4 August 2020, p. 57.
[276] Ziller, Expert Report dated 4 August 2020, p. 57.

Conclusion

363. The expert evidence of Dr Alison Ziller and the objector evidence given in oral and written form by lay objectors should be preferred to the applicant's SIA and CSRM 2, given Dr Ziller's 18 years of experience in reviewing SIAs for the public sector and community organisations and the lived experiences of the overwhelming number of lay objectors to the Project.

364. The Project will have a significant negative social impact on residents and the community of Narrabri, contrary to the public interest, the principle of intergenerational equity, and the precautionary principle. The IPC should refuse development consent.

F. SALT WASTE DISPOSAL

365. In its determination, the IPC is required to consider the likely impacts of the Project (including environmental impacts on both the natural and built environments),[277] the suitability of the site for the Project,[278] and the public interest[279] (including the principles of ESD, particularly intergenerational equity and the polluter pays principle). The issue of salt waste generated from the Project is relevant to these matters for consideration. A reasonable assessment of salt waste militates against approval of development consent to the Project in its current form.

366. NWA obtained an expert report from Prof Stuart Khan, Professor in the School of Civil & Environmental Engineering at UNSW. His most recent report is provided to the IPC in the form of a written submission dated 26 July 2020 and through a presentation at the IPC hearing on 23 July 2020. Prof Khan's strong message to the IPC was that *'the salt disposal aspect of this project cannot be approved*'.[280]

367. Community members and experts alike have expressed concerns about the failure of the applicant to identify a viable means of disposing of salt waste from the Project. As Prof Khan observes in his expert report (footnote omitted):[281]

> *The DPIE Assessment Report notes that the proponent's Environmental Impact Statement predicted that some 430,000 tonnes of salt would be produced over the life of the project. But it then states: "However, based on updated water baseline information in the Response to Submissions, the Water Expert Panel considers that salt production could be up to approximately 850,000 tonnes over the project life". If so, we're now talking about **85** Eiffel Towers or **17x** the mass of steel in the Sydney Harbour Bridge. This is a considerable mass of salt to manage, by any standard.*

368. The salt waste is a product that will not breakdown and, unless adaptively reused, will create a risk of environmental pollution forever. Under the current proposal, the applicant has identified that it intends to dispose of the salt waste in

[277] EP&A Act, s 4.15(1)(b).
[278] EP&A Act, s 4.15(1)(e).
[279] EP&A Act, s 4.15(1)(e).
[280] Khan, Expert Report dated 26 July 2020, p. 1.
[281] Khan, Expert Report dated 26 July 2020, pp. 3-4.

landfill as 'general solid waste'. Prof Khan has noted that given the highly soluble nature of the salt, this proposal is simply *'shifting a problem from one location to another'*.[282] In Prof Khan's opinion:

The future will necessarily involve at least one of the following three options:
1. Ongoing active management of the landfill storage, forever;
2. Acceptance that the containment will eventually fail and salts will be released to groundwater and surface water; or
3. Recovery of the salts, by digging them all out again.

369. Prof Khan opines:[283]

In any of these three circumstances, we will be passing the burden of addressing this problem on to future generations. In my opinion, such an arrangement is not acceptable and should not be approved under any circumstances.

370. NWA notes that not only is this shifting the problem in space, it is shifting the problem in time, creating a significant pollution risk for future generations.

371. During the public hearing, the IPC heard that Santos has entered an MoU to investigate the reuse of salt as soda ash and sodium bicarbonate. However, the highest the Santos Chief Executive Officer Kevin Gallagher could put it was:[284]

Look, the status is that we're now engaging in studies with, you know, the company you're referring to. They're a large US-based organisation, and this is their core business so, really, they're undertaking those studies now to ascertain the market opportunity and whether or not they can build a viable business on the basis of the salt that we would supply from the project.

372. DPIE told the IPC that:[285]

for some time now we have been pushing Santos to really investigate that through the WEP and, you know, recently they have come up with – you know, they've entered into this MOU with this company to investigate it further, so we – I mean, we're fully supportive of that.

373. However, in the absence of any condition requiring the re-use of the salt, the IPC must assume that the salt waste will be directed to landfill as proposed in the environmental assessment, thereby requiring management in-perpetuity.

374. In its meeting with the IPC, the NSW Environment Protection Authority (**EPA**) made it clear that it accepted that the waste could be disposed as a 'general solid waste' under the EPA *Environmental Guidelines: Solid waste landfills*.[286] This is despite Prof Khan's view that:[287]

The idea of highly saline water containing hundreds of thousands of tonnes of salt

[282] Khan Expert Report dated 26 July 2020, p. 6.
[283] Khan, Expert Report dated 26 July 2020, p. 6.
[284] Transcript, IPC Public Hearing – Narrabri Gas Project, 20 July 2020, p. 36, at 38-43.
[285] Transcript, IPC Public Hearing – Narrabri Gas Project, 1 August 2020, p. 98, at 35-39.
[286] Transcript, IPC meeting with EPA, DPIE-Water and NRAR – Narrabri Gas Project, 28 July 2020, p. 6, at 10-12.
[287] Transcript, IPC Public Hearing – Narrabri Gas Project, 23 July 2020, p. 26, at 34-36.

leaching from these landfills is an entirely unrelated and unconsidered concept in these guidelines.

375. Moreover, Prof Khan states:[288]

The challenges relating to physical containment of these salts, as well as the risks they present to the environment, are fundamentally different from all other wastes that would normally be classified as general solid wastes. In my opinion, the NSW Waste Classification Guidelines (2014) should not be applied for the classification of this particular type of waste material.

376. DPIE suggested to the IPC in the meeting with the EPA that Santos will bear the cost of disposing of the salt waste:[289]

But I think if you get to the disposal side of things, the cost of it you can work that out now in terms of what a liner would be, where it would be. You'd need to have it all – all those things in place and – and so, you know, that's what – that's – that's an unavoidable cost that Santos – Santos as the polluter in this situation would have to pay.

377. However, once Santos has disposed of the salt waste to a landfill facility, it will no longer bear responsibility for its management, rather the waste management will become the responsibility of the landfill operator for ongoing leachate management or, in the event of management failure, the Australian community.

378. At the public hearing, Prof Khan explained to the IPC why this approach was problematic from an environmental perspective:[290]

The next issue then is disposing of that leachate which will eventually wash out all of the salts. The challenges for a solid waste landfill operator in disposing of a concentrated brine solution are effectively the same as the challenges that the coal seam gas company faces in disposing of a concentrated brine solution. One option to consider might be reverse osmosis, followed by thermal brine concentration, followed by crystallisation of the salts. But while these highly energy intensive and expensive technologies might be viable for a coal seam gas company, they're unlikely to be affordable to a solid waste landfill operator, and in this scenario a lot of energy, money and greenhouse footprint has been invested in shifting a problem from one location to another, but the problem is far from solved.

379. In NWA's submission this approach is also problematic from an assessment perspective. Allowing the burden of perpetual management of waste to be transferred to another location and another time is inconsistent with both intergenerational equity and the polluter pays principle, important components of ESD. The substantial problems created by salt waste generated by the Project, and the three options for dealing with the salt waste canvassed by Prof Khan, cannot be accepted. These circumstances countenance against approval of the Project in its current form.

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[288] Khan, Expert Report dated 26 July 2020, p. 9.
[289] Transcript, IPC meeting with EPA, DPIE-Water and NRAR – Narrabri Gas Project, 28 July 2020, p. 23, at 1-5.
[290] Transcript, IPC Public Hearing – Narrabri Gas Project, 23 July 2020, p. 27, at 14-23.

CONCLUSION

380. In respect of State significant development, section 4.38 of the EP&A Act provides relevantly:

> ***4.38 Consent for State significant development (cf previous s 89E)***
> *(1) The consent authority is to determine a development application in respect of State significant development by:*
> *(a) granting consent to the application with such modifications of the proposed development or on such conditions as the consent authority may determine, or*
> *(b) refusing consent to the application.*

381. The exercise of the power under section 4.38 of the EP&A Act to grant or refuse consent to the Project involves consideration, weighting and balancing of the environmental, social and economic impacts of the Project. It is NWA's submission that the proper consideration, weighting and balancing of the environmental, social and economic impacts of the Project lead to a conclusion that the Project should be rejected.

382. The exercise of a similar power under the former Part 3A of the EP&A Act was described by Preston CJ in *Bulga Milbrodale Progress Association Inc v Minister for Planning and Infrastructure and Warkworth Mining Ltd* (2013) 194 LGERA 347 at [31] as involving a "polycentric" problem:

> *The range of interests affected, the complexity of the issues and the interdependence of the issues, means that decision-making involves a polycentric problem. A polycentric problem involves a complex network of relationships, with interacting points of influence. Each decision made communicates itself to other centres of decision, changing the conditions, so that a new basis must be found for the next decision: Jowell J, "The Legal Control of Administrative Discretion" [1973]* Public Law *178 at p 213.*

383. Issues concerning a polycentric problem are interlinked:[291]

> *A decision about one issue raised by the carrying out of the project is linked by interacting points of influence to decisions about other issues, necessitating readjustment of the project (Jowell at p 214).*

384. Further, the criteria to be considered in determining a polycentric problem are numerous, cannot be objectively weighted, and are interdependent:[292]

> *The decision-maker must not only determine what are the relevant matters to be considered in deciding whether or not to approve the carrying out of the project, but also subjectively determine the weight to be given to each matter. Eisenberg suggests that where this is the case, an optimal solution can normally be arrived at by vesting a single decision-maker with managerial authority; that is, authority not only to select and apply relevant criteria but*

[291] *Bulga Milbrodale Progress Association Inc v Minister for Planning and Infrastructure and Warkworth Mining Ltd* (2013) 194 LGERA 347, [33].
[292] *Bulga Milbrodale Progress Association Inc v Minister for Planning and Infrastructure and Warkworth Mining Ltd* (2013) 194 LGERA 347, [35].

also to determine how much weight each criterion is to receive, and to change those weights as new objectives and criteria may require (Eisenberg at p 425).

385. Preston CJ outlines the approach to determining a polycentric problem as follows:[293]

… first, identification of the relevant matters needing to be considered; secondly, fact finding for each relevant matter; thirdly, determining how much weight each relevant matter is to receive, and fourthly, balancing the weighted matters to arrive at a managerial decision.

386. The fourth process, the balancing of the weighted matters,[294]

is a qualitative and not quantitative exercise. The ultimate decision involves an intuitive synthesis of the various matters. Forms of economic analysis, such as cost benefit analysis, which endeavour to balance different factors by use of a common, quantitative unit, such as money, assist but are not a substitute for the intuitive synthesis required of the decision-maker.

387. The Court of Appeal dismissed a challenge to this approach (*Warkworth Mining Ltd v Bulga Milbrodale Progress Association Inc* (2014) 200 LGERA 375 at [147]-[174]), observing at [171] that the task for the Court is:

to balance the public interest in approving or disapproving the project, having regard to the competing economic and other benefits and the potential negative impacts the Project would have if approved.

388. Similar to the decision to approve or refuse the development application in *Bulga Milbrodale Progress Association Inc v Minister for Planning and Infrastructure and Warkworth Mining Ltd* (2013) 194 LGERA 347, the decision to approve or refuse consent to the Project is a polycentric problem.[295]

389. Importantly, the applicant and DPIE have not been able to demonstrate a need for the Project on the grounds of either achieving security of supply or driving down gas prices, or that any need outweighs the significant environmental impacts that are likely to be caused.

390. Moreover, the proper balancing of the environmental, social and economic factors, considering the principles of ESD and in particular the principles of intragenerational and intergenerational equity, the precautionary principle, the principle of conservation of biological diversity and the polluter pays principle, results in:

a. Adverse groundwater impacts;

b. Adverse ecology/biodiversity impacts;

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[293] *Bulga Milbrodale Progress Association Inc v Minister for Planning and Infrastructure and Warkworth Mining Ltd* (2013) 194 LGERA 347, [36].
[294] *Bulga Milbrodale Progress Association Inc v Minister for Planning and Infrastructure and Warkworth Mining Ltd* (2013) 194 LGERA 347, [41].
[295] *Bulga Milbrodale Progress Association Inc v Minister for Planning and Infrastructure and Warkworth Mining Ltd* (2013) 194 LGERA 347, [33].

c. Adverse climate change impacts;

d. Adverse bushfire risk impacts;

e. Adverse social impacts; and

f. Adverse salt waste disposal impacts.

391. While it is purported that the Project will have economic benefits, the evidence has demonstrated that these have been overstated by the applicant and any such benefits do not outweigh the negative impacts identified above.

392. In the final analysis, the Project is not in the public interest and contrary to the principles of ESD. The Project must be refused consent.